Télécom ParisTech
A “Grande Ecole”...

...at the heart of centers of excellence

Télécom ParisTech is...

> A public graduate school, member of IMT (Institut Mines-Télécom), France’s number one public institution dedicated to higher education and research serving innovation.

> Founder member of a joint venture set to become the “French MIT”, an Institute of Science and Technology with a global reputation bringing together École polytechnique, ENSTA ParisTech, ENSAE ParisTech, Télécom SudParis and with HEC as the main partner.

> Founder member of ParisTech, a cooperative venture bringing together 10 Grandes Écoles in a publicly recognized foundation supporting diversity, French business and innovation, and working to export its “Grande Ecole” model (notably to Shanghai).

Currently located in Paris in the 13th district, in September 2019 Télécom ParisTech will move to Palaiseau at the heart of the Paris-Saclay campus.

A school on a human scale
- 800 engineering students
- 470 specialized Master’s degrees
- 270 PhD students
- 16,500 graduates

Open to the world
- 139 partnerships in 41 countries
- 46 double degrees
- 46 Erasmus programs
- 48% international students
- 1 Télécom ParisTech Shanghai Jiao Tong school with ParisTech schools

Cutting-edge research
- 150 faculty members and researchers on permanent contracts
- 630 international publications
- 15 patents and 21 international extensions
- 20 teaching & research chairs and laboratories funded by companies

Enterprise creation
- 1st incubator in France for digital start-ups
- 3 start-ups founded each month
- 374 companies started up since 1999
- 293 active companies

At the top of the rankings
- 1st engineering graduate school for academic excellence (L’Étudiant)
- 1st engineering graduate school for proximity to companies (L’Étudiant)
- 3rd institution worldwide in computer sciences (U-Multirank)

Your engineering training at Télécom ParisTech

1st year
Common core
Paris-Saclay Campus
- Coursework, projects and internship to improve personal & professional skills

Paris-Saclay curriculum
Choose 2 study tracks out of 14 + humanities courses

Sophia Antipolis curriculum
Choose 1 study track out of 4 + numerous technical courses to choose from

2nd year
Technological innovation
- Choose an option out of 14 available at Télécom ParisTech with a Master Innovation Research Project (PRIM)

Master of science in engineering
- Master 2 specialized programs within the University (double degree in engineering + Master’s degree)

Multidisciplinary partnership
- Master 2 cross-disciplinary and complementary degree or elite double degree with partner schools in France

International option
- International program: Double degree or exchange program (e.g. Erasmus)

3rd year
6-month engineering internship

1 international experience

Two curricula for a single Télécom ParisTech engineering degree
YOUR 1ST YEAR AT TÉLÉCOM PARISTECH: DISRUPTIVE LEARNING

The 1st-year program comprises about twenty common core courses, projects and cross-disciplinary subjects for students to choose from. At the end of the 1st year, students go on to choose subjects that they want to study in more depth in 2nd year.

COMMON CORE COURSES

• Mathematics for engineering
  Analysis (14h)
  Probabilities and statistics (130h)
  Mathematics (85h)

• Basics of electronics, physics, communication
  Digital communication and information theory (38h)
  Electronics of acquisition systems (30h)
  Propagation (15h)
  Optics and photonics (38h)
  Microphysics and nanophysics (30h)

• Signal, image and sound processing
  Tools and applications for signals, images and sound (46h)

• Computer science and networks
  Operating systems and C language (48h)
  Data structures and algorithms (30h)
  Digital processors and architectures (27h)
  Java Language (42h)
  Networks (44h)
  Language theory (18h)

• Economics, social and human sciences
  Introduction to contemporary economics (18h)
  Introduction to management (15h)
  Challenges of information and communication technologies (22h)
  Practice and analysis of written communication (22h)

• Discovering the corporate world
  For an understanding and awareness of the role and responsibilities of digital engineers
  Visits to companies (8h)
  Career roundtables (12h)

PROJECTS

• Thematic collaborative learning project - PACT
  (110 hours approx.)
  By adopting disruptive teaching methods which foster creativity and autonomy, the PACT responds to the concrete problems faced by companies, the aim being to teach you how to investigate.
  Teamwork, project management, grasping the complexity of real problems: each group of students chooses a subject at the beginning of the year and are assisted by a tutor for the six months of this project.

• Final application project - PAF
  (65 hours approx.)
  This project enables students to apply what has been learned in the first year to concrete hardware and software solutions, by combining at least two technological disciplines. It helps students to choose their path in the Master’s cycle by giving them a foretaste of the potential of the different disciplines offered.

CHOICE OF COURSES

• Language course
  English + one or two languages from a choice of 10, beginner or advanced level.
• General culture course (1 course per year to be selected)
• Courses in personal and professional skills (theater, improvisation, etc.)

PERSONAL AND PROFESSIONAL SKILLS INTERNSHIP

For 1 to 2 months during the summer following the 1st year, this internship provides experience of life in a company or association. Students are free to choose their own internship, in France or abroad.

YOUR 2ND YEAR AT TÉLÉCOM PARISTECH

PARIS-SACLAY CURRICULUM

2 STUDY TRACKS AND THEIR AREAS OF APPLICATION FOR IN-DEPTH STUDY

In the 2nd year, courses are organized into Teaching Units (UE). You will choose 2 study tracks from the 14 that are offered (192 hours of teaching) and in addition you will choose complementary courses in social sciences (85 hours), language (30 to 60 hours) and personal and professional skills activities (30 hours).

