

Smarter fiber data transmission doubles capacity to the home

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Researchers of Eindhoven University of Technology and fiber broadband equipment supplier Genexis have developed data transmission techniques that can double or even triple the data transmission capacity of existing fiber to the home connections. Enjoying this increase requires you to upgrade your modem. But even if only your neighbors do, you can get a higher data capacity as well.

The techniques apply to passive [optical networks](#) (PONs). This type of connection makes up roughly 80 percent of fiber to the home connections worldwide. PONs typically connect 16 to 64 households to one fiber entering the street or district. But not all of them have the same connection quality. Especially the ones further away from the central data station (a.k.a. central office) have a lower signal quality. Since providers want to guarantee connectivity for everybody, current networks are over-dimensioned, leading to unused capacity.

The Dutch researchers found some clever, cost-efficient ways to employ this extra capacity, depending on the actual signal quality for each user, using proven technology from wireless, coax and ADSL/VDSL communication. "A normal signal consists of two states: a bit is either a one or a zero", researcher Robbert van der Linden explains. "We have increased the number of states to four or even eight levels. A higher number of levels implies more information. This way we can transfer twice or even three times as much."

For further improved performance, it is possible to transmit these levels

with unequal distances between them. As the levels that are further apart are easier to distinguish and hence to decode, they require less high [signal quality](#). Therefore, the users further away are assigned the levels that are further apart, and the ones nearby the local station use the levels that are closer together. This effectively leads to an additional performance gain.

A third improvement was made using multiple clock rates for different users. This enables shorter time intervals between the symbols that are transmitted, and thus increasing the throughput. The attainable increase depends on the specific network layout. "We have demonstrated that by using only three different clock rates, already an increase in throughput of 180 percent can be achieved", says Van der Linden.

The extra capacity these techniques make available comes from the high-quality connections close to the central data station. But as their capacity goes up, they require a shorter time to communicate. That means that more time becomes available for the users further away on the same PON, thereby also increasing their connection capacity.

The researchers and their partners are now looking to develop chips that incorporate the new techniques. The central data stations as well as the users' modems need to be provided with these. It is most likely that new customers, who get a new modem, will benefit first from the new techniques. But even if only your neighbors that are part of the same PON upgrade, your own [capacity](#) is likely to increase as well. The improved techniques will shorten the timeslots the upgraded users need for data transfer, leaving more time for the other users to get their share of data.

Robbert van der Linden defended his PhD thesis entitled 'Adaptive Modulation Techniques for Passive Optical Networks' on Tuesday April 17th at Eindhoven University of Technology.

Provided by Eindhoven University of Technology

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