Subject: High-Performance Communication Systems
Code: 32438
Institution: Escuela Politécnica Superior
Degree: Master's program in Research and Innovation in Information and Communications Technologies (RI^2CT)
Level: Master
Type: Elective [High Performance Systems]
ECTS: 6

COURSE GUIDE: High-Performance Communication Systems (HPCS)

Academic year: 2012-2013

Program: Master's program in Research and Innovation in Information and Communication Technologies (RI^2CT)
Center: Escuela Politécnica Superior
University: Universidad Autónoma de Madrid

Last modified: 2012/07/27
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1. ASIGNATURA / COURSE (ID)

Sistemas de comunicaciones de altas prestaciones
High-Performance Communication Systems (HPCS)

1.1. Programa / program

Máster Universitario en Investigación e Innovación en Tecnologías de la Información y las Comunicaciones (I^2-TIC)

Master in Research and Innovation in Information and Communication Technologies (RI^{2}CT) [Officially certified]

1.2. Course code

32438

1.3. Course areas

High Performance Systems

1.4. Tipo de asignatura / Course type

Optativa [itinerario: Sistemas de Altas Prestaciones]
Elective [itinerary: High Performance Systems]

1.5. Semester

Second semester

1.6. Credits

6 ETCS

1.7. Language of instruction

The lecture notes are in English. The lectures are in Spanish.

1.8. Recommendations / Related subjects

Knowledge of computer networks at an advanced level is necessary to follow the course.
Knowledge of FPGA technologies is advisable.

1.9. Lecturers

Add @uam.es to all email addresses below.

Lectures and labs:

Dr. Jorge E. López de Vergara Mendez (Coordinator)
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1.10. Objetivos de la asignatura / Course objectives

La asignatura estudia los últimos avances en el campo de las redes de comunicación, tanto desde un punto de vista de tecnología de protocolos de alta velocidad, como del hardware y drivers que se emplean habitualmente en los sistemas de altas prestaciones.

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This course studies the latest advances in the area of communication networks, from the point of view of high-speed protocols as well as drivers and hardware commonly used in high-performance systems.

At the end of each unit, the student should be able to:

UNIT BY UNIT SPECIFIC OBJECTIVES	
UNIT 1.- High speed data networks	
1.1.	Know different broadband network technologies
1.2.	Know different traffic engineering techniques
1.3.	Know broadband standards and protocols
1.4.	Understand technology trends in state-of-the-art broadband networks
1.5.	Compare different approaches to Broadband architectures and implementations
UNIT 2.- High performance LAN technologies	
2.1.	Know the reasons for Infiniband
2.2.	Know the benefits of Infiniband
2.3.	Know Infiniband architecture and components
2.4	Compare Infiniband to existing technologies
2.5	Know hardware acceleration techniques in Ethernet Networks
UNIT 3.- Quality of service and network management	
3.1	Know QoS parameters
3.2	Know mechanisms to provide QoS in IP networks
3.3	Know IP network management techniques
3.4	Know IP network monitoring and measurement technologies

1.11. Course contents

PART I High speed data networks

1. Broadband networks
    a. Broadband fundamentals
    b. Traffic Engineering principles

2. DWDM
    a. DWDM fundamentals
    b. DWDM in Broadband networks

3. MPLS
    a. MPLS protocol fundamentals
    b. Label distribution protocols
    c. Traffic Engineering with MPLS

4. Advanced topics in Broadband networks
    a. Optical Burst/Packet Switching

b. Next Generation Networks

5. Seminar I: Core networks control plane
    a. Seminar imparted by Víctor López, Telefónica I+D

6. Seminar II: Cloud-aware networks
    a. Seminar imparted by Víctor López, Telefónica I+D

PART 2 High performance LAN technologies

7. Overview of high performance LAN network technologies
    a. 10G Ethernet
    b. Infiniband
    c. Fiber Channel

8. Introduction to InfiniBand
    a. Networking and InfiniBand
    b. InfiniBand System Area Network
    c. InfiniBand Features

9. InfiniBand Architectural Components
    a. Layered Architecture
    b. IBA System Area Network
    c. Memory, Protocol and Management
        i. Memory
        ii. Protocol Stack
        iii. Management

10. The NetFPGA Platform
    a. Introduction
    b. Inside the NetFPGA hardware
    c. Hardware Datapath
    d. Interface to software
    e. Demo: NetFPGA running on Etomic

PART 3 Quality of service and network management

11. Introduction to Quality of Service
    a. Quality of Service definition
    b. Quality of Service parameters
    c. Quality of Experience

12. Implementing Quality of Service in IP networks
    a. Classes of services
    b. Scheduling and policing
    c. DiffServ
    d. IntServ and RSVP

13. Network management
    a. Network management definition
    b. SNMP
    c. High performance counters in MIBs

14. Network monitoring and measurements
    a. QoS measurements
    b. MRTG
    c. Netflow

1.12. Course bibliography

1. *Computer networking, a top-down approach*, 6th ed. J.F. Kurose, K.W. Ross
2. *QoS in Packet Networks*, Kun I. Park, Springer 2005.
3. *Traffic Engineering with MPLS*, Eric Osborne , Ajay Simha Cisco Press
4. *Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE*. Ulf Troppens, Wolfgang Müller-Friedt, Rainer Wolafka; Rainer Erkens, Nils Haustein. John Wiley & Sons. Second Edition. 2009. Online: http://proquest.safaribooksonline.com/book/operating-systems-and-server-administration/storage-systems/9780470741436
5. *InfiniBand Network Architecture*. MindShare, Inc.; Tom Shanley. Addison-Wesley Professional. 2002. Online: http://proquest.safaribooksonline.com/book/networking/wireless/0321117654
6. *Advances in network management*. J. Ding
7. *Network management, know it all*. A. Farrel *et al*

1.13. Coursework and evaluation

The course involves lectures and assignments, which will be turned in by the student in the classroom, including a seminar presentation on a research topic in this subject.

It will also include lab practices and it is necessary to pass both practice and classroom assignments to pass the subject.

In the ordinary exam period, the evaluation will be made according to the following scheme:

- 33 % Exercises and class participation
- 33 % Lab assignments
- 33 % Seminar presentation on a research topic in this subject

In case of a fail grade in the ordinary exam period, an extraordinary exam (100% of the grade) will also be available for those students who do not turn in the assignments.