



Soggetto: proposta di tirocinio

<i>ID</i>	PTI_IT_Giacobbe Maurizio_16/07/2026 15.44.04
<i>Data</i>	16/07/2026 15.44.04

Supervisore del progetto

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Co-Supervisore del progetto

<i>Cognome</i>	
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<i>Dipartimento</i>	



Laboratorio	
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Numero di telefono	

Dettagli del progetto

Titolo	Secure and Resilient Immutable Operating Systems for Resource-Constrained Edge Devices		
<i>Descrizione dettagliata:</i> Resource-constrained edge devices are decentralized computing nodes deployed at the physical perimeter of a network. Unlike cloud servers, these devices, i.e. Microcontrollers (MCUs), Low-Power Single Board Computers (SBCs), and Edge Gateways, must operate with minimal electrical power, memory, and processing capabilities. Constrained edge devices are the backbone of modern decentralized infrastructure:Industrial IoT (IIoT), Smart Grid & Utilities, Environmental Monitoring, Smart Medical Devices. In decentralized Edge Computing, devices are deployed in remote, unmonitored environments, making them highly vulnerable to System Corruption, and Physical Tampering. Implementing an Immutable Operating System by mounting the root filesystem as strictly read-only and isolating runtime changes to volatile memory (RAM) could help to mitigate corruption risks.To evaluate the system's performance and security, the internship will target the following quantitative goals: 0% File System Corruption, Minimal Boot Latency, Optimized Resource Footprint, 100% Tamper Detection. Embedded OS & Deployment Software (to better investigate in the internship): (i) Yocto Project / OpenEmbedded to build a custom, minimal, and read-only Linux distribution; (ii) Alpine Linux (Diskless Mode) for rapid prototyping of ultra-lightweight RAM-run operating systems; (iii) Mender.io / SWUpdate as Open-source OTA (Over-The-Air) update managers supporting secure A/B partition switching. Additional: QEMU, Stress-testing tools.			
Durata (mesi – max 12)		3-5 months	
Durata (ore)		150	



Numero di posizioni aperte	3
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Competenze richieste dal tirocinio

<i>Requisiti tecnici:</i> To successfully execute this internship, the candidate will need a mix of systems programming, operating systems, and cybersecurity skills. Systems Programming and Scripting: Proficiency in C/C++ (for modifying bootloaders/drivers or reading kernel code) and Python/Bash (for automating build scripts, image flashing, and test automation). Emulation Environments: Competence in utilizing QEMU to emulate ARM platforms, allowing the candidate to test OS configurations rapidly without constant flashing to physical media. Performance Benchmarking: Ability to write testing scripts to gather KPIs like boot time, CPU overhead, and memory footprints. The ideal candidate doesn't need to be an expert in all these areas from day one, but a strong foundation in Embedded Linux (Yocto/Buildroot) and C/Python programming is essential to hitting the ground running.	
<i>Altri requisiti</i>	Disciplined behavior.