Internship Program 2023
Simulation of Edge Interactions across IoT-enhanced Environments
November 17, 2022

Internship Description

With the advent of Internet of Things (IoT) devices and supporting technologies, spaces (e.g. buildings and homes) are becoming smarter and interconnected. IoT applications deployed in such spaces provide services to improve people's daily activities, life quality, and public safety: for example, IoT applications for building utility optimization, air/noise monitoring, enforcing emergency & rescue procedures. Such applications are composed of different QoS requirements such as end-to-end latency bounds, throughput, and tolerated message loss rates. IoT systems designers often have to tune the data exchange infrastructure to ensure that the QoS requirements of deployed applications are satisfied. This is usually a tedious process that requires tuning different system parameters.

Commercial and open-source simulation tools such as IoTIFY[1], CupCarbon [1], and DPWSim [2] have been developed to facilitate such tasks prior to system deployment. They enable simulating some aspects of IoT systems and provide system performance insights in terms of energy-efficiency, battery consumption, etc. While such tools are useful, IoT designers have to spend considerable effort in learning how to use a simulator for representing an IoT system.

The DiSSEM group of Télécom SudParis / IP Paris is currently building a simulation tool that enables IoT designers to quickly simulate IoT systems using standard IoT representations and data exchange architectures. The main goal of this internship is to integrate the modules developed by DiSSEM and deliver a usable simulation tool.

Internship Objectives

The selected applicant will be working on the following:

– Get familiar with the modules developed and the NGSI-LD representation of IoT systems.
– Integrate the modules developed using container-based technologies (e.g., Docker).
– Run experiments for the comparison of simulated datasets against real ones.

Qualifications

Master 2 or last year of engineering school.

Skills & qualities

– Fluent in English
– Knowledge of Object-oriented programming (Java)
– Good knowledge and understanding of data structures and data formats.
– Ability to analyze existing software code base.
– Knowledge of shell scripts
– Familiarity with development tools for managing and building software projects (Eclipse, Maven) and version control systems (Git).
– Knowledge of Docker and Kubernetes is a plus.

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[1]https://iotify.io/

Additional information

  – Starting date: February 2023 (Flexible)
  – Duration:: 5-6 months

To apply, contact Georgios Bouloukakis - `georgios.bouloukakis AT telecom-sudparis.eu` and Denis Conan - `denis.conan AT telecom-sudparis.eu` by providing the following documents:

1. CV
2. Motivation letter
3. Transcripts of the last 3 years
4. A course report or article written in English (if any)

References and Additional Reading

[1] K. Mehdi, M. Lounis, A. Bounceur, and T. Kechadi. Cupcarbon: A multi-agent and discrete event wireless sensor network design and simulation tool. In *Proc. of the 7th International Conference on Simulation Tools and Techniques*, pages 126–131, Lisbon, Portugal, March 2014.

[2] S.N. Han, G.M. Lee, N. Crespi, K. Heo, N. Van Luong, M. Brut, and P. Gatellier. DPWSim: A simulation toolkit for IoT applications using devices profile for web services. In *Proc. of the IEEE World Forum on Internet of Things*, pages 544–547, 2014.

[3] Tony Field. Jinqs: An extensible library for simulating multiclass queueing networks, v1. 0 user guide, 2006.

[4] Tzu-Ching Horng, Nikolas Anastasiou, Tony Field, and William Knottenbelt. Loctrackjinqs: An extensible location-aware simulation tool for multiclass queueing networks. *Electronic Notes in Theoretical Computer Science*, 275:93–104, 2011.

[5] Marco Bertoli, Giuliano Casale, and Giuseppe Serazzi. The jmt simulator for performance evaluation of non-product-form queueing networks. In *40th Annual Simulation Symposium (ANSS'07)*, pages 3–10. IEEE, 2007.

[6] Marco Bertoli, Giuliano Casale, and Giuseppe Serazzi. Jmt: performance engineering tools for system modeling. *ACM SIGMETRICS Performance Evaluation Review*, 36(4):10–15, 2009.

[7] Marco Bertoli, Giuliano Casale, and Giuseppe Serazzi. An overview of the jmt queueing network simulator. *Politecnico di Milano-DEI, Tech. Rep. TR*, 2007, 2007.

[8] Georgios Bouloukakis, Nikolaos Georgantas, Ajay Kattepur, and Valérie Issarny. Timeliness evaluation of intermittent mobile connectivity over pub/sub systems. In *Proceedings of the 8th ACM/SPEC on International Conference on Performance Engineering*, pages 275–286, 2017.

[9] Georgios Bouloukakis, Ajay Kattepur, Nikolaos Georgantas, and Valérie Issarny. Queueing network modeling patterns for reliable and unreliable publish/subscribe protocols. In *Proceedings of the 15th EAI International Conference on Mobile and Ubiquitous Systems: Computing, Networking and Services*, pages 176–186, 2018.

[10] Georgios Bouloukakis, Kyle Benson, Luca Scalzotto, Paolo Bellavista, Casey Grant, Valérie Issarny, Sharad Mehrotra, Ioannis Moscholios, and Nalini Venkatasubramanian. Priodex: a data exchange middleware for efficient event prioritization in sdn-based iot systems. *ACM Transactions on Internet of Things*, pages 1–30, 2021.