COM-413  
**Real-time networks**  
Decotignie Jean-Dominique

<table>
<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energie et durabilité</td>
<td>MA2, MA4</td>
<td>Opt.</td>
</tr>
<tr>
<td>Informatique</td>
<td>MA2</td>
<td>Opt.</td>
</tr>
<tr>
<td>Robotique</td>
<td>MA2</td>
<td>Opt.</td>
</tr>
<tr>
<td>SC master EPFL</td>
<td>MA2, MA4</td>
<td>Opt.</td>
</tr>
</tbody>
</table>

**Language**  
English  
**Credits**  
3  
**Session**  
Summer  
**Semester**  
Spring  
**Exam**  
Oral  
**Workload**  
90h  
**Weeks**  
14  
**Hours**  
2 weekly  
**Lecture**  
2 weekly

**Summary**
At course completion, the student will be able to analyse the real-time properties of a communication network; and will also be able to create a new solution either balancing the tradeoffs between the different design parameters or composing building blocks. Applications to multimedia, transports.

**Content**
1. Introduction (hierarchy in communications, motivation for networks, types of applications)  
2. Requirements (delay, jitter, predictability, topology, cost, etc.)  
3. Communication systems architecture and its influence on temporal behavior (OSI model, communication models, real-time paradigms: Time-Triggered vs. Event-Triggered, interworking)  
4. Fieldbusses and how real-time performance assessment: FIP and CAN as examples  
5. Ethernet, industrial Ethernet and real-time Ethernet  
6. Wireless communications and their impact on real-time guarantees  
7. IEEE 802.11 and IEEE 802.11e  
8. Bluetooth, IEEE 802.15.4 (ZigBee) and wireless sensor networks  
9. Real-time in wireless sensor networks

**Keywords**
real-time, networking, wireless, wireless sensor networks, medium access control, quality of service

**Learning Prerequisites**
- **Required courses**
  none
- **Recommended courses**
  real-time systems, protocols

**Important concepts to start the course**
Protocols and real-time system background

**Learning Outcomes**
By the end of the course, the student must be able to:
- master real-time techniques in wired and wireless networking  
- modelling of quality of service requirements  
- deep knowledge of real-time medium access control techniques
• exercise the real-time guarantee evaluation techniques
• capability to design a new real-time solution

Transversal skills
• Communicate effectively, being understood, including across different languages and cultures.

Teaching methods
Ex cathedra + student presentations + exercises

Expected student activities
Learning the course material, reading, presentation and discussion of a scientific paper as an introduction to research

Assessment methods
Mid-term presentation 50% and final exam 50%

Supervision
Office hours No
Assistants No
Forum Yes

Resources
Bibliography
See course URL

Websites
• http://lamspeople.epfl.ch/decotignie/
• http://moodle.epfl.ch

Moodle Link
• http://moodle.epfl.ch/course/view.php?id=10761