270639 - CNANM - Computer Network Architectures and Network Management

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 701 - AC - Department of Computer Architecture
Academic year: 2018
Degree: MASTER'S DEGREE IN INNOVATION AND RESEARCH IN INFORMATICS (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan

Prior skills

Bachelor Degree. Admission to MIRI.
For exchange students: a basic course on computer networks is a requisite.

Degree competences to which the subject contributes

Basic:
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.
CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.
CB8. Capability to communicate their conclusions, and the knowledge and rationale underpinning these, to both skilled and unskilled public in a clear and unambiguous way.
CB9. Possession of the learning skills that enable the students to continue studying in a way that will be mainly self-directed or autonomous.

Specific:
CEE2.1. Capability to understand models, problems and algorithms related to distributed systems, and to design and evaluate algorithms and systems that process the distribution problems and provide distributed services.
CEE2.2. Capability to understand models, problems and algorithms related to computer networks and to design and evaluate algorithms, protocols and systems that process the complexity of computer communications networks.
CEE2.3. Capability to understand models, problems and mathematical tools to analyze, design and evaluate computer networks and distributed systems.

Generical:
CG1. Capability to apply the scientific method to study and analyse of phenomena and systems in any area of Computer Science, and in the conception, design and implementation of innovative and original solutions.
CG3. Capacity for mathematical modeling, calculation and experimental designing in technology and companies engineering centers, particularly in research and innovation in all areas of Computer Science.
CG5. Capability to apply innovative solutions and make progress in the knowledge to exploit the new paradigms of computing, particularly in distributed environments.

Transversal:
CTR3. TEAMWORK: Capacity of being able to work as a team member, either as a regular member or performing directive activities, in order to help the development of projects in a pragmatic manner and with sense of responsibility; capability to take into account the available resources.
CTR4. INFORMATION LITERACY: Capability to manage the acquisition, structuring, analysis and visualization of data and information in the area of informatics engineering, and critically assess the results of this effort.
CTR5. APPROPRIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.
CTR6. REASONING: Capacity for critical, logical and mathematical reasoning. Capability to solve problems in their area
1. The main goal is to understand the basic concepts of the network architecture, the fundamental principles of network design and of the most relevant algorithms used in protocols and network functions.

2. The main goal will be achieved via discussion sessions based on selected readings. This approach fosters autonomous learning and teamwork skills.

Teaching methodology

Theoretical sessions will be complemented by discussion sessions based on assigned readings. Studying some selected research papers will provide the flavor of research work.

Learning objectives of the subject

1. The main goal is to understand the basic concepts of the network architecture, the fundamental principles of network design and of the most relevant algorithms used in protocols and network functions.

2. The main goal will be achieved via discussion sessions based on selected readings. This approach fosters autonomous learning and team work skills.

Study load

| Total learning time: 150h | Theory classes: 24h 16.00% | Practical classes: 12h 8.00% | Laboratory classes: 12h 8.00% | Guided activities: 6h 4.00% | Self study: 96h 64.00% |
## Evolution of the Network Architecture

**Degree competences to which the content contributes:**

**Description:**
- Internet Design Principles
- Key protocols and their evolution
- Internet structure, Exchange Points
- Economic relationships among stakeholders

## Trends in the Evolution of the Network Architecture

**Degree competences to which the content contributes:**

**Description:**
- Naming and Addressing.
- Addressing and Routing. Mobility.
- New Network Architectures.

## Routing and Inter-Networking

**Degree competences to which the content contributes:**

**Description:**
- Routing Algorithms.
- Classless Inter-domain Routing.
- Inter-domain Routing. IDR.
- BGP. IBGP. BGP attributes. Scalability of BGP.

## Transport Network (Backbone)

**Degree competences to which the content contributes:**

**Description:**
- Optical Transport Network.
- IP over SDH.
- IP over WDM/ASON.
- IP over WDM/GbEthernet.
- MPLS.
- From MPLS to GMPLS.

## New Network and Transport Protocols

**Degree competences to which the content contributes:**
Resource Management

**Description:**
- IPv6. IPv4-IPv6 coexistence.
- Mobile IP.
- IP Multicast.
- Other IP protocols (HIP).
- Multipath TCP.
- Other Transport protocols (QUIC).

**Degree competences to which the content contributes:**
- Quality of Service principles.
- Quality of Service and Quality of Experience (QoS and QoE).
- Integrated Services Architecture.
- Differentiated Services Architecture.

5G Network Architecture

**Description:**
- Framework for 5G networks. Core, edge and access networks
- Virtualization technologies (NFV)
- Software Defined Networks (SDN)
- Orchestration and management. Slicing
### Planning of activities

<table>
<thead>
<tr>
<th>Planning of activities</th>
<th>Hours</th>
<th>Specific objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evolution of the Network Architecture</strong></td>
<td>36h</td>
<td>1, 2</td>
</tr>
<tr>
<td><strong>Trends in the Evolution of the Network Architecture</strong></td>
<td>18h</td>
<td>1, 2</td>
</tr>
<tr>
<td><strong>Routing and Inter-networking</strong></td>
<td>18h</td>
<td>1, 2</td>
</tr>
<tr>
<td><strong>Transport Networks (Backbone)</strong></td>
<td>18h</td>
<td>1, 2</td>
</tr>
</tbody>
</table>

### Specific objectives:

- 1
- 2
### New Network and Transport Protocols

**Specific objectives:**
1, 2

**Hours:** 24h
- Theory classes: 8h
- Practical classes: 0h
- Laboratory classes: 0h
- Guided activities: 0h
- Self study: 16h

### Network Resource Management

**Specific objectives:**
1, 2

**Hours:** 24h
- Theory classes: 8h
- Practical classes: 0h
- Laboratory classes: 0h
- Guided activities: 0h
- Self study: 16h

### 5G Network Architecture

**Hours:** 18h
- Theory classes: 6h
- Practical classes: 0h
- Laboratory classes: 0h
- Guided activities: 0h
- Self study: 12h

### Qualification system

- Midterm/Assignments: 25%
- Discussion sessions: 25%
- Active Participation in Class: 10%
- Final Exam / Final project: 40%
Bibliography

Basic:


Complementary:


