

Proposal for a Tutorial for 2000 IEEE SoutheastCon

QUALITY of SERVICE in INTEGRATED NETWORKS

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OBJECTIVE

Integrated networks have become a reality. Users demand applications that deliver text, audio, images and video, often in real time and with a high degree of interactivity; economic and market forces dictate that these should be delivered over a common infrastructure. The heterogeneity of the applications leads to the desirability of some sort of service differentiation, or what is commonly referred to as Quality of Service (QoS).

The objective of this tutorial is to provide attendees with an understanding of the primary traffic management mechanisms needed to support QoS and a survey of various QoS architectures. The discussion will be anchored primarily on how such mechanisms are currently implemented in Asynchronous Transfer Mode (ATM) networks and on the advances in adding service differentiation to the Internet. This subject has generated substantial interest in the industry and research communities due to its role in the design and architecture of future networks, including the Internet.

DURATION

This is a half-day tutorial.

DESCRIPTION

Upon completing this tutorial, attendees should be able to:

- a. Define quality of service (QoS) and enumerate the provision and control mechanisms needed to support QoS.
- b. Identify the QoS requirements of different classes of applications and the types of service differentiation currently being offered.
- c. Describe the main components of service level agreements.
- d. Explain the issues involved in providing service differentiation in the context of the Internet, and identify the main solutions proposed to date.

The topics to be covered in the tutorial are as follows:

A. Introduction

1. Motivation for QoS
2. QoS architectures and protocols
3. Service Level Agreements - QoS metrics, traffic descriptors

B. QoS Mechanisms

1. Resource Provisioning
2. Queuing and Scheduling Mechanisms
3. Shaping and Policing
4. Call Admission Control
5. Flow Control
6. QoS Mapping

C. ATM

1. ATM Service Classes
2. ATM Traffic Contracts
3. ATM QoS Control Mechanisms

D. IP QoS

1. Resource Reservation Protocol (RSVP)
2. Integrated Services (IntServ)
3. Differentiated Services (DiffServ)
4. Multi Protocol Label Switching (MPLS)

E. Challenges: QoS for the Internet

1. Scalability
2. Multicasting
3. Synchronization and multimedia support
4. Pricing - usage-dependent, static/dynamic

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EDUCATION

Ph.D., Electrical Engineering, The University of Kansas, Lawrence, KS, 1998.
Dissertation: *Static Pricing in Multiple-Service Networks: A Game-Theoretic Analysis*
M.S., Electrical Engineering, The University of Kansas, Lawrence, KS, 1988.
Thesis: *A Class-oriented Voice Communication System for Packet-switched Networks: Description and Performance Study*
B.S., Electrical Engineering, The University of Kansas, Lawrence, KS, 1986.

EXPERIENCE

Academic

Assistant Professor, Electrical and Computer Engineering, Virginia Polytechnic Institute and State University, August 1998 to present.
Research Assistant, Information and Telecommunication Technology Center, The University of Kansas, January 1995 to July 1998.
Research Assistant, Telecommunications and Information Sciences Laboratory, The University of Kansas, May 1987 to July 1988.

Industrial

Product Specialist, Systems Engineer, IBM Brazil, Rio de Janeiro, Brazil, March 1989 to January 1995.

SELECTED PUBLICATIONS (complete list in <http://www.ee.vt.edu/~ldasilva/cv.pdf>)

1. "Static Pricing and Quality of Service in Multiple Service Networks," L. A. DaSilva, D. W. Petr, N. Akar, to appear in the *Fifth International Conference on Computer Science and Informatics (CS&I'2000)*, February 27-March 3, 2000, Atlantic City, NJ.
2. "Effects of Pricing on Multiple-service Networks with Resource Allocation," L. DaSilva, D. Petr and N. Akar, *Proceedings of SPIE - Performance and Control of Network Systems II*, Vol. 3530, pp. 206-217, Boston, MA, November 1998.
3. "Equilibrium Pricing in Multi-service Priority-based Networks," L. DaSilva, D. Petr and N. Akar, *Proceedings of IEEE Global Telecommunications Conference (GLOBECOM)*, Vol. 3, pp. 1373-1377, Phoenix, AZ, November 1997.
4. "ATM WAN Performance Tools, Experiments and Results," L. DaSilva, J. Evans, D. Niehaus, V. Frost, R. Jonkman, B. Lee and G. Lazarou, *IEEE Communications Magazine*, Vol. 35, No. 8, August 1997, pp. 118-125.
5. "Priority Discarding of Speech in Integrated Packet Networks," D. Petr, L. DaSilva and V. Frost, *IEEE Journal on Selected Areas in Communications*, Vol. 7, no. 5, pp. 644-656, 1989.

AWARDS

- 1999 Frontiers in Education New Faculty Fellow (ASEE/IEEE, 1999)
- Paul F. Huebner Memorial Award, for excellence in teaching (The University of Kansas, 1996)
- IIE/Fulbright undergraduate scholarship (1983)