THE 14 STUDY TRACKS
(see details on the following pages)

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
  > Data Science
  > Signal Processing for Artificial Intelligence
  > Image

MATHEMATICS AND COMPUTER SCIENCE
  > Stochastic modeling and scientific computing
  > Applied algebra
  > Mathematics, theoretical computer science and operational research

ECONOMICS AND DIGITAL INNOVATIONS
  > Strategy, innovation, markets

NETWORKS, COMMUNICATION AND CYBERSECURITY
  > Wireless networks and Internet of Things
  > Network security and computer infrastructure
  > Networks
  > Telecommunications: from data to systems

COMPUTER SCIENCE, INTERACTIVE AND EMBEDDED SYSTEMS
  > Embedded systems
  > Distributed software systems
  > 3D and interactive systems

A CURRICULUM IN ENGLISH IN PARIS

A curriculum entirely in English is offered on the Paris-Saclay campus for your 2nd and 3rd years. You will follow two study tracks chosen from Applied algebra, Stochastic modeling & scientific computing, Data science, Strategy, innovation and markets, and Signal processing for Artificial Intelligence, and in addition selected courses in social sciences and humanities from those available in English.
Courses in this study track are taught in English.

The Data Science track covers all fields related to the operation, management and analysis of large datasets, both structured and unstructured.

**Aim**

To explore large volumes of data, to understand and analyze data.

**In concrete terms**

Courses combine theory and practice with a good balance between tutorials in math and practical work in the computer lab. You will develop your knowledge of databases, web development, statistics and machine learning.

**Career opportunities**

Some examples of natural career opportunities are jobs as data scientists or data analysts, engineering statisticians, database administrators or research and R&D careers in machine learning, data management, data extraction, data mining, and mathematics of learning.

**Technological innovation in Year 3 at the School**

- Data science
- Artificial Intelligence

**Double Degree Master of Science in Engineering**

**Learning Option:**
- Machine learning, Information and Content (Université Paris-Saclay)
- Data Science (Université Paris-Saclay)
- Mathematics, Vision and Learning (Université Paris-Saclay)

**Data Management Option:**
- DataScale: Data management in a digital world (Université Paris-Saclay)
- Data and Knowledge (Université Paris-Saclay)

**Alexandra HUARD, Class of 2018**

This general study track is at the heart of today’s most popular topic: extracting value from data. You have to be able to identify the important variables in datasets then construct predictive tools. For example, the price of a house according to surface area and location, or predicting whether a person is a man or a woman based on a picture. Courses combine theory and practice with a good balance between the two: math tutorials or practical work in the computer lab—we program using Python! There’s no need to be scared, the demonstrations in class are always easy to understand. Whichever track you are originally from, you’ll find a subject you like at Télécom: I come from a Physics & Chemistry track, I did statistics, but I managed with no problem.

**For those who like**

- Applied Mathematics
- Working on (very) topical subjects

**For those who like**

- Math applied to real problems
- Machine learning
- Signal processing
Aim
This study track ensures that students have a solid knowledge in the field of image processing and interpretation, which will be useful both in industry and in a research lab if they go on to do a PhD.

In concrete terms
This track gives students the basics of image analysis then moves on to more advanced courses dealing with developing mathematical imaging techniques, computer vision and 3D reconstruction. These approaches are inspired by artificial intelligence, and in particular deep learning, for image analysis and interpretation, image classification and indexing, and video. The main areas of study (medical imaging, aerial and satellite imagery and photography for the general public) will be presented by researchers active in these fields, then complemented by talks from industrialists on other applications (biometrics, industrial vision, etc.).

Career opportunities
This study track prepares students for jobs such as research engineer and design engineer, processing and interpreting images, visually and in 3D, in a variety of fields: medical and biological imaging, photography for the general public, scene modeling and synthesis, spatial and aerial imagery, biometrics, defense, etc.

Courses in this study track will be taught in English.

Aim
This study track offers courses in applied mathematics, or more precisely in the domains of stochastic modeling and scientific computing for applications (several to choose from) in financial mathematics, data science, signal and image processing and modeling.

In concrete terms
We do an in-depth study of mathematical tools for statistics, scientific computation and financial mathematics. The theoretical approach is similar to that used in the “Classes préparatoires”, with tutorials and practical work. The subsequent Master2 courses are in probabilities, finance or statistics.

Career opportunities
A double degree that includes these Master’s is particularly sought after by technology companies or the financial industry. This type of course also opens up many opportunities for doctoral studies either in the form of an academic thesis or in the context of an industrial project (CIFRE thesis).

Course directors: Yann Gousseau, Isabelle Bloch and Florence Tupin

Heads of international mobility: Yann Gousseau, Isabelle Bloch and Florence Tupin

Internship coordination: Michel Roux

I’m passionate about math and as I wanted to specialize in finance, I decided on this study track which offers a course in applied math. Each session alternates courses and tutorials. This track covers Hilbert spaces, probabilities (stochastic processes, mathematical statistics, Markov chains), martingales, asymptotic statistics, digital analysis (with several sessions of practical work), then offers a choice between two options in the last period: stochastic calculus ([ALEA option]) or distribution theory ([Analysis option]). As I wanted to go into finance, I chose the ALEA option.

Course director: François Roueff

Head of international mobility: Anne Sabourin

Internship coordination: Laurent Decreusefond

Michel Roux

Internship coordination:
Yann Gousseau, Isabelle Bloch and Florence Tupin

Heads of international mobility:
Yann Gousseau, Isabelle Bloch and Florence Tupin

Internship coordination: Michel Roux

Léa DEMRI,
Class of 2018

Simon DAHAN,
Class of 2019

The IMA study track offers the opportunity to acquire knowledge in a highly valued area of expertise, in an age dominated by data processing and the arrival of artificial intelligence and human-computer interaction. The strength of this study track lies in its human scale (20 students). Classes are enjoyable and there is excellent contact with the teaching staff. Courses combine computer skills, applied math and some basic physics. Its strength also lies in the fact that you work on projects in a wide variety of fields: processing medical or satellite images, computational photography, machine learning applied to image processing. There is a very varied range of applications and this is another advantage of this study track, which combines perfectly with other courses at Télécom.

