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.

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

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

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

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>24h</th>
<th>16.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>12h</td>
<td>8.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>12h</td>
<td>8.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>6h</td>
<td>4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>96h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
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.
- SDN.

New Network and Transport Protocols

Degree competences to which the content contributes:
**Description:**
IPv6. IPv4-IPv6 coexistence.
Mobile IP.
IP Multicast.
Other IP protocols (HIP).
Multipath TCP.
Other Transport protocols (QUIC).

---

**Resource Management**

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

**Description:**
Quality of Service principles.
Quality of Service and Quality of Experience (QoS and QoE).
Integrated Services Architecture.
Differentiated Services Architecture.

---

**5G Network Architecture**

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

**Description:**
5G Network Characteristics. Key Performance Indicators (KPI).
Virtualization technologies (NFV).
Software Defined Networks (SDN).
Orchestration and management. Slicing.
5G projects and Initiatives.
### Planning of activities

<table>
<thead>
<tr>
<th>Description</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evolution of the Network Architecture</strong></td>
<td>1, 2</td>
</tr>
</tbody>
</table>
| Description:  
Internet Design Principles.  
Key protocols and their evolution.  
Internet structure, Exchange Points.  
Economic relationships among stakeholders. | |
| Specific objectives:  
1, 2 | |

| Hours | Theory classes: 12h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 24h | |

| **Trends in the Evolution of the Network Architecture** | 1, 2 |
| Description:  
| Specific objectives:  
1, 2 | |

| Hours | Theory classes: 6h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 12h | |

| **Routing and Inter-networking** | 1, 2 |
| Description:  
| Specific objectives:  
1, 2 | |

| Hours | Theory classes: 6h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 12h | |
## Transport Networks (Backbone)

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

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

**Specific objectives:**  
1, 2

## New Network and Transport Protocols

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

**Description:**  

**Specific objectives:**  
1, 2

## Network Resource Management

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

**Description:**  

**Specific objectives:**  
1, 2

## 5G Network Architecture

**Hours:** 18h  
- Theory classes: 6h  
- Practical classes: 0h  
- Laboratory classes: 0h  
- Guided activities: 0h  
- Self study: 12h
Description:
Características de la red 5G. Indicadores clave de rendimiento (KPI). Marco para redes 5G. Redes de núcleo, borde y acceso. Tecnologías de virtualización (NFV). Redes definidas por software (SDN). Orquestación y gestión. Rebanar Proyectos e iniciativas 5G.

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

Bibliography

Basic:


Complementary:


