Pioneering advanced fibre technologies for next-generation internet

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Credit: MODE-GAP

Researchers at EU project MODE-GAP ('Multi-mode capacity enhancement with PBG fibre') are working to boost the internet's capacity by developing and testing advanced fibre technologies.

Their work could be the building blocks for the high-capacity access networks needed for channelling new applications such as high-definition TV, interactive gaming, and video-on-demand directly via fibre to subscribers.

Today's telecommunications networks rely on single-mode optical fibres (SMFs) for signal transmission. These fibres are responsible for the enormous bandwidth now available, making possible the recent

explosion of broadband communications.

But SMFs do have a physical limit, beyond which no more information can be squeezed through a single ray of light.

And with the growth in demand for broadband showing no signs of diminishing, there will come a time when demand outstrips even SMF capacity. When that happens, internet services will be increasingly difficult to access at the required speed.

MODE-GAP coordinator Ian Giles of the University of Southampton says the project team is addressing the problem by investigating the use of few-mode fibres (FMF), which have additional light pathways within a single fibre.

"When you look at the problem of SMF capacity limits, the simple solution may seem to be to increase the number of fibres in the network, but when you do this you also get increased cost and increased energy usage," he says.

He adds: "These pathways or 'modes' are essentially independent, so different information can be transmitted along each mode. The fibres use a form of 'spatial-division multiplexing', utilising the spatial dimension to increase transmission capacity."

Along with investigating FMF solid-core fibres, the MODE-GAP team is researching the application of novel hollow-core photonic bandgap fibres (HC-PBGF), which could provide further capacity. The team is also considering using a new wavelength range as another way of boosting capacity.

Although the research is still underway, Giles says the project team has already produced significant results.

"For both types of fibres, we have shown a transmission capacity six times greater than what is currently achievable with SMF fibres," he says. "This headline transmission result is fully supported by the development of components and sub-systems required to build a network. World-leading results have also been achieved by the project in many of the supporting technology areas."

Giles says he believes the project has achieved more than the sum of work of the individual researchers.

"With projects of this type, and MODE-GAP in particular, it would be difficult for any independent state to leverage the broad base of expertise and investment required to achieve a positive result in a limited timescale," he says. "EU-funding of collaborative research such as this enables a group of European experts to work together focussed on very specific problems."

Meanwhile, he adds, exploitation of the work undertaken within MODE-GAP is of critical importance: "On the components level, there have been several spin-out products already. The objectives of the project will be met and, from a systems perspective, the results will provide a very solid platform for future product development."

For Giles and other MODE-GAP researchers, the potential broadband 'capacity crunch' they are addressing is a global problem that could affect anyone using the internet.

"A solution to the problem will benefit everyone," he says.

Jim Somers, CEO of Eblana Photonics Ltd., an Irish SME partner in the project, explains that the project is focused on achieving a 100 fold increase in the amount of data and voice that can be transmitted through telecommunications networks.

In addition, he says that through this project Eblana Photonics has now developed the next generation laser components that will be used in such systems.

Somers says: "Eblana is one of only a handful of companies in the world capable of designing and producing such lasers. This project has also spawned several new product additions to our portfolio which in turn have played a key role establishing our company in the industrial marketplace and significantly increasing our sales and employment figures over the last three years."

More information: modegap.eu/

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