Course directors: Yann Gousseau, Isabelle Bloch and Florence Tupin

Heads of international mobility: Yann Gousseau, Isabelle Bloch and Florence Tupin

Internship coordination: Michel Roux

Simon DAHAN,
Class of 2019

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Heads of international mobility: Yann Gousseau, Isabelle Bloch and Florence Tupin

Internship coordination: Michel Roux

Simon DAHAN,
Class of 2019
### APPLIED ALGEBRA

**Cryptography, Quantum information, Coding theory**

Courses in the Applied Algebra study track will be taught in English.

**Aim**
The study track gives an introduction to several areas of computer science and telecommunications: formal calculation, correction coding, cryptography and quantum information theory. This study track is mostly based on a common core of mathematics, mainly algebra.

**In concrete terms**
These subject areas will be dealt with theoretically. There will be courses that are purely mathematical (arithmetic and finite bodies, algebraic curves) and courses at the interface of computer science and mathematics, or even physics (correction coding, cryptography, quantum information). The modules are given in the form of traditional lessons-tutorials, with about fifteen students. Some modules can also be completed in the form of projects or as practical work on a machine (computational algebra).

**Career opportunities**
This study track represents a first step towards a career opportunities in communication systems, networks or complement for students who want to move into research career. The most obvious next step is to go on to an M2 Master's degree and then a PhD.

**For those who like**
- Algebra
- Mathematics in general and who are not afraid of abstraction
- Machine learning applications

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### TECHNOLOGICAL INNOVATION IN YEAR 3 AT THE SCHOOL

**- Quantum Safe Cryptography**

**Double Degree Master of Science in Engineering**
- Algorithmics and Foundations of Programming (Université Paris-Saclay)
- Digital Telecommunications Systems (Sorbonne University)

**Aim**
This study track is aimed at students looking for an advanced course at the interface between computer science and mathematics. It is particularly suited to those who hope to go on to a PhD in computer science.

**In concrete terms**
On the one hand, the program combines courses introducing methods of combinatorial optimization, advanced algorithmics, game theory, graph theory and computation, and on the other, the Teaching Units enable students to understand the limitations and the ins and outs of programming, through computability and logic.

**Career opportunities**
This study track prepares students with good common sense to solve the challenges posed by the great names in computer science and in all types of sector (transport, energy, logistics, banking, healthcare, telecommunications). Future careers are possible both in research and as an expert in companies ranging from innovative start-ups to major groups.

**For those who like**
- Solving mathematical problems using original approaches
- Understanding the possibilities and limitations of computer science

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### TECHNOLOGICAL INNOVATION IN YEAR 3 AT THE SCHOOL

**- Quantum Safe Cryptography**

**Double Degree Master of Science in Engineering**
- Algorithmics and Foundations of Programming (Université Paris-Saclay)
- Foundations of Computer science and Software engineering (Université Paris-Saclay)
- Operational Research (Université Paris-Saclay)

**Aim**
The track provides future engineers with the tools to analyze and solve difficult mathematical problems and algorithms using a variety of approaches.

**In concrete terms**
On the one hand, the program combines courses introducing methods of combinatorial optimization, advanced algorithmics, game theory, graph theory and computation, and on the other, the Teaching Units enable students to understand the limitations and the ins and outs of programming, through computability and logic.

**Career opportunities**
This study track is perfect for anyone who likes computer-related math. From game theory to solving complex algorithmic problems, the mathematics that we are taught are varied and exciting, and make it possible to move either into research or into engineering, at Google for example. The skills we acquire are highly sought after as they are what is needed to solve current problems: everyone needs optimization. And finally, the faculty are renowned experts in their field and are excellent teachers.

**For those who like**
- Understanding the possibilities and limitations of computer science

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### COURSE DIRECTOR:

**Nicolas MAURIZOT, Class of 2019**

Algebra is the basis on which today's telecommunications are built. From the discovery of qubits to factoring polynomials for cryptography, via the unavoidable Shannon's theorem, it's in fact the hidden theory behind coding, transmission and communications security that you cover in Applied Algebra.

This is a demanding study track, requiring a real thirst for math and sound abstraction skills. However, because it combines the esthetics of pure theory with the discovery of practical, concrete issues, it is truly exciting.

It will give you a powerful theoretical base, whether you want to go on to research or into telecommunications engineering, and will open up some fine prospects for Year 3, in particular the most prestigious Information Technology Master's degrees in the world (KTH, ETH, Imperial College).

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### COURSE DIRECTOR:

**Bertrand Meyer**

**Head of International mobility: Petr Kuznetsov**

**Internship coordination: Bertrand Meyer**

**Adrien MARCENAT, Class of 2018**

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### COURSE DIRECTOR:

**Ghaya Rekaya**

**Internship coordination: Michèle Wigger**

**Class of 2019**

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It will give you a powerful theoretical base, whether you want to go on to research or into telecommunications engineering, and will open up some fine prospects for Year 3, in particular the most prestigious Information Technology Master's degrees in the world (KTH, ETH, Imperial College).
The courses in the Strategy, Innovation, Markets study track can be taught in English.

**Aim**

In the SIM study track you are taught to understand the phases of innovation from design through to launch. Two specializations are offered:

- one on the digital economy & management for an in-depth economic and strategic analysis of information systems,
- one on the design, development and economic models of innovation in start-ups or in large companies.

**In concrete terms**

Through company-related projects you will experience the way in which technical skills, an understanding of the market, a knowledge of practices and interpersonal skills all fit together (working in a team, communication, creativity, etc.). You will experience the innovation process from the inside. This track also gives an insight into the dimensions and determinants of a company's strategic orientation.

**Career opportunities**

This study track is aimed particularly at two types of students:

- those who wish to go into consulting, corporate strategy and marketing,
- those who are motivated by business innovation (research and development, intrapreneurship) and entrepreneurship (start-up creation).

**For those who like**

- Creating their own start-up
- Understanding how economics and business work
- Working in consulting or in finance

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**WIRELESS NETWORKS AND THE INTERNET OF THINGS**

This study track provides in-depth courses in wireless networks and the Internet of Things (IoT). Cellular networks have turned our communication methods upside down, and IoT is set to revolutionize health, industry, transport, cities and entertainment. As a result, wireless networks and IoT are the two major components of the future fifth generation.

