ENACloud

ENergy efficiency through Architectural tactics for CLOUD systems

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Keywords

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Context

Energy efficiency has already been considered for many years at the hardware level. However, powerful, and cheaper computing resources have led to less resource optimization in software. Considering the planet resource limits and the increasing role of software in society, there is an urgent need to design software with energy awareness as a requirement. In practice, this means to consider energy-efficiency in software quality attributes at design time and then to implement architectural tactics enforcing them. Moreover, usage conditions varying a lot at run-time, software evolution would enable additional energy savings. Cloud-based services and applications can evolve through various configurations of cloud software and provisions of hardware resources Such a behavior offers the foundation for achieving elasticity in a modern cloud computing paradigm. In this context, qualities of service such as response time, resource utilization were explored. However, energy efficiency has been neglected so far [1].

Internship objectives

The objective of this internship is to take into account energy efficiency as quality attribute in the design of cloud-based software products and to provide recommendations to software engineers for developing and evolving software with low environmental impact.

Concretely the tasks that will be carried out by the selected candidate:

1. Study the software-based power meters that can be used for monitoring energy consumption of cloud-based applications [5, 6].

2. Study the architectural tactics for cloud-based applications [1, 2, 3, 4]

3. Conceive an approach based on architectural tactics that recommend software developers how to build and evolve cloud-based systems to improve their energy efficiency.

4. Run experimental studies for validating the proposed solutions.

The objective of this internship is to establish first results that can be extended in a thesis project, many research challenges should be addressed for this.

References

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[6] Foutse Khomh and S. Amirhossein Abtahizadeh. Understanding the impact of cloud patterns on performance and energy consumption. J. Syst. Softw., 141 :151–170, 2018. Contribution des différents laboratoires membres de ESSI impliqués dans le projet de recherche : The TSP team has been working for some years in the domain of distributed software systems. Recently, the team has been working on IoTvar, a middleware offering the right abstraction level to transparently handle the interactions between IoT applications and several IoT platforms, the energy consumption impact of this middleware has been measured. The team has also proposed a distributed event-based systems able to enforce dissemination contracts between producers and consumers. Distributed Event-Based Systems for broad IoT face unprecedented scales in terms of the volume of exchanged data, number of participants and communication distance. The team is also working on the impact of the ICT on energy consumption. We are proposing a new teaching unit on this subject for the next academic year. And we are supervising a PhD on the subject of middleware support for energy-awareness in Internet of Things platforms and application since 2019. The ENSIIE team has been working on methods that allow the evolution of software systems. A multi-criteria decision making tool was proposed in order to support stakeholders for deciding how to evolve the software system. The proposals were evaluated through semi- controlled experiments in which human participants were involved. Moreover, the ENSIIE team is also working on the impact of ICT on energy consumption. Recently, we ran empirical experiments to evaluate the impact of database query strategies on energy consumption. The ENSIIE team analysed the software energy efficiency from a more abstract level in the software development life-cycle, ie. from requirements level.