Research internship (Master 2)

Smartphone-as-a-Service platform for Computer Science Research

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1 Introduction

The digital sector's growing energy consumption, particularly from cloud infrastructure and end-user devices, presents a major environmental challenge [1, 2]. Local-first software [3] offers a sustainable [5] alternative by prioritizing data processing on local devices, reducing reliance on energy-intensive data centers. This paradigm aligns user sovereignty with Green IT goals, making it highly relevant for edge computing and national strategic initiatives like France's PEPR Cloud[1].

Our empirical research [4], has begun quantifying the energy profile of local-first applications on mobile platforms. However, a significant barrier remains: the lack of a robust, scalable platform for conducting rigorous, reproducible experiments on diverse real smartphones. This hinders large-scale validation and comparison of results across the research community.

To overcome this, we propose the creation of a public platform for experimentation. This "smartphone-as-a-service" platform would provide researchers with remote, on-demand access to a fleet of instrumented mobile devices for precise energy measurement. This internship will focus on designing and prototyping the core architecture for this platform, using the energy evaluation of local-first software as its primary use-case. The ultimate goal is to establish a foundational resource that accelerates sustainable computing research and provides evidence-based guidance for software development.

2 Expected work

Expected Work. The internship will focus on the design and implementation of a prototype platform for remote, automated experimentation on a fleet of Android smartphones. The work is structured into core objectives and potential extensions, should time permit.

Code Development & Integration. The primary focus will be on establishing a robust provisioning and scheduling system. This involves designing a multi-user framework to allow for the shared, scheduled use of the device fleet. The intern will define and implement the complete lifecycle of a test, encompassing device reservation, application installation, test execution, and pre/post-test reset/wipe procedures. Crucially, this architecture will be designed to integrate with or be inspired by the principles and APIs of existing national testbeds, particularly EnOSlib[2] (used in Grid'5000[3]), to ensure scalability and familiarity for the research community.

Metrics & Measurement Pipeline. A critical output of the platform is the collection of reproducible data. The intern will develop a pipeline to periodically sample and retrieve system-level metrics during test execution. This includes detailed energy consumption data from the battery, as

*Possibility to adjust dates, see 4 for more details.

[1] `https://pepr-cloud.fr/en/`

[2] `https://discovery.gitlabpages.inria.fr/enoslib/`

[3] `https://www.grid5000.fr/w/Grid5000:Home`

well as CPU, memory, and network usage statistics. The results must be reliably gathered and stored for analysis at the end of each experiment.

Validation through Core Scenarios. The platform's functionality will be validated by implementing three core experimental scenarios of increasing complexity:

1. **Browser-based test:** Reserve a device, execute an automated test scenario that runs on the mobile's browser, and collect all system metrics.
2. **Application test:** Fully wipe a device, install a target application, execute a test, and retrieve the application logs alongside system metrics.
3. **Full device flash:** Extend the provisioning system to dynamically flash a specific OS or custom ROM onto a device as part of the test setup process.

Stretch Goals. Potential extensions include implementing network emulation (e.g., controlling bandwidth/latency) to simulate real-world conditions, and developing a feature to record and replay user interaction macros to facilitate test creation.

Related Work. Along with the research prototype we developed, some projects are closely related and can serve as a source of inspiration. Appium[4] is an open source project for facilitating UI automation; and STF[5] is a device farm management tool that incorporates many features such as device reservation, remote control, etc.

3 Required Skills & Profile

We are looking for a candidate with the following profile:

- A student in the last year of a Master's degree in Computer Science, or in the last year of an engineering school.
- Strong proficiency in Python for automation and backend development.
- Knowledge of or a strong interest in system-level programming and tooling, particularly with the Android Debug Bridge (ADB).
- Knowledge of or a strong interest in learning infrastructure automation tools and concepts inspired by platforms like Kubernetes, EnOSlib, or Grid'5000.
- Familiarity with Linux systems, command-line tools, and basic networking.
- A good level of English to contribute to the writing of documentation and a potential research paper.
- An ability to work autonomously, collaborate effectively, and communicate clearly.
- Curiosity and a strong appetite for tackling complex systems-level challenges.

4 Additional information

Advisors.

- Lylian Siffre, Kapela, Inria, IMT Atlantique lylian.siffre@inria.fr
- Guillaume Rosinosky, Inria, IMT Atlantique guillaume.rosinosky@inria.fr
- Baptiste Jonglez, Inria, IMT Atlantique baptiste.jonglez@inria.fr

Duration. 6 months, from February or March 2026.
Salary. Legal minimum of 4,50 € / hour (net of taxes), full time.
Location. IMT Atlantique, Inria Stack team, LS2N laboratory in Nantes

[4] `https://appium.io/docs/en/2.0/intro/`
[5] `https://github.com/DeviceFarmer/stf`

References

[1] Freitag, C., Berners-Lee, M., Widdicks, K., Knowles, B., Blair, G. S., and Friday, A. The real climate and transformative impact of ict: A critique of estimates, trends, and regulations. *Patterns 2*, 9 (2021), 100340.

[2] IEA. Energy and ai, Apr. 2025.

[3] Kleppmann, M., Wiggins, A., van Hardenberg, P., and McGranaghan, M. Local-first software: you own your data, in spite of the cloud. In *Proceedings of the 2019 ACM SIGPLAN International Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software* (Athens Greece, Oct. 2019), ACM, p. 154–178.

[4] Siffre, L., Ledoux, T., Pawlak, R., and Guery, J. Local Computing vs. Cloud Computing: An Empirical Study of Energy Consumption. In *IEEE/ACM 18th International Conference on Utility and Cloud Computing* (Nantes, France, Dec. 2025), ACM, pp. 1–10.

[5] Siffre, L., Ledoux, T., Pawlak, R., and Guery, J. Local-first software for green it. In *2025 11th International Conference on ICT for Sustainability (ICT4S)* (2025), pp. 58–68.