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Advanced Services over IP networks.

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This article describes the modern advanced IP network services used today and how they will change at the future. This article will have a short description of the differences of the competing hardware solutions (ATM, Gigabit Ethernet, Frame-Relay, ISDN) and the kind of network services that can be built on them. This article will also describe the extra protocols needed for the performance optimisation and the quality improvement at the different layers of the OSI-model. After describing the data flow layers of the OSI-model (layer one to four) the article will describe the services a Advanced Intelligent Network (AIN) will support and provide at the application layers of the OSI-model (layer five to seven).

The predefined Quality of Services (QoS) and support for a real-time content are the most essential requirements for any system transporting a multimedia over network. The QoS parameters are the building blocks of all multimedia systems. Multimedia content places real-time requirements, such as low jitter and latency. Increased bandwidth sometimes solves the problem, but the bottleneck always remains somewhere in the network. The real-time (RTP, RTCP, RTSP) and the resource reservation (RSVP) protocols are needed for a successful transportation of the real-time sensitive content media over the networks. The goal is to offer variables such as predictability, adaptability and scalability for the applications in a system that may consist of the heterogeneous networks. Real-time protocols have also an important part to play in solving the problem with the transportation of the distributed multimedia. Traditionally the protocols of the Internet are considered as “best-effort”-protocols meaning that they cannot meet the requirements placed by the real-time applications.

The same goes with meeting the requirements of a distributed data transportation (such as multicasting over Internet), where the data should be sent only once and when there are multiple receivers who should get the service within a predetermined quality.

The throughput of the private and the open networks is growing fast. Firms all over the world are seeking for the opportunities to both cut the expenses down and increase the number of the services the network may provide. Services deploying the network performance, such as the teleconferencing over network, the voice calls over the Internet (VoIP) or even the large scale data storage systems (NAS/SAN), still use IP-based network model. Some extra concern has to be paid on because the Internet today is far from a secure platform for these applications. Many of the services are still quite vulnerable for the attacks from the Internet. Whether the Internet community wants it or not the crimes committed against the private business networks show growing numbers at the same time when the ways to resist the attacks are improving. The IP security policy includes the use of firewalls, the data encryption and the strong identifying mechanism, which all can be used as a protection from the hostile forces. As we clearly see, that in the future the security aspects will be more and more important at the design of the new protocols.

The challenges described at these paragraphs are all related with the simplicity of the basic IP-model. This article will describe the ways the traditional IP-model has to be improved in order to answer these challenges. Different services have many different requirements for the underlying network and the requirements may vary quite a lot from one to another. The key to the success is to improve the Internet or the company intranets so that the applications may have a freedom of choosing the variables best suited for the specific application.

Keywords: QoS, Quality of Service, real-time, multimedia, advance reservations, IETF, RSVP, RTP, RTCP, RTSP, Gigabit Ethernet, ATM, Frame-Relay, ISDN, Video-Telephony, VoIP, IPSec, VPN, DoS, SPAM, SSL, RADIUS, Multicast, Video-on-demand, IPTV, Distance Learning, NAS, SAN, AIN

Useful sources of information

- *Multimedia over IP: RSVP, RTP, RTCP, RTSP*. Raj Jain, Internet article made available at Http://www.cis.ohio-state.edu/~cliu/cis/ipmultimedia/ "This article has a quite complete description of the real-time protocols needed for example with Multimedia"

- *Cisco White Paper: Gigabit Campus Network Design - Principles and Architecture.* Cisco Systems (1999), Internet article made available at *http://www.cisco.com/warp/public/cc/so/neso/lnso/cpso/gcnd_wp.pdf* "This article has a quite understandable description of the Gigabit Networking with the Cisco's technology and it has also some designing examples of such networks."

- *Voice over IP: Strategies for the converged Network.* Mark A. Miller, The M&T Books, ISBN 0-7645-4617-1 (2000). "This book is a good starting point for anyone willing to understand the ways the Real-time sensitive services (such as voice call over Internet, VoIP) can be constructed nowadays".

- *IPSec: The New Security Standard for the Internet, Intranets, and Virtual Private Networks.* Naganand Doraswamy, Dan Harkins, Prentice Hall PTR, Internet Infrastructure Series, ISBN 0-13-011898-2, (1999). "This book is a good starting point for anyone willing to understand the IP Security schema and see the possibilities that lies within this technology".

- *Cisco White Paper: Architecture for Voice, Video and Integrated Data.* Cisco Systems (2000), Internet article made available at http://www.cisco.com/warp/public/cc/so/neso/vvda/iptl/avvid_wp.pdf "This paper discusses Cisco AVVID (Architecture for Voice, Video and Integrated Data). Cisco AVVID brings to multiservice networking a standards-based, open-systems architecture for converged networking."

