4GBB

Enabling 4th generation broadband systems via the last copper drop

Stefan Höst
Lund University
stefan.host@eit.lth.se

Per Ödling
Lund University
per.odling@eit.lth.se

Rob van den Brink
TNO
rob.vandenbrink@tno.nl

Henrik Almeida
Ericsson AB
henrik.almeida@
ericsson.com

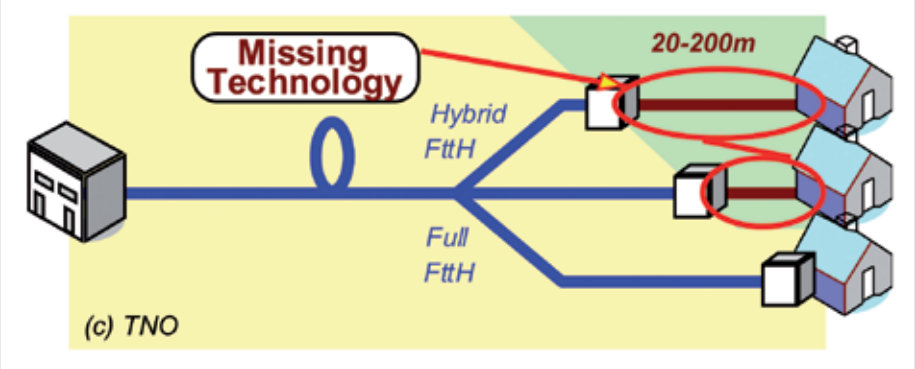

Figure 1: Hybrid copper fibre solutions to achieve Gb/s rates.

The 4GBB project shows how great engineering ideas can build the networked society, merging economic realities and political ambition. The project created a standard and a discussion platform for engineers, policymakers and researchers with the vision of a connected Europe.

The vision of economic prosperity, democratic participation and a sustainable society led the European Commission to formulate the Digital Agenda. The idea of bringing broadband connections to the citizens of Europe is an ambition shared by many of us. It inspired telecommunication companies and engineers to establish the 4GBB project to create an economically realistic path towards fulfiling this vision.

While political speeches often advocate optical fibre to every home, operators realized that, in most cases, fibre deployment will lead to very high costs. All agree that a fibre to the home (FttH) broadband network would be a great asset and many agree that a large-scale European roll-out will take place as soon as we have services requiring fibre, which end-customers are willing to pay for.

The problem with an FttH network does not lie in the technology, but rather in the investment and deployment cost, which is a too large bite to chew all at once.

The purpose of the 4GBB project is to allow us to evolve the network in smaller pieces, developing and standardising a system with fibre almost all the way, keeping only the last piece of copper. Such a technology will also support future mobile backhauling capacity demands, and therefore has the potential to become a very important enabler for the massive roll-out of mobile broadband. The new standard for this, G.fast, was initiated in ITU-T, February 2011, and its first release is expected in 2013.

Technological and economic challenges

The 4GBB project started with the technological challenge to achieve the connectivity in pair with fibre technology. The best known connectivity today is achieved by FttH taking fibre all the way to the customer. However, there are two economic barriers exploiting the technology. First, the cost of fibre deployment, which increases as the fibre termination is moved closer to the customer. Each section of installed fibre serves fewer customers, and the likelihood of utilizing ducts decreases, if ducts are available at all. Therefore the final drop of 20-200m is the most expensive part of the access section, normally meaning digging along individual paths to each customer. Secondly, the cost of installing new fibre inside the customer premises is higher than utilizing existing wires. Such an installation impacts not only the interior work, but also exterior, requiring permission for digging etc. If instead the last 20-200 meters of the existing telephone grid is used to transmit the signals, these inconveniences and expenses can be avoided (see Figure 1). At such short ranges, bandwidths of up to 200 MHz can be used on the copper, achieving service rates in the range of 1 Gb/s.

At the launch of the project, little was known about how the telephone wires behave at these high frequencies, much higher than what is used for VDSL2, i.e. above 30 MHz. Throughout the project there has been a lot of effort in measuring and modelling cables up to 200 MHz or more, both for the direct customer wire and the cross-talk channels between neighbouring wires. With this newfound knowledge we have shown by capacity calculations, simulations and a series of demonstrators that it is possible to reach Gigabit rates at distances between 20-200 meters. The technical study has been complemented by a techno-economic study showing that the foreseen economic incentives indeed are realistic.

