CYBERSECURITY

FROM DESIGN TO OPERATIONS

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MASTER'S PROGRAM IN

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Why

- **A thriving job market**
  - predicted growth:
    172 billion USD (2023) -> 424 billion USD (2030)
  - 300.000 skilled workers needed in Europe
  - 3.4 million unfilled position globally
- **An appealing career**
  - ranked 5th in the U.S. News and World Report's list of the 100 best jobs (up from 8th in 2022)
  - continuous, stimulating challenges
  - huge variety of employment opportunities, both in terms of roles and of application fields

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Who

Academic faculty

- Bologna University
- King's College London

cini Cybersecurity National Lab

Committed industrial partners

- financial support
- experienced trainers
- engaging internship positions

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When

- lectures
  - 12 hours each weekend
    - Friday afternoon
    - Satuday all day
- internship
  - to be decided with host
- project work
  - self-organized

November – December, lectures only

Winter Break

January – April, lectures + internship

Spring Break

May – June, lectures + internship

July, internship only

Summer Break

September, report and presentation writing

Early October, final exam

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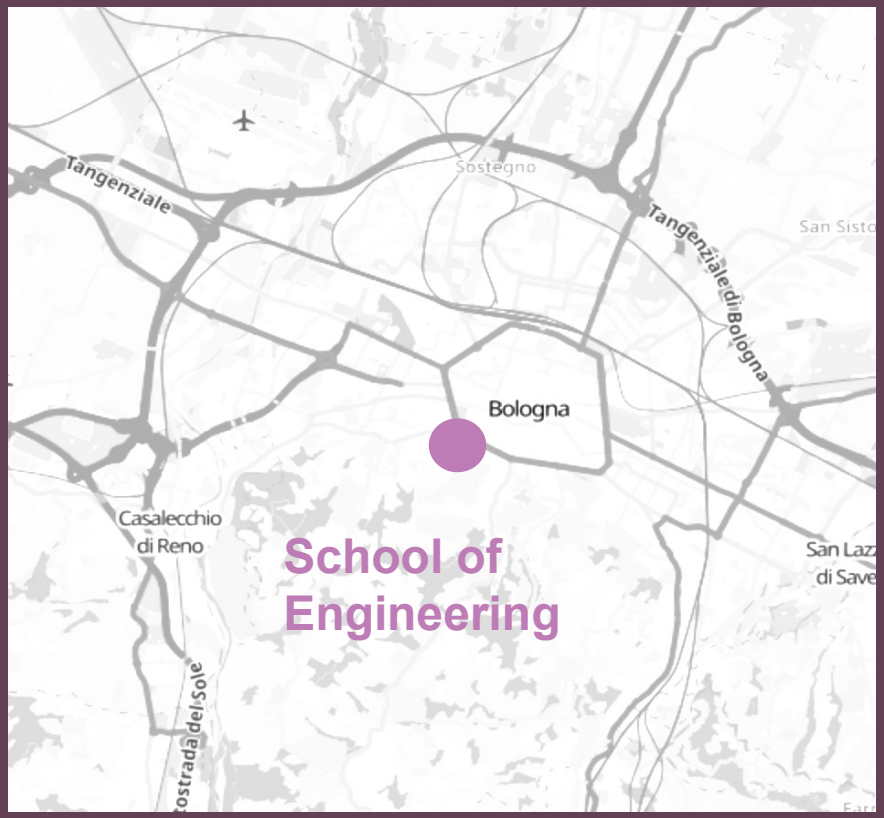
Where

- **IN PRESENCE BY DEFAULT**

  School of Engineering
  Viale del Risorgimento 2
  40136 Bologna

- **OPTIONALLY ONLINE**

  ONLY FOR STUDENTS RESIDING MORE THAN 1 HOUR AWAY



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How

11 BASE MODULES (LECTURES+LABS)

- Every topic will be illustrated in theory and demonstrated in practice

2 HOT TOPIC WORKSHOPS

- Application security testing
- Cloud security

BYOD

- Students need to bring their own laptop, suitable for the execution of virtual machines provided by instructors

KEEPING TABS ON PROGRESS

- Attendance of at least 80% of lecture hours is **mandatory**
- At the end of each module, an exam will measure its effectiveness
- Skipping or failing a few intermediate exams is not critical, **but**
- Admission to the final exam is judged on the overall positive performance

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What 1/11

Fundamentals of Security and Cryptography

- Prof. Rebecca Montanari (UniBO)
  Prof. Marco Prandinii (UniBO)
- 24 hours

Outcomes:

- Knowledge of the main different aspects of security as a process, and of the technical language used to describe threats, vulnerabilities, and countermeasures.
- Security requirements: confidentiality, integrity, authenticity, and how to achieve them in presence of different adversaries.
- Analysis of the main cryptographic building blocks to design security countermeasures. Tips on correct implementation of cryptographic mechanisms.

What 2/11

Network security and administration

- Prof. Franco Callegati (UniBO)
  Prof. Walter Cerroni (UniBO)
- 40 hours

Outcomes:

- Basic ability to program network devices to implement segmented layer-2 and layer-3 internetworks.
- Knowledge of security issues in telecommunication and of protocols (e.g. IPSec, TLS) for their mitigation.