**Aim**

The aim of the study track is to train engineers who will have an excellent knowledge of existing technologies, and will be able to design these networks of the future.

**In concrete terms**

The study track offers a good balance of courses including general principles of wireless networks, technological aspects (standards, protocols, architectures, including those for cloud computing), platform experiments, theoretical aspects (stochastic modeling for performance evaluation optimization) and openings onto today’s challenges.

**Career opportunities**

This study track trains consultants, network architects, design engineers for operators, and also for energy suppliers, smart car manufacturers, and in e-health, etc. Graduates will also be able to work in IoT start-ups, or move into research or teaching.

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**STRATEGY, INNOVATION, MARKETS**

**The Internet of Things**

Sawsan Alzahr
Internship coordination: Marceau Coupechoux
Course director: Marceau Coupechoux
Head of international mobility: Kei SABURO-CLOCHARD

This study track was inevitably the one for me, and I have absolutely no regrets about my choice of track!
**NETWORKS**

**Aim**
The Networks study track provides comprehensive training in the networks of today and tomorrow. It will train engineers to give them excellent knowledge of existing network technologies and protocols.

**In concrete terms**
Students on the RES study track will understand routing protocols, operator networks, the basic principles of Cloud Computing, processing client data in the network, the technical-economic model of OTT (over-the-top) companies such as Google or Amazon, TCP/IP model layers, the function of addressing and the description of signaling techniques...

This is a well-balanced course including general principles, technological aspects and more theoretical aspects, and it also takes the experimentation aspect of students' projects into account.

**Career opportunities**
- Major telecoms operators, landline and mobile (Orange, SFR, Bouygues, Free, etc.)
- IT-Cloud networks (Microsoft-France, IBM-France, Nexedi, Atos, Steria, etc.)
- Network and telecoms suppliers (Nokia, CISCO-Systems, Dassault Systèmes, etc.)
- Banks, finance (BNP Paribas, Société Générale, etc.)
- Internet, new technologies (Altran, Amadeus, etc.)
- Technical-economic design (Accenture, BearingPoint, Boston Consulting Group, etc.)
- Transport (Peugeot, Renault, SNCF, Air France etc.)
- Network security (Gemalto)
- Energy (Electricity distribution networks, Enedis, EDF, etc.)

**For those who like**
- Understanding the mechanisms that go on behind their screen
- Understanding the choices that operators are faced with
- Discovering the essential tools for networks

**Technological innovation in Year 3 at the School**
- Network Security and Computer Infrastructure

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**COMPUTER INFRASTRUCTURE AND NETWORK SECURITY**

**Aim**
This study track aims to train highly qualified engineers in Cybersecurity to master the technical, organizational and legal aspects of IT infrastructure and networks in their various mutations, so that they are able to manage the associated risks.

**In concrete terms**
This includes:
- Mastering the different security services and their cryptographic mechanisms
- Being able to assess risks, threats and their consequences
- Analyzing and implementing attacks
- Mastering security analysis and auditing tools
- Mastering techniques for developing secure applications and protocols
- Setting up trusted infrastructure

The study track comprises theoretical coursework backed up with various practical applications (workshops, practical work, group projects, individual projects) to ensure that concepts and tools are well assimilated.

**Career opportunities**
The SR2I study track trains engineers in communication systems in networks and in security.

**For those who like**
- Thinking about a system and diverting its use
- All aspects of cybersecurity
- Cryptographic challenges
- Networks of the future and critical infrastructure
- Electronic payments and embedded systems

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**Technological innovation in Year 3 at the School**
- Network Security and Computer Infrastructure

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Emilien LAVIE, Class of 2018

I chose this track to study security issues within systems. And what better way to protect systems than to learn how to attack them? We learn how to exploit the most common vulnerabilities, and also more advanced ones in the course of development projects on the topics we select! The track is training future engineers who will be well aware of security issues, both technical and organizational, and who will always be very much in demand in companies: it’s exciting!

Vincent BOUCARD, Class of 2018

In the networks study track I am able to study the functioning of mobile and IP networks (Internet). When I joined Télécom after a physics and engineering degree, I discovered many fields that I was quite unaware of until then. Eventually I decided on Networks because I was tempted by the 1st year courses! This study track has enabled me to understand and reflect on a wide range of tools that we use on a daily basis: from calls on our smartphone to Peer-to-Peer file sharing, via real-time discussions on Messenger, we have no idea what is hidden in there and it’s fascinating!

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**Course director:** Maurice Gagnaire
**Head of international mobility:** Dario Rossi
**Internship coordination:** Luigi Iannone

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**Course director:** Ahmed Serhrouchni
**Head of international mobility:** Rida Khatoun
**Internship coordination:** Pascal Urien
### Embedded Systems

**Aim**
The Embedded Systems study track aims to produce engineers who have specialized theoretical and practical knowledge in the field of embedded systems.

**Technological innovation in Year 3 at the School**
- Embedded systems, organized around 3 topics:
  - Embedded real-time critical systems
  - Design and architecture of embedded systems and connected objects
  - Systems on a chip

**Double Degree Master of Science in Engineering**
- Integration Circuit Systems (Université Paris-Saclay)
- Embedded systems at Information processing (Université Paris-Saclay)
- Design, Modeling and Architecture of Complex Systems (Université Paris-Saclay)
- Distributed Systems and Applications (Sorbonne University)
- Multimedia Networking (Université Paris-Saclay)

**For those who like**
- To understand interactions between hardware and software, leaving no gray areas
- A course that is as practical as it is theoretical

**Course director:** Guillaume Duc  
**Head of international mobility:** Samuel Tardieu  
**Internship coordination:** Tarik Graba

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### Telecommunications: From Data to Systems

**Aim**
The study track “Telecommunications: from data to systems” provides a global and exhaustive overview of communication network technologies from both a theoretical and a practical standpoint.

