



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

itee^{PhD}
information technology
electrical engineering



DIE
TI.

UNI
NA

Carmine Cesarano

Security Assessment and Hardening of Fog Computing Systems

Tutor: prof. Roberto Natella

Cycle: XXXVIII

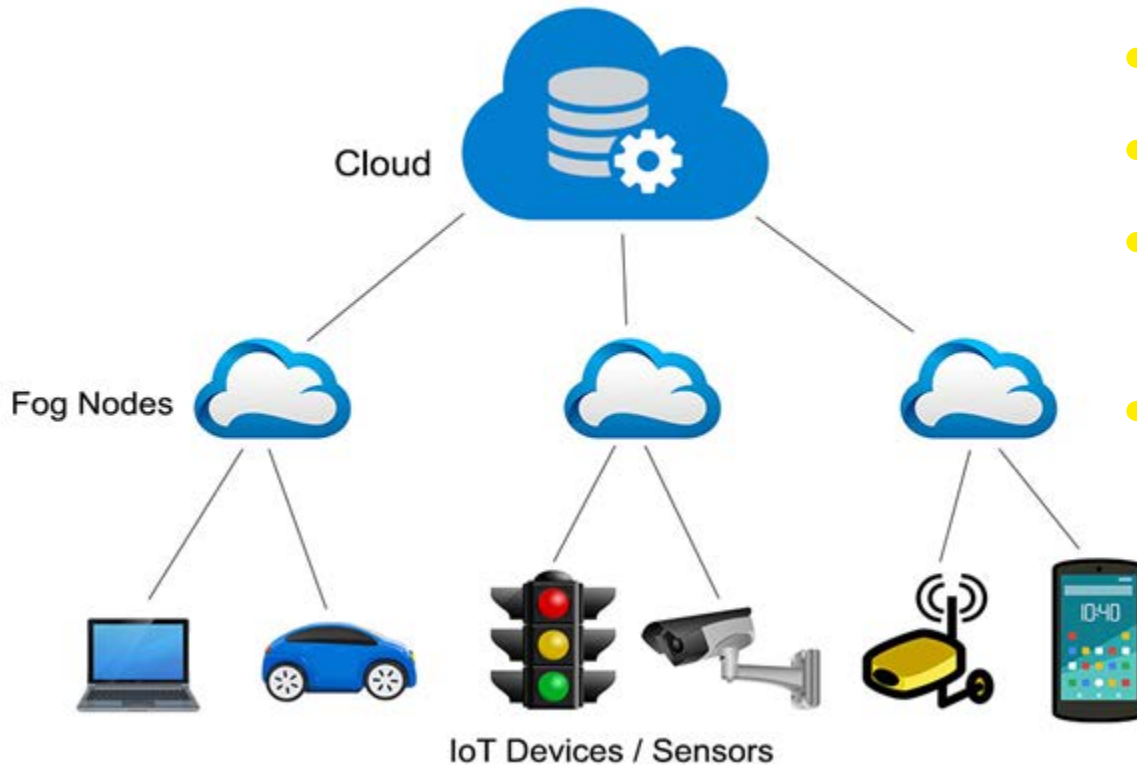
Year: First

My background

- MSc degree in **Computer Engineering** (June 2022)
 - Thesis: “Assessing Isolation Properties in Partitioning Hypervisors”
- **Research group:** Dependable and Secure Software Engineering and Real-Time Systems (DESSERT – www.dessert.unina.it)
- **PhD start date:** 1st November 2022
- **Scholarship type:** UNINA

Research field of interest

My research field concerns the security assessment and hardening of software stack employed in Fog Computing Systems



- Middleware Systems
- Operating Systems
- Virtualization Platforms
- IoT Frameworks

Summary of study activities

Ad hoc PhD courses / schools:

- IoT Data Analysis
- Virtualization Technologies and their applications
- Statistical Data Analysis for Science and Engineering Research

Conferences / events attended

- IEEE International Symposium on Software Reliability Engineering (ISSRE2023), presenting author

Research activity: Overview

Problem (1):

*OSS and OTS software need **security hardening** to be used in the context of Edge Computing*

- *Large attack surface*
- *Redundant code and unnecessary features*
- *Vast configuration space*

Problem (2):

*Communication mechanisms in Edge Computing (e.g., Firewalls, Application Level Gateways, APIs sandboxing) need **security assessment***

- *Source code is not always available*
- *Heterogeneity in terms of architecture, technology stack, hardware devices*

Research activity: Overview

Objective

Foster the adoption of edge computing architectures in security-critical and safety-critical domains.

Methodology (1):

- *Definition of techniques to automatically **identify the only necessary APIs** reducing the attack surface*
- *Definition of techniques to **selecting the only necessary code components** and remove the remaining*
- *Definition of techniques to **automatically explore the configuration** space*

Methodology (2):

*Design a **generalizable** testing technique based on **virtualization** allowing for binary only testing and transparent test of secure communication mechanisms*

Products

[P1]	Cesarano, C.; Cotroneo, D.; De Simone, L. Towards Assessing Isolation Properties in Partitioning Hypervisors 33rd IEEE International Symposium on Software Reliability Engineering (ISSRE2022)
[P2]	Cesarano, C.; Cinque, M.; Cotroneo, D.; De Simone, L.,; Farina, G. IRIS: a Record and Replay Framework to Enable Hardware-assisted Virtualization Fuzzing 53rd IEEE/IFIP International Conference on Dependable Systems and Networks (DSN2023)
[P3]	Cesarano, C.; Security Assessment and Hardening of Fog Computing Systems 34th IEEE International Symposium on Software Reliability Engineering (ISSRE2023)

Tutorship

«**Software Security**» course support and tutorship on:

- Basic Malware analysis laboratory (2.5 hours)
- Reverse engineering laboratory (2.5 hours)
- Windows Malware analysis laboratory (2.5 hours)

Thank you for your attention