Researchers achieve transmission rates of 107 Gbits per second over a single fiber channel

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In cooperation with Micram, the Fraunhofer Institute for Telecommunications (Heinrich-Hertz-Institut) and Eindhoven Technical University, Siemens has successfully tested the network of the future. This involved the 100% electrical processing of data rates of 107 Gbits per second and transmission over a 100 mile long fiber-optic route in the U.S. – the first time this has ever been done outside the laboratory.

The record performance was made possible by a newly developed transmission and receiving system that processes the data by purely electrical means directly before and after its conversion into optical signals. The test was conducted at a long-haul network at one of world's largest optical network operators, in which Siemens has previously deployed a 40 Gbits per second optical network for commercial use.

Ultra-high bandwidth capacity in core network will be required to cater the traffic generated by online games, music, and video downloads. By 2011, legal music downloads alone will account for 36 percent of the entire music business in Europe according to market research institute Forrester Research. And network operators are reacting to this development: They're not only expanding their access networks with broadband technology, but are also having to adapt the capacities of their optical core networks accordingly. To prepare for the data traffic volume of the future, Siemens is already working to develop key technologies within its labs.

Recently and for the first time made public, Siemens researchers have successfully tested transmission at 107 Gbits per second with 100% electrical processing in the transmitter and receiver, the first time this has ever been achieved outside the laboratory. On a 100 mile test route in the U.S., they have succeeded in bettering the current maximum transmission performance per channel by a factor of 2.5.

This record performance is made possible by a newly developed transmission and receiving system which can process data directly before and after its conversion into optical signals using electrical processing only. On the high-speed routes of the Internet, data is transported in the form of light signals. Until now, for very high data rates, signals had to be split into multiple lower data rate signals and later be reconverted from optical to electrical in order to avoid data bottlenecks in the downstream electronics. This adds cost and reduces system capacity.

A few months ago, Siemens researchers already proved the feasibility of a receiver with 100% electrical processing for optical transmission at 107 Gbits per second in which the signal from the photo diode is picked up and processed directly by a chip. Now the next step has been taken and the optical transmitter has been "fully electrified." Siemens has thus developed a system that processes data 100% electrically directly before and after conversion from electrical into optical signals, and vice versa. The system can handle data volumes of 107 Gbits per second, which is currently a record. 107 Gbits is approximately equivalent to the amount of data that fits on two DVDs today.

"In the spring of 2006 we demonstrated the system with a fully electric receiver," said Dr. Rainer H. Derksen, project coordinator at Siemens Corporate Technology in Munich. "At that time we were still using optical multiplexing in the transmitter. Now we've designed a complete system with 100% electrical processing of the data in both the receiver and the transmitter." That increases the performance of the system

enormously. Theoretically it's already possible to process the signals from 100,000 DSL users simultaneously. Derksen expects that the first products based on the prototype will be available on the market within a few years.

Such a system would be particularly interesting for the future 100-Gbit/s-Ethernet on which the telecommunication providers are currently working. Ethernet – albeit with significantly lower transmission speeds of 1 Gbit/s or less – has long been the data communication standard on corporate and home networks. Since it transports data in a particularly flexible manner, it plays an increasingly important role in large carrier networks as well. One of its advantages is that the data is no longer transmitted over switched connections to the end customer, but in packets that can be routed over alternate lines to bypass overloaded or very busy network sections — making the entire network more reliable and keeping customers happy. Ethernet's ubiquity has historically followed fast cost degradation as the technology has been massively adopted. Cost for Ethernet ports are expected to outperform their comparable TDM switched variants in cost per bit performance due to this massive adoption and cost decline. Higher flexibility and cost efficiency are the reasons, why 100-Gbit/s-Ethernet is the next step in Ethernet transmission technology and a cornerstone technology of next decade's backbone networks.

Source: Siemens