**In concrete terms**
One of the key strengths of the study track is the major project that accompanies students throughout the year and which gives them a better understanding of the notion of communication systems by linking up the different courses.

More precisely, digital communication, optical communication, antennae and associated wireless electronic communication systems will be studied, as well as their interaction with one another, to obtain an end-to-end view of a communication network.

**Career opportunities**
After completing this study track, you will have a full and interdisciplinary view of communication systems. In the 3rd year you will study one of these areas in more detail. You will then be able to join a large group, an SME or an innovative start-up in many different sectors such as telecoms but also aeronautics, the automotive industry, healthcare, etc. Your profile will also be of interest to technology consulting firms. An industrial or academic thesis is yet another possibility.

**Course director:** Anne-Claire Lepage  
**Head of international mobility:** Michèle Wigger  
**Internship coordination:** Anne-Claire Lepage

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**For those who like**
- Understanding the architecture of a communication system
- Knowing how data transfer works
- Knowing how a laser works, or an antenna, etc.

**Technological innovation in Year 3 at the School**
- Microwave engineering for connected objects and mobile and satellite communications
- Integration circuit systems and smart objects

**Double Degree Master of Science in Engineering**
from Université Paris-Saclay:  
- Components and Antennae for Telecommunications
- Integrated Circuit Systems
- Optics Photonics System Networks
- Advanced Wireless Communications Systems
- Advanced Communication Networks

**Chloé MOLLE, Class of 2018**

"In this study track I understand how all types of communication system work, whether they are wireless or fiber optic systems. This is the physical part of the networks, the part that we can touch! To model and represent these systems we use mathematical tools and adapted physical models. We also have many practical assignments which give a pragmatic vision of a communication system."

**For those who like**
- Understanding the architecture of a communication system
- Knowing how data transfer works
- Knowing how a laser works, or an antenna, etc.

**Technological innovation in Year 3 at the School**
- Embedded systems, organized around 3 topics:
  - Embedded real-time critical systems
  - Design and architecture of embedded systems and connected objects
  - Systems on a chip

**Double Degree Master of Science in Engineering**
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- Multimedia Networking (Université Paris-Saclay)

**Matthieu RENAULT, Class of 2018**

"In this study track I understand how all types of communication system work, whether they are wireless or fiber optic systems. This is the physical part of the networks, the part that we can touch! To model and represent these systems we use mathematical tools and adapted physical models. We also have many practical assignments which give a pragmatic vision of a communication system."

**For those who like**
- Understanding the architecture of a communication system
- Knowing how data transfer works
- Knowing how a laser works, or an antenna, etc.

**Career opportunities**
The track offers opportunities in many sectors of industry: transport, telecommunications, space, nuclear, robotics production, defense, consumer electronics, etc. This track is also a preparation for several Master 2 programs.

**Course director:** Guillaume Duc  
**Head of international mobility:** Samuel Tardieu  
**Internship coordination:** Tarik Graba

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**For those who like**
- Understanding the architecture of a communication system
- Knowing how data transfer works
- Knowing how a laser works, or an antenna, etc.

**Technological innovation in Year 3 at the School**
- Embedded systems, organized around 3 topics:
  - Embedded real-time critical systems
  - Design and architecture of embedded systems and connected objects
  - Systems on a chip

**Double Degree Master of Science in Engineering**
- Integration Circuit Systems (Université Paris-Saclay)
- Embedded systems at Information processing (Université Paris-Saclay)
- Design, Modeling and Architecture of Complex Systems (Université Paris-Saclay)
- Distributed Systems and Applications (Sorbonne University)
- Multimedia Networking (Université Paris-Saclay)

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**For those who like**
- Understanding the architecture of a communication system
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**DISTRIBUTED SOFTWARE SYSTEMS**

**Aim**
The study track presents an overview of the theoretical foundations, structural models, solutions, practices and methods that are essential for architects, designers, and developers of distributed software and systems. The aim is that students acquire practical knowledge allowing them to understand engineering as it is currently practiced in companies.

**In concrete terms**
The issues addressed concern distribution, design, verification, and validation, the development life-cycle and these are updated in relation to new areas of application.

**Career opportunities**
This study track aims to train specialists in IT thanks to the skills they have acquired in three key areas: advanced technology in distributed systems, new development and deployment methods for software solutions, and business processes.

Some of the careers targeted by this study track:
- Architect or urban planner in distributed systems,
- Software development and software systems engineer,
- Integration engineer,
- Consultant,
- Project manager...

**Technological innovation in Year 3 at the School**
-Distributed systems and software

**Multidisciplinary partnership**
Integration and deployment of information systems (Télécom SudParis and IMT Business School)

**Double Degree Master of Science in Engineering**
-Design, Modeling and Architecture of Complex IT Systems (Université Paris-Saclay)

**For those who like**
- Designing computer systems
- Perceiving trends in current systems
- Materializing your ideas with practical work

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**3D AND INTERACTIVE SYSTEMS**

**Aim**
The aim of this study track is to provide students with a comprehensive program in the areas of human-computer interaction and 3D computer graphics. The course will prepare engineers of the future to design advanced interactive visual systems by giving them the basic computer science and mathematical skills needed for modeling such systems.

**In concrete terms**
You will learn to develop 2D and 3D interactive applications for mobile tools and the web; you will produce 3D computer graphics and virtual reality and you will develop a project of your choice during dedicated seminars.

**Career opportunities**
Some of the obvious careers for this study track are as follows: computer-aided design (CAD), video games, special effects, mobile applications, simulation, interaction design, virtual reality and visualization. This track also prepares students for scientific careers in research into HCI or 3D computer graphics with the possibility of going on to a Master 2 program specialized in one of these two fields.

