



Future Internet PPP Architecture Position paper No2: Ethernet Transport for Future Internet

From: EIT ICT KIC/Helsinki Node
Comnet/Aalto University

Prof. Raimo Kantola, Jukka Manner
{firstname.lastname}@tkk.fi

Critical Analysis

Current Internet uses both synchronous, bit-stream oriented and asynchronous packet based transport. Synchronous transport links run with constant capacity. When used in for transporting bursty data traffic, all bits carried use energy but most of them are meaningless. Energy efficient Ethernet (EEE) standards are being created by the IEEE. The first of them 802.3az, applicable to copper links, is expected to come out in September 2010. Energy consumption by ICT and in particular by networks is becoming a problem. In the US, according to some sources, 9% of energy is used by ICT and the usage by this sector is growing fastest. One cost driver is broadband wireless and mobile networking. For example LTE access network will consume up to 40 times more power than a GSM access network. It is expected that the sleep mode in EEE will save hundreds of millions of Euros worldwide when deployed. This is based on avoiding the transmission of the meaningless bits. Another energy cost driver is higher capacity that is needed for the Future Internet links: with a given technology energy consumption tends to grow relative to the second power of link speed. With terabit links that are just a few years in the future, energy consumption with the current technology base becomes intolerable.

When Internet links run over synchronous transport the protocol stack is IP or IP/MPLS over PPP or Ethernet over SDH/PDH. When the underlying transport changes to Ethernet, the PHD/SDH layer is removed saving energy and OPEX as well as CAPEX. Ethernet frames have addresses. When Ethernet becomes ubiquitous, the role of IP as the network integrator needs to be re-evaluated. At the same time, we note that MPLS has scalability limitations: in large networks the cost of fault management grows faster than linearly and scaling to inter-carrier networks is limited.

Before Ethernet can become ubiquitous from access and corporate networks to mobile and fixed access and core networks, be that local, metropolitan or wide area, the technology must be enhanced significantly. For example co-existence of clock distribution and EEE, Traffic Engineering in EEE networks, wide area addressing, support of mobility on Ethernet layer, routing on Ethernet layer, smooth deployment scenarios etc. are areas that need further work.

Recommendations for Advancement of Technology

We propose to enhance Ethernet technology with the target of making it the ubiquitous packet transport technology supporting energy efficiency, low OPEX, mission critical networking, fast convergence, tight interoperation with optics, network virtualization, traffic engineering, inter-carrier services and mobility.

In order to achieve the goal, we need an EEE solution for optical and wireless links, a native Ethernet based virtualization and TE solution that is independent of IP that also will provide managed inter-carrier virtual networks making network capacity a commodity that is available on-demand at a minute's notice globally.



Future Internet PPP Architecture

The mobility solution needs to be applicable to mobile broadband access networks leading to simplification of the protocol stack and lower OPEX and CAPEX.

Future Orientation

The proposed development will give a new breath of life to increasing the capacity of the data networks and to the deployment of mobile broadband allowing the implementation of the Instant Wireless Internet available anytime, anywhere. The potential for new business for the European Industry is huge. In our vision, we can deploy and evolve Ethernet-based access and core networks without explicit support from OS vendors and end device manufacturers, but still also enable the evolution of services being delivered on this network.

What can EIT Helsinki Node/Comnet Contribute now?

In the 100GET project, we have developed and implemented a routed Ethernet technology based on TRILL but one that does not use broadcasting for ARP nor for MAC learning, and supports mobility without changes in the end hosts. The solution can for example be applied to wireless access eliminating a lot of irrelevant traffic that a WLAN card on a PC sees and for scaling Ethernet to a wider area network than is possible with the legacy techniques. The implementation has also a major positive impact on privacy. In the FP7 ETNA project, together with our partners we have developed a native Ethernet based carrier grade transport solution that supports both intra- and inter-carrier connectivity services allowing the virtualization of the network and selling network capacity worldwide as a commodity. Capacity can be made available on a minute's notice worldwide. We are developing ways to leverage and enhance these technologies for different use scenarios.

The development of Ethernet as a ubiquitous transport technology links nicely with our work on connecting the Internet of Things with the current Internet (see Position Paper No 1). The latter smoothly accommodates Ethernet transport but does not presume it facilitating smooth migration to new technology.

We have built the competence to advance this technology till it can be taken over by the vendors.

Experimentation Facilities

It would make sense to set up several European wide experiments using the NREN facilities and the FIRE or a similar new framework created by the FI PPP. We can provide a node for a joint experimentation platform; we have our own fiber already connecting several universities and companies in Finland, and can extend this connectivity relatively easily to other Nordic countries and central Europe.

More information on the site: www.re2ee.org.