- *Cisco White Paper: Networked Multimedia Overview*. Cisco Systems (1999), Internet article made available at http://www.cisco.com/warp/public/614/19.html "This paper discusses the structure of the industry that is delivering multimedia, the requirements that multimedia places on a network, and Cisco's products that will enable multimedia both today and in the future."

- *Cisco White Paper: Advanced QoS Services for the Intelligent Internet.* Cisco Systems (2000), Internet article made available at http://www.cisco.com/warp/public/cc/pd/iosw/ioft/ioqo/tech/qos_wp.pdf "A good introduction into the Cisco's way of treating the Quality of Service (QoS) schema."

References

AFK95 Ronnie T. Apteker, James A. Fisher, Valentin S. Kisimov, Hanoch Neishlos, Video Acceptability and Frame Rate. IEEE Multimedia Fall (1995), 32-40

AKR94 Caglan M. Aras, James F. Kurose, Douglas S. Reeves, Henning Schulzrinne, Real-time communication in the Packet-Switched Networks. Proceedings of the IEEE 82,1 (1994), 122-139.

BWG96 Shahab Baqai, Miae Woo, Arif Ghafoor, Network Resource Management for Enterprise-Wide Multimedia Services. IEEE Communications Magazine 34,1 (1996), 78-85.

BoT94 Jean-Chrysostome Bolot, Thierry Turletti, A rate control mechanism for packet video in the Internet. Proceedings of IEEE Infocom (1994), 1216-1223.

BDS95 Ingo Busse, Bernd Deffner, Henning Schulzrinne, Dynamic QoS Control of Multimedia Application based on RTP. Internet article made available at http://www.fokus.gdm.de/step/acontrol/ac.html.

Cha97 Samir Chatterjee, Requirements for Success in Gigabit Networking, Communications of the ACM, July 1997 / Vol 40, no. 7, 64-73.

Chi97 Leonardo Chiarigliano, The Challenge of Multimedia Standardization. IEEE Multimedia April-June (1997), 79-83.

CrL98 Lorrie Faith Cranor, Brian A. LaMacchia, Spam!, Communications of the ACM, August 1998 / Vol 41, no. 8, 74-83.

DKP97 Mikael Degerman, Torsten Köhler, Stephen Pink, Olov Schelen, Advance reservations for predictable service in the Internet. Multimedia Systems 5 (1997), 177-186.

DoH99 Naganand Doraswamy, Dan Harkins, IPSec: The New Security Standard for the Internet, Intranets, and Virtual Private Networks, Prentice Hall PTR, Internet Infrastructure Series, ISBN 0-13-011898-2, (1999)

FGV97 Domenico Ferrari, Amit Gupta, Giorgio Ventre, Distributed advance reservation of real-time connections. Multimedia Systems 5 (1997), 187-198.

HSK98 Vicky Hardman, Martina Angela Sasse, Isidor Kouvelas, Successful Multiparty Audio Communication over the Internet, Communications of the ACM, May 1998 / Vol 41, no. 5, 74-80.

Jai98 Raj Jain, Multimedia over IP: RSVP, RTP, RTCP, RTSP. Internet article made available at Http://www.cis.ohio-state.edu/~cliu/cis/ipmultimedia/

KuL98 Geng-Sheng Kuo, Jing-Pei Lin, New design concepts for an Intelligent Internet, Communications of the ACM, November 1998 / Vol 41, no. 11, 93-98.

Mil00 Mark A. Miller, Voice over IP: Strategies for the converged Network. The M&T Books, ISBN 0-7645-4617-1 (2000).

Opp97 Rolf Oppliger, Internet Security: Firewalls and Beyond, Communications of the ACM, May 1997 / Vol 40, no. 5, 92-102.

SCF96 H. Schulzrinne, S. Casner, R. Frederick, V. Jacobson, RTP: A Transport Protocol for Real-time Applications. Internet Engineering Task Force, RFC 1889 (1996).

SRL97 H. Schulzrinne, A. Rao, R. Lanphier, Real Time Streaming Protocol (RTSP). Internet Engineering Task Force, IETF (1997).

Sta99_ip Stardust.com, White Paper - Introduction to QoS Policies,

Stardust.com Inc (1999)

Sta99_nq Stardust.com, White Paper - The Need for QoS, Stardust.com Inc (1999)

Sta99_pa Stardust.com, White Paper - QoS protocols & architecture, Stardust.com Inc (1999)

Whi97 Paul P. White. RSVP and Integrated Services in the Internet: A Tutorial. IEEE Communications Magazine 35,5 (1997), 100-107.

VKB95 Andreas Vogel, Brigitte Kerherve, Gregor Von Bochmann, Jan Gecsei, Distributed Multimedia and QoS: A Survey. IEEE Multimedia Summer (1995), 10-19.

ZDE93 Lixia Zhang, Stephen Deering, Deborah Estrin, Scott Shenker, Daniel Zappala. RSVP: A New Resource ReSerVation Protocol. IEEE Network Magazine 7,5 (1993), 8-18.