

# From the Internet to the IoT: Fundamental of Modern Computer Networking

**Subject area:** Computer Science/ICT

**University:** L'X  
**Level:** MA1, MA2  
**Teaching mode:** completely online, not time-specific  
**Instructor(s):** Thomas Heide Clausen

## Short description

The 21st century is becoming a data-driven century. Interaction with everyday objects may yield a wealth of information, especially when correlated: if in a flat the fridge door is being opened and closed regularly, then flat is inhabited; if oven is used frequently, the inhabitant is either overeating (so a potential customer for diet plans) or is entertaining frequently (so a potential customer for party supplies). Something which analysing the usage patterns of the door bell would reveal...

## Full description

The 21st century is, if anything, becoming a data-driven century. Interaction with everyday objects may yield a wealth of information, especially when correlated: if in an apartment the fridge door is being opened and closed regularly, then presumably apartment is inhabited ; if a drinking glass is subsequently emptied, presumably the inhabitant is alive and well, and, is staying both fresh and hydrated ; if the BBQ or the oven is used frequently, perhaps the inhabitant is either overeating (and so, a potential customer for diet plans) or is entertaining frequently (and so, a potential customer for party supplies) — something which analysing the usage patterns of the door bell would reveal...

A premise for being able to analyse usage patterns and interactions is, of course, that these physical actions are captured and transformed into data — and, that these data are communicated from everyday objects with and through the Internet, and to the cloud.

And so, the 21st century is necessarily also the connected century: smartphones, watches, fridges, toothbrushes, drinking glasses, coffee machines, medical implants, BBQs, office plants, and forks are all becoming connected objects, generating data — and thus, becoming part of the Internet.

Outside of the consumer market, knowing the state of a machine, of an airplane engine, or of a power substation, permits scheduling predictive maintenance and avoid accidents — embedded sensors able to capture, and communicate, this state is a necessary premise.

As a matter of fact, a company launching a product today that doesn't "run an app" and "connects to the Internet" is a company, which just hasn't grasped the needs (or, at least, the desires) of its market - much as the guy installing the bike rack on the left, clearly misunderstood his "target market".

In order to ensure that YOU do not end up being that gal/guy, building a product miserably missing the market, this course provides you with the core competencies, necessary for developing connected systems.

Specifically, this course:

- Offers a pragmatic and practical approach to communicating systems and to computer networking
- Studies, for each of the four major functional layers in a protocol stack (data-link, internetwork, transport, and application) the fundamental ideas, algorithms, and architectural principles, that apply “from the Internet, and to the IoT”
- Provides an in-depth tutorial in the principles behind TCP/IP Networking
- Introduces and decrypts modern Internet and IoT protocols: from IPv6 to 6LoWPAN, from ALOHA through Ethernet and WiFi to LoRa and Bluetooth — and from the WEB and REST to CORE And CoAP
- Provides practical experience in developing networked applications, and in developing and implementing protocols.

In short, this course provides an in-depth understanding of “how the net works” (pun intended), and gives the necessary baggage for an engineer (regardless of area of exercise) to be able to design communicating systems.

This course is self-contained: it assumes some programming skills, and a lot of curiosity — and will introduce the rest as it goes along. The course will be available asynchronously, fully on-line, or on-site, through learning flows with short videos, quizzes, homework, lab exercises.

## Learning outcomes

The course provides students a thorough understanding of how the Internet work — as well as why it is designed the way that it is.

## General information

**Contact hours per week:** 4 hours

**Total workload:** 40 hours + personal work (in student hours for the whole course)

**ECTS credits:** 5

**Language:** English

**Course start date:** 03 January 2023

**Course end date:** 03 June 2023

**Add. info about start date:** Individualised, can be any date, between Jan 3 and April 1, 2023. Please note that the intended start-date must be communicated to Ecole Polytechnique at the time of registration. The course end date should be exactly 10 weeks after the start-date.

**Weekly teaching day/time:** Available fully asynchronous

**Time zone:** CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

**Further information:** Interested EuroTeQ students are welcome to, at any time, to come discuss their course choices in chat, or in visio, with the instructors from Ecole Polytechnique who will be teaching the classes. To this end, a dedicated WebEx space is permanently available here: <https://eurl.io/#fCk0f6iWF>.

**Prerequisites:** Any “introduction to networking” course

**Activities and methods:** The course will be available asynchronously, fully on-line, or on-side, through learning flows with short videos, quizzes, homework, lab exercises / tutorials — as well as office-hours via Webex with professors and instructors. While being asynchronous, each student is expected to check in with an instructor over Webex, weekly, following the chosen start-date.

**Presence on campus:** no

## Final examination

**Form:** Final exam, weekly quizzes, graded assignments

**Date:**

**Location/format:** online

**Re-sit possibility:** no

**Transcript available:** end of the semester and generally 8 weeks after the exam.

**Add. info/requirements:**

## Registration

To register for this course, follow the registration requirements of your **home university** as specified here: [www.euroteq.eu/courses-registration](http://www.euroteq.eu/courses-registration).

## Administration

**Number of places:** 24-30

**Minimum participants:**

**Internal course code:**

**Contact:** [euroteq-mobility@polytechnique.fr](mailto:euroteq-mobility@polytechnique.fr)

*This course is part of the EuroTeQ Engineering University joint course catalogue 2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit [www.euroteq.eu](http://www.euroteq.eu) or get in touch with the above-mentioned point of contact.*