**Technological innovation in Year 3 at the School**
-Human-Machine Interaction and 3D Computer Graphics

**Double Degree Master of Science in Engineering**
-Image (Sorbonne University)
-Image-Computer Interaction (Université Paris-Saclay)
-Mathematics, Vision, Learning (Université Paris-Saclay)

**For those who like**
- 3D design and virtual reality
- Interactive devices and systems
- Tactile, mobile, gestural interfaces, etc.
- Video games and special effects

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Sirui YANG, Class of 2018

I was particularly drawn to this study track as it brings new insights into software development. It’s no longer just a question of writing software code but of thinking upstream about its development (modeling, software architecture, development method, etc.) while still bearing the technical part in mind with rival programming.

Anna ARIAS, Class of 2018

We are surrounded by interactive systems of all kinds: mobile applications, the web, and in 2D and 3D. In this study track, I was able to learn the basics of all these interactive systems, for example digital models to represent 3D forms, textures, lighting, etc. A really exciting experience!

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Course director: Petr Kuznetsov
Head of international mobility: Elie Najm and Petr Kuznetsov
Internship coordination: Sylvie Vignes

Course directors: Tamy Boubakeur and Eric Lecolinet
Head of international mobility: James Eagan
Internship coordination: Jean-Claude Moissinac
Because a Télécom ParisTech engineer has to understand how the digital world is transforming economies and societies, you will have courses in economics, law, digital sociology, general culture, management and languages.

You must therefore sign up for a Teaching Unit (UE) in Eco-Management, one in SocioDesign, a MOOC, a course in general culture and a course in law. You can complete your study program with elective courses in science and technology. The Optimization course is compulsory, as are some of the scientific UEs, depending on the different study tracks.

**SCIENCE AND TECHNOLOGY**
- Foundation for learning
- Databases
- Queuing
- Technological innovation
- Modern physics in Python
- Optimization and numerical analysis
- Programming paradigms, theory and practice
- Preparation for programming competitive exam
- Statistics
- Web Development

**ECONOMICS AND SOCIAL SCIENCES**
- Digital economy
- Digital management
- Internet and society
- Cultural industries in a digital world: from creation to consumption
- Cinema, society and management
- Sociology of Big Data
- Design: the design-space method
- Digital sociology
- Responsible innovation
- Digital marketing

**PERSONAL AND PROFESSIONAL SKILLS**
- Through your diversity, become a leader of tomorrow
- Happiness at work
- Motivational compass and career path
- Clarify your professional project
- Negotiation
- Creative CV
- Oral expression
- Gain self-confidence and be confident with others
- Humor in work relationships
- The human voice and its challenges
- Activism in the digital age
- The circle of eloquence
- The pitch: a human experience
- Stress, a driving force or an impediment?
- Leadership and cooperation: the way to achieve balance
- Leadership for non-French speakers
- Managing and working in a team
- Managing Communication in an International Context
- Lead an agreement-oriented discussion
- Public speaking
- Professional project and recruitment situation
- Customer relations in the consulting business
- Responsibility, myth and Opera

**GENERAL CULTURE**
- Cinema, society and management
- Geopolitics
- Opera – musicology
- Philosophy of science
- New technologies law
- Sociology
- History of art
- Architecture
- Philosophy
- Political Science
- Anthropology
- Comparative international law
- Labor law
- Psychoanalysis
- Telecommunication sociology
- Contemporary art
- Management – Theories and practices in business analysis
- General culture

**YOUR 3RD YEAR AT TÉLÉCOM PARISTECH**

Students in their 3rd year at Télécom ParisTech choose an area in which to specialize. The year comprises six months of courses and a 6-month engineering internship. Choose from the following options:

**TECHNOLOGICAL INNOVATION**
Linked with your 2nd-year study tracks, the Technological Innovation option, an “internal” option, takes place at Télécom ParisTech and lasts for one semester (240 hours). As well as the teaching for this option, you will produce a Master Innovation Research Project: this represents real training in innovation at the heart of the problems experienced by companies or research laboratories.

**DOUBLE DEGREE-MASTER OF SCIENCE IN ENGINEERING**
You can choose to follow a Master2 program offered by one of our many partner universities. You will then be awarded a Double Degree from Télécom ParisTech and a Master’s degree from the partner university concerned.

**MULTIDISCIPLINARY PARTNERSHIP**
This option is an opportunity to choose a quite different course after the 2nd year. You can choose from courses on offer at the School, or in one of Télécom ParisTech’s partner schools, such as HEC, Mines ParisTech, ENSAE, etc. as part of a Double Degree.

**INTERNATIONAL OPTION**
The international option is a program abroad (Erasmus, double degree, etc.). In the case of the double degree, students obtain the Télécom ParisTech double degree plus a Master’s degree from the partner university.
The internal option is a continuation of the 2nd-year study tracks. You choose from the 14 options those that you would like to study in depth with 120 hours of courses. In addition to these courses, students must complete a Master Innovation Research Project which represents about 120 hours’ work for 12 ECTS.

### THE 14 OPTIONS IN 3rd YEAR MASTER
- Entrepreneurship
- Integration of systems circuit and smart objects
- Data intelligence and statistical learning of signals
- Human-machine interaction and 3D computer graphics
- Image
- Microwave engineering for connected objects and mobile and satellite communications
- Artificial Intelligence
- Stochastic modeling and scientific computation
- Quantum safe cryptography
- Networks
- Data science
- Embedded systems
- Network security and computer infrastructure
- Advanced distributed systems and software

### THE ENTREPRENEURSHIP OPTION
If you already have a business start-up project, the “Entrepreneurship” option will help you make progress with the technical aspects of your project and will provide support with the Business Model, Design and Use aspects. The School awards a Student-Entrepreneur degree!

### THE MASTER INNOVATION RESEARCH PROJECT
The Master Innovation Research Project (PRIM) is an innovation program. For one semester, you will work on this project autonomously.

You are faced with real-life projects, suggested by the School’s partner companies and research laboratories, which deal with new innovation issues. You can also put forward a subject that you would like to examine in depth and which you have already started working on.

This project is enriched by additional courses on key innovation skills. The aim is to be fully equipped for research, innovation and entrepreneurship in a digital world.

