

ECO: Electro-optical communication

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Optical telecommunication networks

Our information society is booming in almost every sense, with exploding amounts of communication devices around us, the latest apps and video games, internet shopping, time-shifted video lectures, 3D HDTV, etc. etc. Without optical communication networks all this would not have been possible; we have witnessed how optical fibre since the early eighties has pervaded everywhere. First in the long-distance networks, then in metropolitan net-

works, and then in fibre-to-the-home (FttH). And the next challenge we are addressing is fibre-in-the-home. Of course also wireless technologies have evolved very rapidly, and it now becomes more and more relevant to combine the strengths of both technologies.

As Fig. 1 shows, the research in our ECO group is encompassing many aspects of networks. Our research in long reach optical fibre links aims to transport Tbit/s data speeds over more

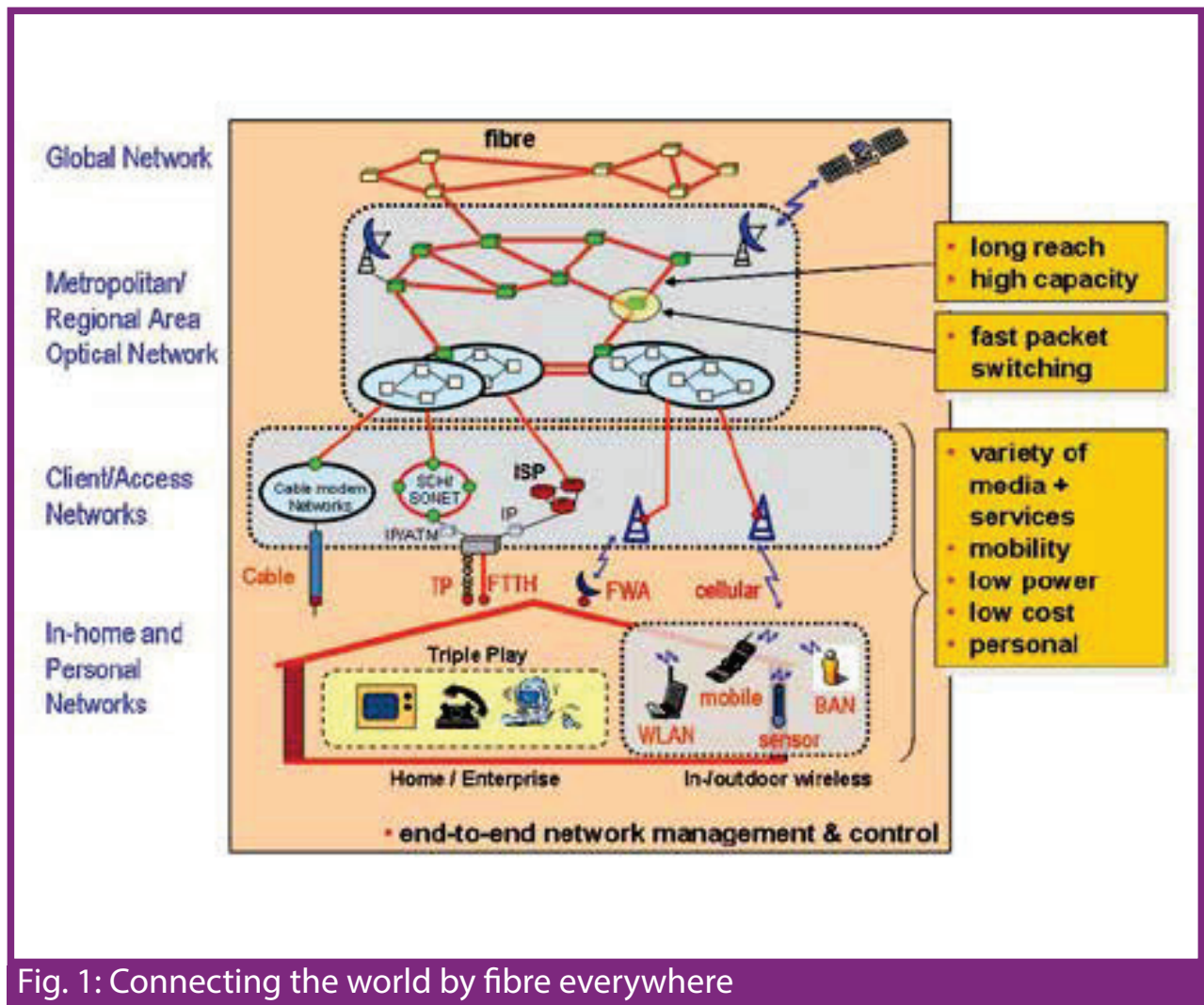


Fig. 1: Connecting the world by fibre everywhere



than 1000km; we recently achieved 5x448Gbit/s over 1230km by combining dense wavelength multiplexing with comprehensive spectrum-efficient signal modulation and Raman/Erbium optical fibre amplifiers. Such links are meant for undersea and international connections.

Within countries, very fast switching nodes are needed to avoid congestion when routing the booming internet traffic volumes over these superfast highways. We explore all-optical switching techniques, avoiding as much as possible opto-electronic conversion at the node interfaces which would cause speed- and energy-consumption bottlenecks. With fast optical gates and wavelength converters we showed routing of data packet streams beyond 640Gbit/s, and also ultra-compact integrated photonic routers.

Today many houses already have (simple) FttH connections. We investigate the more versatile and sustainable next generation FttH systems. By using multiple wavelengths we showed how Gigabit Ethernet data can be assigned on demand to homes, thus drastically improving the efficiency with which the network resources can be deployed,

and lowering the power consumption. To extend the highway truly all the way to the customer, we are exploring fibre-in-the-home network techniques. Our goal is to come up with unified network solutions which can serve the large amount of (high-speed) wirebound as well as wireless devices by means of a powerful yet cost-effective optical fibre in-door backbone network. We have shown data transmission at more than 5Gbit/s over easy-to-install large-core plastic optical fibre (POF). To marry the large bandwidth of fibre with the high mobility of wireless, we are exploring radio over fibre techniques, where we showed amongst others the transport of ultra-wideband radio signals for HDTV over graded-index POF.

The smooth interworking of all these networks requests careful management and control of all network parts. We are exploring autonomic networking techniques, which will make the network adapt to the demands of the users, instead of the other way around, and thus really lets us enjoy all the benefits of this wonderful telecommunication world!

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