Setting the Standards with Dr. Yaakov Stein

Next Generation Networks

Dr. Yaakov Stein is RAD's Chief Scientist, and has a regular column in TechTalk in which he discusses developments in the world of telecommunications standards.

In past editions of "Setting the Standards" I have discussed the use of carrier-grade Packet Switched Networks (PSNs) for providing a variety of services, from traditional voice services, to virtual private networks (VPNs) and streaming video. When used in this way, these PSNs are called Next Generation Networks (NGNs), and many Standards Development Organizations (SDOs) are laboring frenetically to specify the architecture and behavior of these networks.

All parties working on developing the NGN specifications accept three basic postulates: The first postulate is that NGNs are PSNs, and therefore efficient and flexible. This is in contrast to conventional carrier-grade networks that are circuit-switched, and thus reliable but inflexible and inefficient in bandwidth utilization.

The second postulate is usually called network convergence. Historically networks were developed for specific services, such as TDM networks for voice services and Ethernet for data services. However, NGNs are designed to support a multitude of different services. All NGNs support a basic packet-voice service ("VoIP") and Internet connectivity, as well as other services including text messaging, high-speed secure virtual private networks, video conferencing, and streaming high definition television.

The third postulate is variously called evolution, migration and co-existence. It is clear to all that conventional networks and end-user equipment are not going to disappear overnight; only in rare cases are massive "forklift" replacements going to take place. So NGNs are going to have to co-exist and seamlessly interact with legacy technologies for at least a decade or two. This means that interfaces to legacy end-user terminals and to legacy transport networks are crucial to the success of any NGN. Indeed, it sometimes seems that more effort is being expended on emulation of legacy services than on developing new ones.

However, that is where the similarity between the approaches of the various Standards Development Organizations (SDOs) ends. Many networks being referred to as NGNs (especially high-volume ones) rely on circuit switched networks for lower layer

transport, but some purists believe that asynchronous technologies need to be used from top to bottom. Some NGNs are connection-oriented PSNs (e.g. MPLS), and are thus similar to conventional networks; while others (e.g. pure IP and Ethernet) are connectionless PSNs. Methods for ensuring Quality of Service (QoS) vary widely, from support of packet prioritization in a best-effort environment, to sophisticated traffic engineering with resource reservation. Incumbent operators deploying NGNs are endeavoring to maintain as much as possible of their existing management infrastructure (e.g. Operational Support Systems), while in green-field scenarios new control planes may be installed. And the services supported by different NGNs vary widely.

One of the first attempts at NGN standardization was by the 3rd Generation Partnership Project (3GPP), the SDO responsible for developing the 3G cellular system based on GSM. 3GPP needed to enhance the TDM-based GSM system with IP capabilities in order to enable multimedia services, and so devised IMS, the IP Multimedia Subsystem. IMS borrowed heavily from the IETF, adopting (with some modification) Session Initiation Protocol (SIP) and Session Description Protocol (SDP) as its control plane, and Real Time Protocol (RTP) and IP version 6 (IPv6) as its bearer plane. IMS then added various features required by service providers, such as security (adopting yet more IETF protocols such as COPS and DIAMETER), billing, and management. More recently, the service enablers and open application interfaces required have been spun off into a new SDO, called the Open Mobile Alliance (OMA).

Once IMS was defined, it was realized that its principles were not overly wireless-specific, and could be readily adapted for any type of managed PSN. The buzzword here is Fixed-Mobile Convergence (FMC): by using the same architecture for both wireless and wireline networks, one can simplify the operation of both and facilitate their interconnection. The European Telecommunications Standards Institute (ETSI) set to work on adapting the IMS concept to fixed networks in its Telecoms and Internet Converged Services and Protocols for Advanced Networks (TISPAN) technical body. IMS is also being adapted by CableLabs for inclusion in its PacketCable 2.0 specification for delivery of real-time multimedia services over two-way cable TV infrastructures.

The ITU-T's Focus Group on NGNs (FG-NGN) produced a voluminous corpus of documents, which were passed on to Study Group 13, which has been named the lead study group for NGN matters. SG13 has defined 16 questions to work on, including requirements and implementation scenarios, principles and functional architecture, terminology, QoS, OAM, FMC, interworking, service scenarios and deployment models, impact of IPV6, interoperability of satellite with terrestrial and NGNs, protocols and service mechanisms for Multi-service Data Networks (MSDN), and security. The

output of SG13 is being published as the Y.2000 series of Recommendations, of which a general overview (Y.2001), a reference model (Y.2011), and principles for management (Y.2401) have been finalized. Some documents soon to be released are:

Y.2012 Functional requirements and architecture of the NGN

Y.2021 IMS for NGNs

Y.2031 PSTN/ISDN emulation architecture

Y.2091 Terms and definitions for NGNs

Y.2111 Resource and admission control functions in NGNs

Y.2171 Admission control priority levels in NGNs

Y.2261 PSTN/ISDN evolution to NGN

Y.2271 Call server based PSTN/ISDN emulation

Y.2701 NGN security.

Our survey has necessarily been brief, and we have only mentioned a few of the SDOs active in the NGN domain. However, even from this survey it is apparent that all parties working on the NGN specifications will agree to a fourth postulate: NGNs are complex, in fact so complex that many are now questioning whether we really need or want them at all.