Efficient Integrated Backbone (EIBONE) – Multi-Layer Transport Networks with Integrated Control

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This talk summarizes results and provides background information related to the work performed on network and transmission aspects within the German research framework EIBONE, funded by BMBF. The common view of the EIBONE partners and the key results are published in two positioning papers on “Multi-Layer Transport Networks with Integrated Control“ [1] and “Transmission Technologies – 100Gbit/s Ethernet” [2], which are presented in this talk.

Upcoming new applications and subsystems, based on the Internet Protocol (IP) and IP Multimedia Subsystem (IMS), are driving the annual traffic growth at rates of 50-100%, in particular the wireline IP traffic in the metro and core transport networks. This emphasizes the importance of evolving transport networks towards a flexible, reliable and Quality-of-Service (QoS) supporting infrastructure fulfilling the requirements of IP based services, whilst also meeting tight cost and performance targets.

The evolution starts from two different platforms: Existing synchronous, circuit-switched Synchronous Digital Hierarchy/ Synchronous Optical Network (SDH/SONET) networks on the one hand which are lacking the flexibility to handle efficiently packet based traffic and its highly dynamic traffic demands although offering high reliability and quality. On the other hand, packet-centric IP backbone networks which are well-suited for the dynamic IP traffic, but which face scalability issues and technology limitations due to the high complexity of the router hardware and protocols, and also provide reliability and quality only to a certain degree. Various technical solutions for future multi-layer (layer 1 - 3) transport networks with an integrated control are studied in the German research framework EIBONE to provide an efficient, cost effective and automated infrastructure with optimized CAPEX (capital expenditure) and OPEX (operational expenditure). The studies are focusing on multi-layer architectures for core and metro networks. This includes considering new layer 2 packet transport concepts as a converged approach providing switching and forwarding of packets or frames and including layer 2 transport services as efficient solutions to the aforementioned challenges. The control of these new multi-layer networks will make use of specific protocols like GMPLS (Generalized Multi-Protocol Label Switching) integrating all three lower network layers into a single control instance for automated, optimized usage of resources and for provisioning of end-to-end QoS in a multi-domain, multi-operator, and multi-layer environment.

The architectural work in EIBONE is accompanied and supported by analysis and modeling of services and traffic profiles as well as architectural options to enable planning, dimensioning, and optimization of transport network solutions and to stimulate techno-economic studies in terms of performance and cost. Feasibility and implementation studies are investigating technological and functional options and will also provide lab demonstrations of selected node functions and its control.

In addition to network architecture related work, an important aspect of EIBONE is the study of transmission technologies and implementation options for transmission up to 100Gbit/s. In the talk a short overview is given on the EIBONE whitepaper on transmission aspects for 100Gbit/s Ethernet [2].

[1] Gerd Eilenberger et al: “Multi-Layer Transport Networks with Integrated Control”, ITG Fachtagung Photonische Netze, 28. - 29.04.2008, Leipzig

[2] P. M. Krummrich et al.: "EIBONE working group transmission technologies - white paper 100 Gbit/s Ethernet", VDE Studien und Reports, April 2008, www.vde.com.