Standardisation

As the desired technology seemed plausible, one of the main goals of the project has been to get the ideas into standardisation. The project has been a platform for coordination of the ITU-T G.fast standard, the embodiment of the 4GBB system that started in February 2011. A standard is necessary as a basis for regulation and system compatibility as well as to achieve necessary mass-market benefits. Standardisation processes themselves are based on a flow of voluntary technical contributions reaching a critical mass. The project partners initiated the G.fast standard and since then provided enough material to make it progress at a fast pace and attract a large interest from parties outside the project. While the contributions from the 4GBB project have kept a more or less steady pace, totalling 87

until July 2012, contributions from other parties are increasing exponentially as the standard gains global interest and support (see Figure 2).

Continuation of the project

In the forthcoming Celtic-Plus project HFCC/G.fast, starting in January 2013, the system development for the concept studied in 4GBB will be adressed. We have distinguished three main goals. The first is to drive the standardisation process home and ensure that the G.fast standard is completed. The second is to maintain a European technology lead and laying the foundation for continued export successes, including providing a new backhaul technology for wireless broadband systems. The third goal is to address, at an early stage, the path from completed standard to a commercial success and widespread deployment in Europe, giving the Digital Agenda a boost.

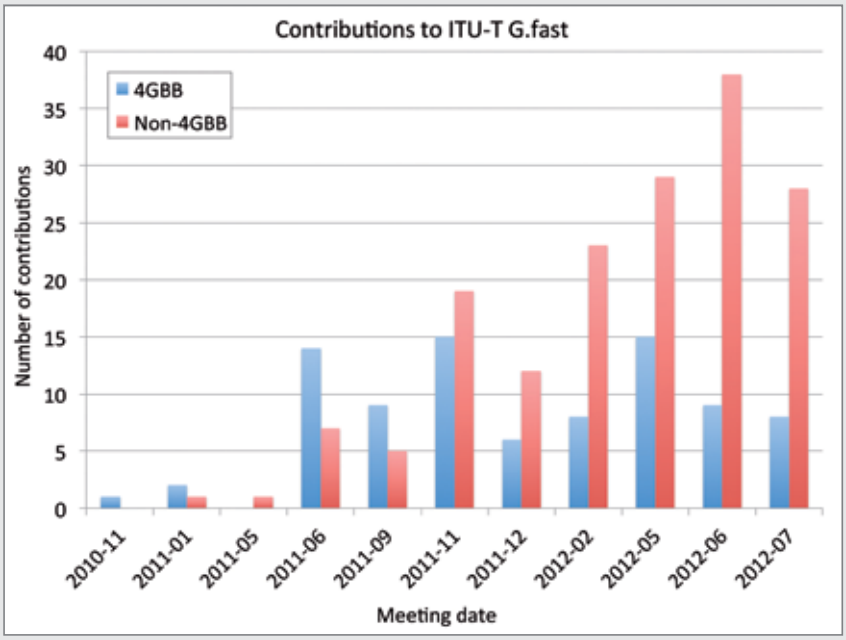

Figure 2: Contributions to ITU-T G.fast until July 2012.

Conclusion

There are two major achievements of the 4GBB project. Firstly, during the project it has been shown that the concept and the project ideas are both technologically and economically feasible. Secondly, the project has successfully initiated the G.fast standardisation project within ITU-T and shared material to bring the process towards a complete standard with global support. At the outset of the project this seemed a distant dream, but it has met with outstanding success.

Furthermore, the project partners have gained increased knowledge and contact networks, new market positions, and a number of pre-standard prototype products that are evaluated and tried in labs and in the field.

Further information is available at www.4gbb.eu

ENGINES

Enabling next generation networks for broadcast services

Dr. Jani Väre
Nokia Corporation
jani.vare@nokia.com

Second Generation Digital Terrestrial Broadcasting (DVB-T2) and Next Generation Handheld (DVB-NGH) are the latest state-of-the-art standards provided by the DVB organization. DVB-T2, adopted or deployed already in some 50 countries globally, was recently extended with the DVB-T2-Lite profile tailored for mobile reception. The DVB-NGH physical layer specification was recently endorsed by the DVB technical module and is now on the way for ETSI standardisation. The remaining specifications are about to be completed soon. The ENGINES project had an important role in the various stages of the development of the two standards.

When the ENGINES project was launched in the beginning of 2010, DVB-T2 was well under way to its current status as a global terrestrial digital television standard. Respectively, DVB-NGH was in its infancy, and the call for technologies had just been launched a few months before. The scope for the ENGINES project was easy to be defined by combining these two rather big topics.

The work related to DVB-T2 Lite profile came as additional 'extra-flavour' when DVB technical module decided to develop this extension for the DVB-T2. The verification and validation of DVB-T2 was a large part of the ENGINES project.

Another major element in the ENGINES project was the focus on contributing to the technical work of DVB-NGH. The third major topic in the project, cognitive radio, was focusing mostly on regulation efforts at the European Conference of Postal and Telecommunications Administrations