



## Internship Topic

### Title: Study and Optimization of Energy Consumption in Blockchain Systems

**Context:** Blockchain technology, while innovative for decentralized digital interactions, presents significant challenges in terms of energy consumption, impacting its large-scale adoption and environmental sustainability. As blockchain continues to evolve, it becomes crucial to better understand its energy consumption profiles and identify solutions to reduce this impact while maintaining high levels of security and data integrity. This internship aims to explore and propose improvements to make blockchain more energy-efficient.

**Objective:** The goal of this internship is to thoroughly analyze the energy consumption of current blockchain systems, identify the contributing factors, and propose optimization strategies. The intern will assess existing blockchain technologies and architectures, explore different approaches to reduce their energy footprint, and develop recommendations or prototypes to minimize their environmental impact while ensuring performance and security. The selected candidate will join the Trustworthy, Intelligent, and Self-Organizing Information Systems Laboratory (LICIA) at CEA LIST.

**Methodology:** The intern will have the following responsibilities:

- 1. State-of-the-art and needs analysis:**
  - Conduct a literature review and existing case studies on blockchain energy consumption and the factors influencing this consumption (e.g., hardware, communication protocols, block size, validation frequency, etc.).
  - Identify the main sources of energy consumption in current blockchain infrastructures.
- 2. Exploration of improvement strategies:**
  - Propose and explore different strategies to reduce blockchain energy consumption, such as optimizing the algorithms used, improving smart contract efficiency, integrating renewable energy solutions, and other innovative approaches.
  - Develop models or prototypes to test the proposed improvements and evaluate their potential impact on overall energy consumption.
- 3. Testing and validation:** Implement a prototype of the proposed consensus algorithms. Conduct tests and simulations to validate the effectiveness of the proposed solutions in terms of energy consumption reduction, while maintaining system security and integrity.
- 4. Documentation and knowledge transfer:** Write comprehensive documentation for the solution.

**Skills:** The candidate should possess the following skills:

- Master's level student (M2) in Computer Science/Engineering.



- Knowledge of blockchain, computer security, and software engineering.
- Understanding of software engineering (previous experience with development models, the software lifecycle, or continuous integration is a plus).
- Knowledge of advanced software design principles (previous experience with strongly-typed languages, polymorphism, generic programming, templates, or design patterns is an advantage).

**Required Specialization:** Computer Science

**Other Specializations, Keywords:** Distributed systems, software engineering

**Resources (experiments, analysis methods, others...):** Research, programming

**Desired Level:** Master's degree (Bac +5) - Master 2

**Internship Duration:** 6 months

**Defense clearance level required (AS minimum):** AS

**Desired Education:** Engineering/Master's degree

**Possibility of continuing with a PhD:** Yes

**Internship Location:** CEA, Saclay Nano-Innov Center, 91191 Gif-sur-Yvette

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