interview

Martin Maier

"FiWi networks may be considered the endgame of broadband access"

Professor Martin Maier, co-author of the Letter 'Frame aggregation in fibre-wireless (FiWi) broadband access networks' on page 377 and founder and creative director of the Optical Zeitgeist Laboratory at the Institut National de la Recherche Scientifique (INRS) of the University of Québec, shares his vision of the networks of the future.

What is your specialist area of research?

Together with my students and collaborators I look into the design of future-proof, low-cost and simple broadband access solutions that seamlessly integrate the most promising optical and wireless network technologies. One of our major design goals is to render today's access-metro networks more flexible and suitable, not only to conventional quad-play applications but also other increasingly important applications, e.g. P2P file sharing and online gaming. We also explore ways of deploying passive optical technologies and new switching paradigms to reduce the CO_2 footprint of today's power-hungry routers and switches; thereby helping the Green Internet materialise.

What inspired you to create the Optical Zeitgeist Laboratory?

The reasons were threefold. First, as the research arm of the University of Québec, INRS provides unbounded freedom and strategic support for groundbreaking research into the unknown. Secondly, I felt there was a need for a new kind of lab that not only addresses the technical challenges and opportunities of bimodal optical-wireless networks but also explores their societal benefits and potential to create new unforeseen services and applications. Thirdly, given the growing gap between academic research and industrial commercialisation, I decided to embark mostly on research activities that rethink the role of optical networks and explore novel applications of optical networking concepts and technologies across emerging multidisciplinary domains and thereby open up new research avenues for communities which used to work separately from each other in the past.

What are FiWi networks?

Simply put, FiWi networks aim at combining the capacity of optical fibre networks with the ubiquity and mobility of wireless networks and smartly merging them in order to realise future-proof broadband access networks that strengthen our information society while avoiding its digital divide. More specifically, FiWi networks may deploy conventional Radio-over-Fibre (RoF) and recently proposed Radio-and-Fibre (R&F) technologies. Arguing that optical fibre is likely to entirely replace copper wires in the near to mid term, FiWi networks represent the final frontier of optical networks; namely, the convergence with their wireless counterparts. FiWi networks may be considered the endgame of broadband access.

What are the challenges of FiWi networks?

FiWi research focuses on the Physical (PHY) and Medium Access Control (MAC) layers with the goal to develop and investigate low-cost enabling FiWi technologies as well as layer-2 protocols and algorithms. Higher-layer network capabilities developed through Fixed Mobile Convergence (FMC) standardisation efforts can be exploited on top of the PHY and MAC layers of FiWi networks. While significant progress has been made at the PHY layer of FiWi and in particular RoF transmission systems, FiWi networking research on layer-2 related issues has begun only very recently. Among others, FiWi layer-2 research includes the joint optimisation of performance-enhancing MAC mechanisms separately used in the wireless and optical network segments, e.g. wireless frame aggregation and optical burst assembly, hybrid access control protocols, integrated path selection algorithms, as well as advanced resilience techniques. Layer-2 networking research is crucial to unleash the full potential of FiWi networks.

How do you think this technology will develop over the next few years?

RoF networks have become technically mature. R&F networks are well suited to build WLAN-based FiWi networks of extended coverage, as opposed to RoF networks that limit the length of deployed fibres to less than two km. However, current R&F prototypes show an unacceptable performance for video applications and require further research.

More controversially, FiWi networks give access to the ever-increasing processing and storage capabilities of memory and CPUs of widely used desktops, laptops and other wireless handhelds. At present, these storage and processing capabilities are quite often utilised only in part. After bridging the notorious first/last mile bandwidth bottleneck, research focus might shift from bandwidth provisioning to the exploitation of distributed storage and processing capabilities, especially as we are about to enter the Petabyte age with optical fibre and wireless sensors everywhere collecting massive amounts of data.

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