

## Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website [www-csc.utt.fr](http://www-csc.utt.fr))

Supervisor's name : LE MOUEL Given names : Frederic

Status (prof., assistant prof., ...): Full Professor

Laboratory : INRIA CITI Laboratory

Website address :  
<http://www.citi-lab.fr>

Institution : INSA Lyon

Website address :  
<http://www.insa-lyon.fr>

Scientific competence :

Recent technological evolutions, including cloud computing, mobile computing, are turning computing ubiquitously distributed. Around 40 billions of devices are estimated to be interconnected at the horizon of 2025, yet building large planetary-scale, efficient and robust distributed systems and communication infrastructures is notoriously challenging. Existing approaches to interconnect data centers across the world rely on in-memory event-based systems with strong, stable connections. Interconnecting planet-wide IoT devices will raise new challenges: social mobility, service roaming, heterogenous Edge/Fog computing capabilities, different application goals: delay-sensitive data flows, QoS, privacy.

Two major publications in the field proposed for the PhD :

- S. Qian, J. Cao, F. Le Mouël, M. Li, and J. Wang. Towards Prioritized Event Matching in a Content-based Publish/Subscribe System. In Proceedings of DEBS, June 2015.

- S. Qian, W Mao, J. Cao, F. Le Mouel, M. Li. Adjusting Matching Algorithm to Adapt to Workload Fluctuations in Content-based Publish/Subscribe Systems. In Proceedings of INFOCOM, May 2019.

Website address of the personal page : <http://perso.citi.insa-lyon.fr/flemouel/>

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**Description of the research work proposed for a PhD**

**Topic # (see list) : I-1**

Title : Mobile-adaptive Fog/Edge Computing System and Overlay Network for Efficient Planetary-Scale Interconnection of the Internet of Everything

Subject :

The work of the PhD student will mostly revolve around the algorithmic design and the architecture implementation of embedded systems, system of systems, overlay networks and distributed computing deployment. She or he will propose and implement mechanisms for cross-overlay interoperability and for taking into account node heterogeneity and node mobility. Finally, she or he will have a fundamental role in the development and deployment of the prototype implementation and its evaluation. The programming systems envisioned are event-based middleware such as Vert.x, and the communication layer envisioned are efficient in-memory publish/subscribe ones such as Hazelcast. The distributed computing platform envisioned are real-time data flow ones such as S4, Storm. The algorithmic techniques envisioned are gossip-based protocols, self-repairing overlays, and peer-to-peer networks in general. Most of the development will be done using high-level languages such as Java. Experience with mobile and/or tiny devices development, while not mandatory, is a plus, as the test platform will be composed of a collection of tiny and low-power devices spread across multiple geographical locations.

Keywords :

Distributed Systems, Event-Based Communication, Algorithmic, Fog/Edge Computing, Planetary-Scale Computing

Expected collaborations :

Shanghai Jiao Tong University, Fudan University, Tsinghua University

Background required from the applicant :

Computer Science: Programming - proven skills, Operating System - good background, Network - good background, Cloud Computing - optional, Embedded Systems - optional ; Mathematics: Optimization and algorithmic - good background, Information Theory - knowledgeable ; Language: English - fluent

Existence of a PDF file detailing the proposal ("yes" or "no") : no

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