

# PI-Grau (Internet Protocols)

José M. Barceló Ordinas  
Departamento de Arquitectura de Computadores  
(UPC)

- **PI-Grau Professor:**

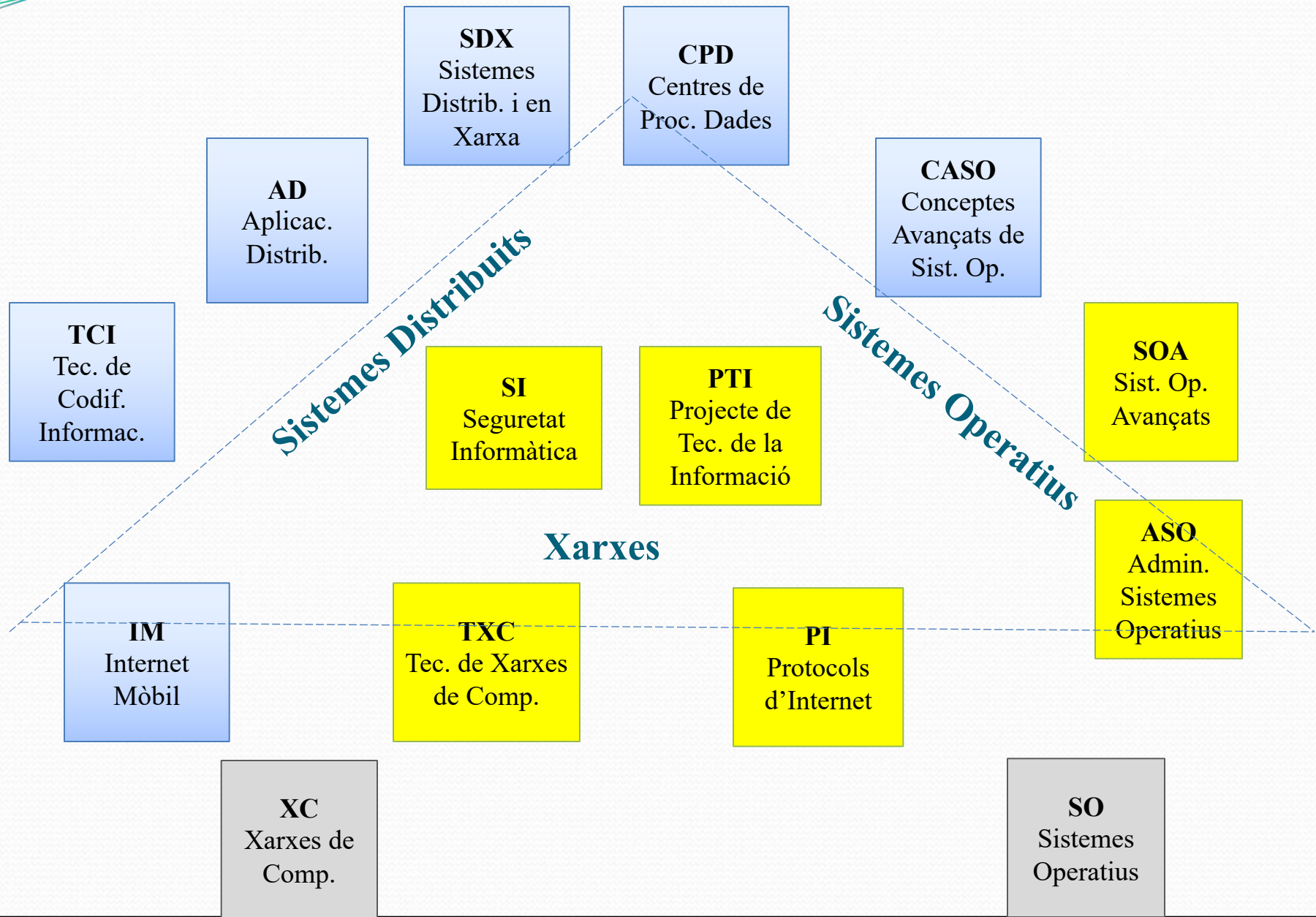
- **José M<sup>a</sup> Barceló Ordinas (Computer Architecture Dept.)**

- **Work-room: C6-214**
- **Personal Web: <http://people.ac.upc.edu/joseb>**
- **E-mail: [jose.maria.barcelo@upc.edu](mailto:jose.maria.barcelo@upc.edu)**

**See files with the planning of the course that are published in RACO**

- **Theory (Monday, 10:00-12:00, Friday 12:00-13:00, A6103)**
- **Lab 10 (Thursday, 12:00-14:00, D6003) is given by Llorenç Cerdà**
- **Tutorships dates: requested and agreed via e-mail**