### SOME RECENT EXAMPLES OF PRIM:
- E. Orisni - Compression de graphes par recouvrement de cliques (Graph compression by clique overlap)
- H. Braun - Aggregating and finding common structure between k strings
- A. Delaunay - Matching de produits dans des images basé sur des techniques d’IA (Matching products in images, based on AI techniques)
- L. de Freitas Smaira - La création automatique de features et leur impact sur les prédictions (The automatic creation of features and their impact on predictions)
- C. Rydhal - Mise en place d’une app mobile et lancement marketing (Setting up a mobile app and launching the marketing)

### TELECOM PARISTECH WORKS IN CLOSE PARTNERSHIP WITH OTHER ENGINEERING GRADUATE SCHOOLS (GRANDES ECOLES) AND UNIVERSITIES TO DEVISE COURSES AND MASTER’S PROGRAMS.
These Master’s degrees are recommended by professors at Télécom ParisTech as 3rd-year specializations in exactly the same way as certain internal options are offered at the School.

Students in their 2nd-year of the Master of Science in Engineering in Paris can apply for the different Master’s degrees shown on the right. Students enter directly at 2nd-year level of the Masters and thus validate a double degree.

Université Paris-Saclay also offers Master’s degrees, 4 of which are led by Télécom ParisTech:
- Advanced Communications Networks
- Data & Knowledge
- Network Industries and Digital Economy
- Multimedia Networking

All courses offered by Université Paris-Saclay can be seen at [www.universite-paris-saclay.fr](http://www.universite-paris-saclay.fr).

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Multidisciplinary partnerships are options that are open to you whatever study track you followed in 2nd year. Each option has its own specific prerequisites.

**A DOUBLE DEGREE IN GRANDES ÉCOLES**

- Students at Télécom ParisTech can apply to HEC Paris to enroll for the HEC Paris Master Grande École and the Télécom ParisTech Master of Science in Engineering (in two years).

- The HEC MSc Digital trains managers to master two languages that are inevitably linked: the language of management and that of technology. You will obtain the Télécom ParisTech Master of Science in Engineering and the HEC Master of Science.

- The double degree with ENSAE comprises a two-year program covering actuarial science, data science, finance and risk management, markets and businesses.

- The IFP School offers a two-year program in the area of energy to meet the needs of industry and the demands of society regarding the technical, industrial, economic and financial aspects of sustainable development and innovation.

**STUDY ABROAD (FAE)**

- Provided a unique opportunity to open up new horizons and at the same time take advantage of an excellent course. You can travel to a partner university on the Erasmus program, for an exchange course abroad, either with or without the award of a diploma.

- The international option is open to our students from French universities or those who joined the course via the common competitive entry in 1st year.

- Study abroad may result in a degree (Double Degree, Master of Science) or there may be no associated degree (especially with the Erasmus programs).

- The Double Degree may be for 12, 18 or 24 months. It may or may not include an internship, but students will have to do an internship in addition if it is not included in the Double Degree.

**MOBILITY: STUDY PROGRAMS AND INTERNSHIPS**

- Students at Télécom ParisTech must spend at least 11 weeks abroad over the entire program.

- An internship carried out abroad during the summer (FAE) can count towards the compulsory 11 weeks abroad, with part of it in the framework of a Humanitarian internship (FH) at the end of the 1st year.

**INTERNATIONAL RELATIONS AT TELECOM PARISTECH**

- Study program (no degree)
  - One to two semesters in 2nd or 3rd year
  - Short stays: Athens weeks, summer schools.

- Degree study program
  - 4 study semesters at the School (includes 1st and 2nd years)
  - 1 semester engineering internship
  - 2 semesters of study abroad

- Engineering internship
  - Six months in 3rd year

- Intermediate internship
  - July-September (between 2nd and 3rd years)
YOUR 2ND YEAR AT TÉLÉCOM PARISTECH

SOPHIA ANTIPOLIS (EURECOM) CURRICULUM

CHOOSING YOUR STUDY TRACK AT EURECOM:
The choice of study track is made after the first two weeks of classes at EURECOM. The idea is to try out most of the courses then opt for those that suit you best. You must remember that above all, the choice of study track gives you a teacher who can act as advisor (study track Director). Far from being a constraint – students follow three courses from the study track per semester in the first year – your study track enables you to show a degree of specialization to possible recruiters, while still leaving the way open for a large number of other courses that you can take in the course of the year.

DID YOU SAY «TECHNICAL COURSES»?
There are two types of course at EURECOM: general and technical. In your curriculum, you must complete courses from both categories.

Under the heading of general courses there are courses based more on soft skills, such as Team Leadership or Property, and of course there are language courses and the project to be completed during the semester.

For the technical courses, these are what would be typically found in a digital engineering school, such as Game Theory, Network Modeling, Operating Systems, 3D Modeling, Signal Processing for Communication - there's something for every taste! And this certainly does not mean that all the technical courses require hours and hours spent coding in front of a screen!

AND IN THE 3RD YEAR?
As a Télécom ParisTech student, for administrative purposes you are still attached to your home school for the 3rd-year exchanges (International academic exchange or in another school in France). You should therefore refer to Télécom ParisTech for information on the available options.

FOUR STUDY TRACKS ARE OFFERED TO BUILD YOUR OWN CURRICULUM:
- DATA SCIENCE AND ENGINEERING (BIG DATA)
- COMMUNICATION SYSTEM SECURITY
- SMART OBJECTS
- MOBILE COMMUNICATION

To find out more:
www.eurecom.fr/en/teaching/engineering-studies/24-months-curriculum

Called the “Silicon Valley” of the French Riviera, Sophia Antipolis technology park is an international center of excellence encompassing 1,710 companies specializing in ITC and representing 21,755 jobs.

EURECOM has been located at the heart of this dynamic ecosystem for 25 years, and students benefit greatly from the School's excellent relations with these companies which provide many possibilities both for internships and jobs.

