

# CYBER SECURITY

MASTER

**EPFL**

**ETH** zürich



We hear about data breaches and attacks on critical infrastructure every day. How do we safeguard our information society? How do we engineer systems that are secure by design? These are the central questions of Cyber Security – an exciting and crucial research area within Computer Science.



# Speeding up the Interplanetary File System

The Interplanetary File System, or IPFS, is an open-source protocol for file storage and distribution on a peer-to-peer network. It aims to provide a secure, open alternative to cloud storage systems offered by companies like Google and Dropbox.

The Decentralized and Distributed Systems Lab (DEDIS) has already developed a protocol called CRUX, which enables distributed systems to be faster and more resilient to network failures through an approach called automated locality. Guillaume's semester project in the Master in Cyber Security program aims to apply CRUX to IPFS. The goal is to create an automated, locality-aware networking framework to make stored data available more quickly and securely, in proportion to user distance and location. For example, users in Switzerland would be able share data faster and more reliably when the processing involves nodes in their own country, rather than more distant nodes in New Zealand.

Guillaume Michel:

*"What interests me the most in Computer Science is the security aspect, because it's like a game. You always get to attack and defend."*



## A Guaranteed-Secure WiFi Router

Nazli Deniz Uzuner:

*"The current need to protect our online data has been an inspiration for choosing this Master. I have always been curious about where my data goes, and what can be done with it when I connect to social networks. I started reading about this topic and thinking about what an adversary could do with my data, and realized that I really like this field."*

Nazli's research is part of the "Secure home router" umbrella project in the Dependable Systems Lab (DSLAb) which is led by Professor George Candea. The overall goal is to verify that all the functions of a modern WiFi home router execute correctly and securely.

Nazli's part of the project is to formally verify the very heart of the intrusion detection and prevention function, common on advanced home routers. This is essentially a regular expression matcher that allows to automatically search for patterns in the network traffic and determine whether an attack is about to begin or is in progress.

"We verify such programs so that, when they run, you know for sure that they don't have any vulnerability that can be exploited by a remote attacker keen on taking control over your home router, spying on you, and stealing your data," Nazli explains. "I wrote such a regular expression matcher, and now I am working on formally verifying it. Unlike testing that can only reveal the presence of errors, formal verification can guarantee the correctness of the algorithm."

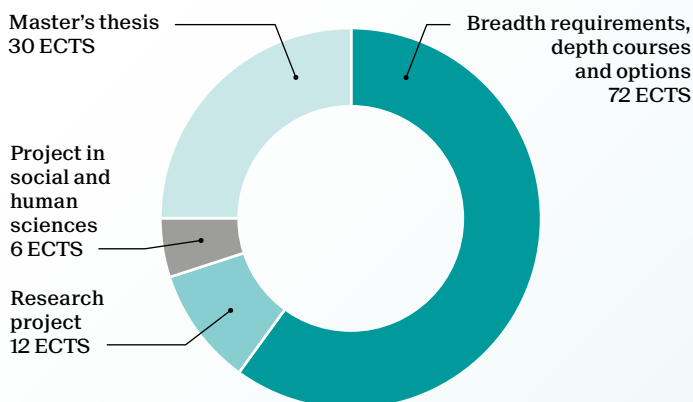




# Master of Science in CYBER SECURITY

Joint master EPF Lausanne - ETH Zürich

2-year program - 120ECTS



	Credits
<b>Breadth requirement (min. 32 credits)</b>	
Algorithms II	8
Advanced computer architecture	8
Advanced topics on privacy enhancing technologies	8
Cryptography and security	8
Decentralized systems engineering	8
Distributed algorithms	8
Information security and privacy	8
Machine learning	8
Systems for data management and data science	8
TCP/IP networking	8
ETHZ courses counting as breadth requirement	

The program includes a compulsory internship of eight weeks during the summer, or six months during the semester. The internship can also be combined with the master's thesis.

Students are required to spend at least one semester at ETH Zürich where they will take classes counting as breadth and depth courses. Upon graduating, they receive a joint Master of Science from both EPFL and ETHZ.

## Career Prospects

The internship portal, with more than 3000 active contacts, is a very effective way to promote internships and master projects. The EPFL Innovation Park, a few steps away from the campus, also hosts many R&D laboratories such as NagraVision SA, Armasuisse and Elca Informatique SA which hire a large number of Cyber Security students for internships or master's projects and also collaborate with researchers from the IC School.

The EPFL Innovation Park is the springboard for numerous start-ups, most of which have emerged from the IC School.

It only takes on average 7 weeks to find one's first job. Moreover, many Cyber Security graduates receive a job offer during the last semester of their training. Companies such as Oracle, Google, Meta, or Microsoft, recruit directly on campus by participating in various events.

School of Computer and Communication Sciences  
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	Credits
<b>Depth courses and options</b>	
Advanced compiler construction	6
Advanced computer graphics	6
Advanced cryptography	6
Advanced multiprocessor architecture	6
Advanced probability and applications	8
AI product management	6
Applied biomedical signal processing	4
Applied biostatistics	5
Applied data analysis	8
Artificial neural networks/reinforcement learning	6
Automatic speech processing	3
Basics of mobile robotics	4
Causal inference	4
Causal thinking	5
Cellular biology and biochemistry for engineers	4
Computational complexity	6
Computational neuroscience: neural dynamics	5
Computational photography	6
Computer vision	6
Concurrent computing	6
Data visualization	6
Deep learning	4
Design technologies for integrated systems	6
Digital education	6
Distributed information systems	6
Distributed intelligent systems	5
Dynamical system theory for engineers	6
Embedded systems design	6
Ethics and law of AI	4
Experience design	6
Formal verification	6
Foundations of data science	8
Foundations of probabilistic proofs	6
Foundations of software	6
Gödel and recursivity	5
Image processing I, II	6
Industrial automation	3
Information theory and coding	8
Intelligent agents	6
Interaction design	6
Introduction to IT consulting	6
Introduction to natural language processing	6
Learning theory	6
Machine learning for behavioral data	6
Management de projet et analyse du risque	4
Markov chains and algorithmic applications	6
Mathematical foundations of signal processing	6
Mobile networks	8
Modern digital communications: a hands-on approach	8
Networks out of control	6
Number theory in cryptography	5
Optimization for machine learning	8
Optional research project in computer science	8
Principles of computer systems	8
Social media	2
Software security	6
Statistical physics of computation	4
Statistical signal and data processing through applications	8
Student seminar: security protocols and applications	3
Sublinear algorithms for big data analysis	6
System programming for Systems-on-Chip	6
Topics in software security	3
Topics in theoretical computer science	6
Virtual reality	6
ETHZ courses counting as depth courses	
ETHZ courses counting as options	