Course guide
230616 - QSN - Quality of Service in Networks

Last modified: 11/04/2025

Unit in charge:	Barcelona School of Telecommunications Engineering
Teaching unit:	744 - ENTEL - Department of Network Engineering.

Degree:	MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject). MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2025   **ECTS Credits:** 5.0   **Languages:** English

LECTURER

Coordinating lecturer:	MONICA AGUILAR IGARTUA

Others:

PRIOR SKILLS

Basic general knowledge about communication networks

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process

Transversal:
2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

3. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

4. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures
- Application classes
- Laboratory practical work
- Individual work (distance)
- Exercises
- Extended answer test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The course gives a basic knowledge in QoS through metrics, algorithms, routing protocols and their application in the performance evaluation of communication systems. This course covers the principles and algorithms that arise in the QoS provision over different kind of networks, mainly in constrained wireless networks such as the infrastructureless ad hoc networks.

Learning results of the subject:

- Knowledge of the main algorithms for packet forwarding and classification, scheduling, traffic shaping and policing, congestion control.
- Knowledge of the main architectures to provide QoS on the Internet.
- Ability to discuss and analyse the performance of different routing protocols.
- Ability to carry out performance evaluations of QoS-aware routing protocols in communication systems using the NS-2 simulator.
- Ability to discuss and analyse the results of a performance evaluation of routing protocols in communication systems using NS-2 simulations.
- QoS-aware routing protocols for MANETs (Mobile Adhoc Networks) and VANETs (Vehicular Adhoc Networks)
- Smart City applications involving VANETs and multimedia services.

STUDY LOAD

Type	Hours	Percentage
Hours large group	26,0	20.80
Self study	86,0	68.80
Hours small group	13,0	10.40

Total learning time: 125 h

CONTENTS

1. Introduction

Description:
- Introduction. QoS architectures for the Internet: IntServ, RSVP, Diffserv.
- Different classes of services and their QoS requirements (ftp, video-streaming¿).
- Introduction to the practices to be done with the Network Simulator NS-2.

Full-or-part-time: 9h
Theory classes: 2h
Laboratory classes: 1h
Self study : 6h

2. Algorithms to provide QoS

Description:
- Traffic policing and traffic shaping algorithms. Leaky bucket algorithms.
- Algorithms to provide QoS locally: Scheduling algorithms (FIFO, RR, WRR...)
- Queuing algorithms (RED, WRED, RIO, CBQ...)
- Introduction to simple network scenarios using NS-2.

Full-or-part-time: 29h
Theory classes: 6h
Laboratory classes: 3h
Self study : 20h

3. Routing protocols and QoS

Description:
- Classification of routing protocols in communication networks from the QoS perspective.
- Routing protocols for ad hoc networks and QoS offered by each one: Terminology, basics and applications, characteristics of ad hoc communication, ad hoc routing protocols (AODV, OLSR, DSR, GPSR¿).
- Simulation of network scenarios for different routing protocols.

Full-or-part-time: 29h
Theory classes: 6h
Laboratory classes: 3h
Self study : 20h

4. QoS metrics used in routing protocols. QoS parameters used in performance evaluation.

Description:
- QoS parameters (delay, jitter delay, percentage of packet losses, throughput)
- QoS metrics (distance, available bandwidth, delay, jitter delay, losses, load).
- Advanced QoS metrics for ad hoc networks (path quality, link lifetime, battery lifetime, nodes' density, nodes' trajectory¿).
- Measure of QoS parameters using real traces from simulations.
- Performance evaluation of proposals of QoS-aware routing protocols compared to traditional routing protocols based only on the distance to destination.

Full-or-part-time: 32h
Theory classes: 8h
Laboratory classes: 4h
Self study : 20h

5. Advanced QoS-aware routing protocols considering different QoS metrics.

Description:
- QoS parameters (delay, jitter delay, percentage of packet losses, throughput)
- QoS metrics (distance, available bandwidth, delay, jitter delay, losses, load).
- Advanced QoS metrics for ad hoc networks (path quality, link lifetime, battery lifetime, nodes' density, nodes' trajectory).
- Confidence intervals of simulation results.

Full-or-part-time: 26h
Theory classes: 4h
Laboratory classes: 2h
Self study : 20h

ACTIVITIES

LABORATORY

Description:
Performance evaluation of routing protocols in mobile ad hoc networks, using NS-2 simulator.

Full-or-part-time: 14h
Theory classes: 14h

EXERCISES

Description:
Exercises to strengthen the theoretical knowledge.

Full-or-part-time: 3h
Theory classes: 3h

ORAL PRESENTATION

Description:
Presentation of a work related to the subject, in groups of two students.

Full-or-part-time: 2h
Theory classes: 2h

EXTENDED ANSWER TEST (FINAL EXAMINATION)

Description:
Final examination.

Full-or-part-time: 1h
Theory classes: 1h

GRADING SYSTEM

Final examination: 60%
Individual assessment in the classroom: 10%
Individual assessment in the laboratory: 30%

BIBLIOGRAPHY

Basic:
- Braun, T.[et al.]. End-to-end quality of service over heterogeneous networks [on line]. New York: Springer, 2008 [Consultation: 08/10/2014]. Available on: http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10240702. ISBN 9783540791201.

Complementary:
- Marchese, M. QoS over heterogeneous networks. Chichester ; Hoboken, NJ: John Wiley & Sons, 2007. ISBN 978-0470017524.
- Hardy, W.C. QoS: measurement and evaluation of telecommunications quality of service. Chichester: John Wiley & Sons, 2001. ISBN 978-0471499572.

RESOURCES

Other resources:
NS-2 network simulator. OVA ready to carry out simulations with the simulation scenario of a MANET (Mobile Ad hoc Network)