Foreword

"Next Generation Networks (NGN)": these three words have emerged since 1998 as a leitmotiv for a number of networking industries and academic organizations. A search engine such as Google will find more than 55 millions answers referencing leading industrial projects for building NGN products, infrastructures, services and applications. There will also be a tremendous amount of technical and scientific contributions published in conferences, workshops, colloquiums, symposiums, and many more events, dedicated to the ngn revolution.

Among the many definitions of NGN, we may for example cite IEC's (International Engineering Consortium): "*The next-generation network seamlessly blends the public switched telephone network (PSTN) and the public switched data network (PSDN), creating a single multiservice network. Rather than large, centralized, proprietary switch infrastructures, this next-generation architecture pushes central-office (CO) functionality to the edge of the network. The result is a distributed network infrastructure that leverages new, open technologies to reduce the cost of market entry dramatically, increase flexibility, and accommodate both circuit-switched voice and packet-switched data.*"

As can be seen, NGN is tightly related to the telecommunication industry as they were the first to use these three words to describe the new networking infrastructures that would merged voice, data and multimedia traffics with the main objectives of reducing the so-called Operating Expenses (OPEX) that have become incredibly high due to the increasing complexity of managing a large number of separate networks. Some recurrent keywords for the NGN initiatives are convergence, data-aware and service-aware, triple-pay, reconfiguration, multi-layer control management, high-performance and quality of service to name a few.

Behind these objectives relies a fundamental component, which is the optical fibre. Most NGN infrastructures, if not all, are built on optical fibre links that offer, with the most recent advances in wavelength multiplexing (WDM), an incredible amount of bandwidth able to satisfy the most demanding customer or application.

The NGN term, initially used by the telecommunication industry, is now commonly also used by the networking community and especially the Internet community which is developing and pushing new IP-based technologies and protocols both in backbone and edge networks. Within this community, the main keywords are IPv6, routing, mobility, wireless and ad-hoc, VOIP, HTTPng, TCP, congestion control, quality of service, high-speed, broadband, MPLS and GMPLS to name a few.

This special issue of Annals of Telecommunications focuses on transport protocol for IP-based NGN. The transport layer of the Internet consists of the

TCP and UDP protocols, which are the most widely deployed protocols. TCP, being connection-oriented, provides reliability features and the fundamental mechanism of congestion control that makes the Internet operational on a large-scale basis. One of the main problems of NGN for transport protocols such as TCP is the increase in several orders of magnitude of the link capacities, enabled by today's optical fibre links. On the other hand, the physical propagation delays merely remain the same, resulting in the so-called high bandwidth-delay product networks where the network infrastructure can be viewed as a large-scale memory. Congestion control in such an environment is therefore highly complex because the performance of the protocol is a difficult trade-off between fairness and efficiency.

As stated previously, there have been a number of propositions on transport protocols for these new infrastructures. Articles in this special issue compare their performance and/or propose novel protocols.

The first article by R. Les Cottrell, Saad Ansari, Parakram Khandpur, Ruchi Gupta, Richard Hughes-Jones, Michael Chen, Larry McIntosh and Frank Leers, entitled *"Charecterization and evaluation of TCP and UDP-based transport on real networks"*, evaluates and compares state-of-the-art transport protocols proposed by the research community. The study presents extensive experimental results of various protocol stacks, including the most recent protocols, on both production and testbed networks. Achievable throughput, stability and intra-protocol fairness are being investigated which could serve as guidelines in the new transport protocol jungle.

The article by Nageswara S. V. Rao, Qishi Wu, Steven M. Carter and William R. Wing *"High-speed dedicated channels and experimental results with Hurricane protocol"* addresses the special case of very-high speed dedicated channels such as those being deployed in large-scale grid infrastructures. The authors highlight the limitations of current protocols in providing the full throughput at the application level. They propose an efficient implementation of a new transport protocol for dedicated channels and give experimental results with various hosts and dedicated channels characteristics.

In the article entitled *"Performance evaluation of dccp: A focus on smoothness and tcp-friendliness"* by Xiaoyuan Gu, Pengfei Di and Lars Wolf, the authors address an important research area which is how to add congestion control to protocols such as UDP used by a large number of multimedia applications. The study presented in the paper focuses on DCCP, which is a new proposed protocol developed with the purpose of replacing UDP as the transport protocol for packet-switched multimedia content delivery. The authors propose an OPNET-based simulation model and show simulation results that focus on smoothness of the data rates and fairness of DCCP.

In their article *"A study of a simple preventive transport protocol"*, Fabien Chatté, Bertrand Ducourthial and Silviu-Iulian Niculescu propose a new congestion control algorithm called "Primo" (PROportional Integral MOdified). Their objective is to develop a preventive congestion control mechanism, similar to TCP-Vegas in that it uses delay measurement to estimate a congestion level of a network, but different in that it uses one-way delays rather than round trip times.

Besides congestion control, there are many interesting research activities related to new applications with a particular focus on how quality of service could be obtained.

In the article by Armando L. Caro, Paul D. Amer and Randall R. Stewart, entitled *"Rethinking end-to-end failover with transport layer multihoming"*, the authors address the problem of multihoming support at the transport layer. As pointed out by the authors "Multihoming can be expected to be the rule rather than the exception in the near future as cheaper network interfaces and Internet access motivate content providers to have simultaneous connectivity through multiple ISPs, and more home users install wired and wireless connections for added flexibility and fault tolerance". In this article, the authors study the end-to-end failover mechanisms and thresholds for transport protocols that support multihoming and propose new mechanisms for improving the end-to-end quality of service.

In their article entitled *"TICP: Transport Information Collection Protocol"*, Chadi Barakat, Mohammad Malli and Naomichi Nonaka propose a TCP-friendly and reliable transport protocol to collect information from a large number of entities. The collector probes every entity, without aggregation, and adapts its request rate as TCP does (AIMD scheme). TICP can be used for collecting information for a large variety of applications, especially those involving a large number of participants.

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