# Welcome to the SWENG (SoftWare ENGineering) transverse option

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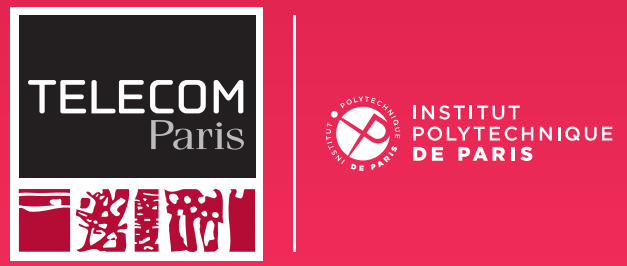

# Introduction

# What is Software Engineering?

**Programming** is *writing code* that “works” (= does something useful for you).

**Software engineering** (SE, sw.eng., hence “SWENG”) is a branch of both computer science and engineering focused on designing, developing, testing, and maintaining software applications.

Software Engineering covers everything needed to make code *keep working*:

- **at scale**: millions of lines, not the few hundreds of a lab assignment
- **over time**: code lives for decades, and spends most of its life being changed
- **with others**: dozens to thousands of developers, most of whom you will never meet in person
- **under constraints**: correctness, security, performance, cost, deadlines, regulations

# From craft to engineering

Hence a set of **disciplines and techniques**:

- Requirements and design
- Software architecture
- Testing, verification, validation
- Build, release, deployment (DevOps)
- Maintenance and evolution
- Measuring what actually works (Software Analytics / Empirical SE)

**Engineering**: not just craft, but principled methods, backed by evidence, that we can teach, apply, and evaluate.

# But what about coding agents?

AI coding agents are good at **writing code**. But that was never the hardest part:

- **Deciding what to build**: an agent optimizes the problem you give it, not the one you should have asked about.
- **Architecture and trade-offs**: performance vs. cost, simplicity vs. flexibility, build vs. buy. Decisions that are expensive to undo, and that no prompt makes for you.
- **Reviewing is harder than writing**: you cannot validate code you do not understand — and now there is a lot more of it to validate.
- **The whole life cycle stays**: integration, testing, security, deployment, maintenance, evolution of systems that outlive their authors (and their LLMs).
- **Accountability is human**: when the software fails, leaks data, or breaks the law (CRA, GDPR, AI Act, …), the engineer answers for it, not the model.

> Agents *raise* the demand for software engineering skills: more code produced, faster, means more to design, review, secure, and maintain.

# The SWENG option in a nutshell

An in-depth study program on the **key principles and practices needed to develop high-quality software systems**.

- **What we cover**: software development, software architectures, testing techniques, and empirical methods in software engineering — both foundations and advanced topics.
- **How**: courses, lab sessions, and collaborative projects. Theory **and** practice.
- **What you take away**: software design, systems integration, project leadership, and applied research on software artifacts.
- **Where it leads**: software engineer, system architect, research engineer, technical project manager — in industry or in research.

> More info on the homepage: `sweng.telecom-paris.fr`

# Practical aspects

# Organization of the year

- First semester (30 ECTS):
  - 12 ECTS of scientific courses
  - 12 ECTS of PRIM project
  - 6 ECTS of language and humanities courses (we do not manage these)
- Second semester (30 ECTS): a five-six month-long internship in a company or research lab.
  - You may have some obligations remaining to validate the school diploma (e.g., number of weeks spent abroad, number of weeks spent in a company, etc.) — we do not manage these.

# Mandatory courses: canceled this year

- ~~Advanced Software Testing and Fuzzing (2 ECTS)~~
- ~~Empirical Methods in Software Engineering (Stefano Zacchiroli, Théo Zimmermann, 2 ECTS)~~
- ~~Software Variability (Xhevahire Tërnava, 2 ECTS)~~

Empirical Methods course can be converted into optional self-study module with office hours and a project. Contact us if you are interested.

# Elective courses

You need to select (at least) **12 ECTS** of elective courses. Some suggestions:

- Formal Methods (*ATHENS week*, 24 hours, **2 ECTS**)
- Collective Intelligence (*M2 DataAI*, 24 hours, **2.5 ECTS**)
- Advanced Programming of Interactive Systems (*M2 IGD*, 42 hours, **5 ECTS**)
  - Warning: Starts next Tuesday (September 8th)
- Safe System Programming in Rust (*M2 Cyber*, 48 hours, **5 ECTS**)
- Self-study Empirical Methods in Software Engineering module (**2 ECTS**).
- *Any other relevant M2-level IP Paris course*: **with our approval**.

All suggested courses are taught in English.

# PRIM project

PRIM = Projet Recherche Innovation Master

- Equivalent to a semester-long half-time job.
- Alone or in a group (usually a pair).
- Can be done with a company or researcher. Entrepreneurial projects are also possible.
- We are currently collecting projects. Let us know if you have a specific interest or if you have a project idea. We can help you find a suitable project.

# Internship

- Can start any time after the end of your first semester courses (e.g., in March).
- You should start looking for an internship early.
- Let us know what you are looking for and we can help.
- Evaluated with a report and a presentation at the end of the internship. (To be organized with your internship pedagogical supervisor.)

# Q&A

- Homepage: `sweng.telecom-paris.fr`
- Contact: sweng-admin@telecom-paris.fr