# Especialitat Tecnologies de la Informació





- **PI-grau**

- Theory: audios + 2h/week of clarifying concepts and 1h solving exercises.
- Lab: 1h/week  $\rightarrow$  2h/2weeks  $\rightarrow$  6 Labs + 1 Lab exam for a total of 7 weeks over 15 weeks of course.
- Students will have to write a work at the end of the course. The topic can be anything related to the specialization.
- **Two exams:**
  - Exam 1: Topics 1 and 2 (35% of the course),
  - Exam 2: Topics 3 to 6 (35% of the course)

- **PI-grau**

- **Theory:**

- **Topic 1: Internet Architecture and Addressing (3 weeks)**

- Internet Architecture: ISP's, corporate networks and access networks.
- Organizations that manage the operation of businesses on the Internet: RIR (Regional Internet Registers), LIR (Local Internet Registries), Customer Cones.
- An Introduction to Content Distribution Networks (CDN).
- Internet Addressing: IPv4 depletion and IPv6.
- Exchange Points.

- **Topic 2: Corporate Network: switching blocks (4 weeks)**

- Ethernet switching.
- Virtual Networks (VLANs, IEEE 802.1Q) and aggregation (IEEE 802.3ad).
- Reliability level 2: Spanning Tree Protocol (IEEE 802.1D).
- Reliability Level 3: VRRP.
- Design of the switching block. Data Processing Centre (CPD): design and basic concepts.



### ● **PI-grau**

- **Topic 3: Intra-domain Routing (2 weeks)**
  - Basics for routing.
  - Link state routing.
  - OSPF: single-area and multi-area systems
- **Topic 4: Inter-domain Routing (2 weeks)**
  - Autonomous systems.
  - BGP (internal/external), attributes, multi-homing, load balancing.
  - Scalability in BGP: route reflectors and confederations.
  - Design of ISP
- **Topic 5: Corporate Networks revisited: VPN (1 week)**
  - Virtual Private Networks: MPLS-BGP and Metro-Ethernet
- **Topic 6: Applications and Services II (2 weeks).**
  - An introduction to Multimedia Services and QoS architectures.
  - Multimedia principles: coding
  - Taxonomy of QoS supporting protocols: RTP, RTCP, RTSP, SIP
  - Multimedia architectures: IntServ, DiffServ

### ● **PI-grau**

- Labs: 6 Labs + 1 Lab exam
  1. **STP** : learn the impact of Spanning Tree Protocol in a switched network.
  2. **Dynamic VLAN and VRRP Lab**: configure Ethernet switches using dynamic VLAN and the VRRP protocol.
  3. **OSPF Lab (inter-domain routing)**: configure OSPF in a single-area and in a multi-area
  4. **BGP Lab (intra-domain routing)**: configure BGP (EBGP/IBGP) and interconnect several AS's
  5. **Multi-homing and Communities Lab**: configure active policies between AS's using communities.
  6. **Scalability Lab**: configure route reflectors in a BGP network.
- Lab Exams using Webtest tool. Lab professor will explain the dynamic of the Labs at class.



- **PI-grau**

- Written work

- The work will consist on searching for information about a challenge topic proposed by by the students,
- The work can be individual or in groups of two (in this case, indicate which part has been worked by each student, e.g. put a color or some type of mark).



### ● **PI-grau**

- Examples of Topics for the works (a doc with ideas and topics can be found in the drive):
  - IPv4-IPv6 transition mechanisms
  - Advantages/disadvantages of using IPv6 with respect IPv4
  - Content Distribution Networks
  - Web services
  - Data Processing Centers
  - CAIDA
  - RIR activities
  - Growth (topology) of Internet
  - ...

**Students have the possibility to propose any topic he/she is interested (related to the contents of the course) in and it is not in the list.**

## • Course Evaluation:

- **Exam 1 at mid-term (Topics 1,2) → 35%**
- **Exam 2 at the end of the course (Topics 3, 4, 5 and 6) → 35%**
- **Written work (WW) about a given topic → 10%**
- **Lab → 20%**
  - **$\text{Lab} = 0.75 * \text{ExamLab} + 0.25 * \text{Sum}_i (\text{miniLabs}), \quad \text{where } i=1,2, \dots, 6$**

## **Calculus of Final mark:**

$$\text{NF} = 0,20 * \text{Lab} + 0,10 * \text{WW} + 0,35 * \text{Ex1} + 0,35 * \text{Ex2}$$



- **Competencia Transversal (CT):**

**Work responsibility**

- **Written Work (WW)** about a given work → **40%**
- **Lab and class participation (Lprt)** (attendance/delivery, ...) → **30%**
- **Lab grading** → **30%**

**Calculus of Final mark for the CT:**

$$\text{CT} = 0,40 * \text{WW} + 0,30 * \text{Lprt} + 0.3 * \text{Lab}$$

The final mark will be normalized to A (9-10), B (7.0-8.99), C (5-6.99), D (<5)