What 3/11

Computer security and administration

- Linux

  Prof. Gabriele D'Angelo (UniBO)
  Prof. Angelo Di Iorio (UniBO)
  Prof. Marco Prandini (UniBO)

- Windows/AD

  Dr. Mattia Masella (Cyberloop)

  Dr. Davide Ciandrini(Cyberloop)

- 40 hours

Outcomes:

- Knowledge of the basic steps of system configuration, from boot to service management. Basic ability to manage software installation, update and configuration in a production environment.
- Knowledge of the different categories of vulnerabilities in a system and of the corresponding attack vectors. Basic ability to use tools for proactive security assessment and centralized monitoring.

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What
4.1/11

Security engineering I - secure coding

- Avv. Valentina Ricci (Privacy Network)
  Dr. Matteo Meucci (IMQ Minded Security)
- 16 hours

Outcomes:

- Security-by-design and Privacy-by-design, and practical applications of the GDPR in secure systems development
- Knowledge of design patterns and best practices for the whole process of secure software development.

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What 4.2/11

Seminar - Cloud Security

- Prof. Marco Prandini (UniBO)
- 8 hours

Contents:

- Threats, vulnerabilities and attacks specific of the cloud computing environment
- Cloud-oriented application development methodologies (image preparation, deployment, management)

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What
4.3/11

Workshop - Static Application Security Testing

- Dr. Andrea Pagani (Crif)
- 8 hours (5 theory + 3 practical teamwork)

Contents:

- CyberSec Fields and TradeOffs
- What is Source Code Analysis?
  SAST, OSS & Dependency, DAST & IAST Considerations
- Top Application Security Risks; OWASP Top 10 2021
  Detection
- Lab 1 – Demo of a SAST tool: Running Fortify scans
- Remediation: High level fixing strategies
- Industrialization of SCA: Distributing SAST on large scale
- Lab 2 – Corporate SAST: Scenarios for building SAST architectures

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What 5/11

Security engineering II - web app security and testing

- Dr. Giueppe Porcu (IMQ Minded Security)
- Ph.D. Andrea Melis (UniBO)
- 24 hours

Outcomes:

- Knowledge of the OWASP methodology for web applications.
- Tools to verify web app security according to the OWASP methodology.
- Specific challenges of web application security testing
- Intelligence gathering and threat modeling
- Vulnerability analysis
- Client side attacks, Server side attacks
- Tools and techniques

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What 6/11

Security engineering III - mobile security and testing

- Dr. Luca Capacci (Cryptonet Labs)
  Dr. Alfonso Solimeo (Cryptonet Labs)
- 24 hours

Outcomes:

- Knowledge of the design patterns and security testing methodology for mobile applications.
- Tools to verify mobile app security according to the presented methodology.
- Specific challenges of mobile application security testing
- Intelligence gathering and threat modeling
- Vulnerability analysis
- Testing authentication, cryptography, code quality.
- Android, iOS and hybrid applications anatomy
- Tools and techniques

What 7/11

Security engineering IV - Industrial Control Systems

- Ph. D. Andrea Melis (UniBO)
- Dr. Edoardo Montrasi (Cryptonet Labs)
- 16 hours

Outcomes:

- Understanding of the structure of an ICS and of challenges posed by its peculiar differences with respect to IT systems.
- Knowledge of security issues and possible countermeasures
- Specific challenges of industrial control systems
- Intelligence gathering and threat modeling
- Vulnerability analysis
- Embedded systems and fieldbus protocols anatomy
- Tools and techniques

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What 8/11

Security monitoring I -
Malware analysis and detection

- Ph.D. Fabio Pierazzi (King's College London)
  Dr. Luigi Martire (Yoroi)
- 32 hours

Outcomes:

- Knowledge of the CERT operations to detect threat trends and ongoing attacks.
- Tools for static and dynamic analysis of code to identify malware.

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What 9/11

Security monitoring II - Information correlation

- Dr. Federico Foschini + staff (Certego)
  Dr. Tommaso di Donato (Crif)
  Dr. Massimiliano Pinto (Crif)
- 24 hours

Outcomes:

- Knowledge of network-based intrusion detection systems and other kinds of probe-based systems to collect and correlate traces of malicious activity in progress.
- Critical (industrial, infrastructural, etc) system architectures and methods for their protection from attacks.

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What 10/11

Incident response

- Dr. Luca Losio (4n6)
- 16 hours

Outcomes:

- Knowledge of the methods to identify ongoing incidents and restore normal operations after a security breach.
- Ability to draw an incident response plan and policy

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What 11/11

Digital Forensics

- Prof. Alessandro Amoroso (UniBO)

  Dr. Luca Losio (4n6)
- 32 hours

Outcomes:

- Knowledge of the issues and challenges of forensics, from a technical and legal viewpoints, such as chain of custody.
- Ability to use the main forensics tools to analyze data and to write the final report.

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APPROXIMATE DATES - TBC

Key steps

- Apply by **27 September 2024**
  - Look for the call (opening soon) on
    https://www.unibo.it/it/studiare/dottorati-master-specializzazioni-e-altra-formazione/master/bandi-aperti
- Pass selections on **8 October 2022**
  - Basic operating systems, network and programming skills are needed
    - Verified during interview if you acquired them on the field
    - Automatically satisfied by holding an IT-related degree (but interview is mandatory nonetheless: strong motivation is essential!)
- Enrollment: **17 October - 3 November 2022**
  - Law requirement: holding a bachelor degree by the time of enrollment

APPROXIMATE DATES - TBC

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How much

- € 5.200 to be paid in two installments of equal amount
  - at the enrolment
  - spring 2025
- Companies can directly pay for their employees upon communication of their intent

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