THE MAIN ADVANTAGE OF COURSES AT EURECOM: FLEXIBILITY!
With over 65 courses in its offer, you are free to select what you want. You can customize your own course of study according to your likes, your objectives and the pace at which you work.
DATA SCIENCE AND ENGINEERING
(BIG DATA)

Aim
This program focuses on statistics and machine learning, data analysis algorithms and the systems that enable storage and processing. Students will develop the necessary skills in computer sciences that are needed to understand and exploit the tools used for large-scale data management and distributed systems.

In concrete terms
The theoretical courses are very closely linked with the many sessions of practical work in the laboratory, using sophisticated and unique tools such as Eurecom’s own Cloud Computing platform and many parallel processing and storage software packages, such as Hadoop MapReduce, Apache Spark and MLlib, R, Scikit and many more.

Students can also develop their own domain knowledge by following applied courses analyzing massive amounts of text and images, modeling computer system attacks and studying countermeasures, predicting human behavior when using mobile applications, etc.

For those who like
- Data analysis
- Making predictions for new solutions

Compulsory courses
- Cloud Computing distributed systems
- Machine learning and intelligent systems
- Implementing the data management system
- Algorithmic aspects of machine learning
- Advanced statistical inference techniques
- Deep learning

Career opportunities
Nowadays, data are everywhere, and data engineers with their very wide-ranging knowledge and their love of a challenge will be able to work in all sectors.

Margaux LEDIEU,
Class of 2018,
Sophia Antipolis
Curriculum

What I liked most about the Big Data study track was that it is geared to be very practical. Some courses are organized as challenges: each challenge earned points and we could see our scores change as it happened. Others consisted of practical work only: we were given a database (e.g. on flights within the USA) and we were asked to make a prediction on these data (what would be the average delay in such and such an airport?). This was my favorite course because it was the one that came closest to the job of Data Scientist.

Coordinator: Benoît HUET

COMMUNICATION SYSTEM SECURITY

Aim
This study track provides the technical knowledge necessary for engineers designing secure systems and for system administrators responsible for ensuring IT security within a company.

In concrete terms
The focus is on analyzing vulnerabilities and designing security mechanisms in the field of networks, computer systems and image processing. The security techniques studied in this study track include cryptography and its applications, intrusion detection systems, network security mechanisms, image tattooing and biometric identification techniques.

Compulsory courses
- Wireless communication security
- System and network security
- Communication security
- Big Data and Cloud security
- Material security
- Cybercrime and computer forensics
- Image processing for security applications

Career opportunities
Protection of systems, infrastructure or data, security is imperative for any company and any activity. Digital security specialists will be able to find jobs in every sector.

Kamélia DAUDEL,
Class of 2018,
Sophia Antipolis
Curriculum

The strength of this very demanding study track was the balance between theory and practice. During the first semester, for example, we learned about the different types of attack that can be carried out (Memory Corruption, SQL injection, etc.) and the defenses that can be put in place to counteract them. All with access to a server where we had to exploit some of the flaws mentioned in class!
In general, I found it fascinating to see how the protections put in place were constantly challenged before eventually being bypassed. After all, security is an area that is constantly evolving and that is exactly what makes it interesting!

Coordinator: Refik MOLVA
The concept of smart objects is linked to a huge field of applications like the Internet of Things, sensor networks, and machine to machine communication.

**Aim**
This study track provides solid experience for engineers involved in embedded software and the design of the hardware architecture of smart objects. Thus the main objective covers all software and electronic technologies associated with these architectures.

**In practical terms**
This study track will enable you to deal with the integration of hw/sw architectures in large-scale networks (e.g. Cloud-based systems) and in mobile networks. Security issues for these objects are also dealt with, in terms of software and hardware.

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**For those who like**
- Embedded systems
- Making machines speak

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**Smart Objects**

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**Compulsory courses**
- Computer architecture
- Operating systems
- Software development methodologies
- Computational methods for digital communication
- Digital systems, hardware-software integration

**Careers**
Connected objects have already invaded many areas, from smart homes to nanorobots in medicine, career opportunities are many and varied.

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**Mobile Communications**

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**Compulsory courses**
- Mobile communication techniques
- Digital communication
- Computer networks defined by software (network softwarization)
- Wireless access technologies
- Radio engineering
- Signal processing for communications

**Careers**
This study track will give you a full and interdisciplinary view of wireless networks, ensuring that you will be an undeniable asset for companies and research laboratories in the sector, or enabling you to found your own start-up.

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**For those who like**
- Inventing new ways of communicating

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**The Smart Object track gives you the possibility to discover the wide world of embedded systems which, nowadays, are spread very wide indeed. The possibility is given to you to adapt your course choice to your favorite field of studies. For example, you can focus on the details of computer architecture, discover how to interface hardware and software or link your studies with mobile networks. While some of the mandatory courses allow you to get an overview of all the application fields, you can go into more detail with some other courses. Together with the study of the theoretical aspect, you are also strongly encouraged to solve practical problems, thanks to the various labs and projects which are very useful when put into practice as they give a better understanding of what has been covered during the class.**

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**Marco COLETTA, Politecnico di Torino 2016 EURECOM 2018**

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**The Communication Systems track is all about addressing the challenges of modern communication systems! This track has offered me the possibility to have several different insights into this rapidly evolving field, ranging from the physical layer to networking and application development. Thanks to this, I was able to see the bigger picture. Moreover, the professors and researchers that work here in this field are at the cutting edge of new trends and are always available for discussion with the students. If you add to all of this the great multi-cultural environment upon which all Eurecom is based, you get one of the best studying experience that one could dream of.**

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**Placido MURSIA, Politecnico di Torino 2016 EURECOM 2018**

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**Coordinator : David GESBERT**

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The concept of smart objects is linked to a huge field of applications like the Internet of Things, sensor networks, and machine to machine communication.

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**Coordinator : Renaud PACALET and Christian BONNET**
In 2019, Télécom ParisTech will join the École polytechnique campus and the sports facilities, accommodation, services and amenities of the Paris-Saclay campus.