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*Academic age as
defined by the SNSF

Romain Jacob

Postdoctoral Researcher – Open Science Enthusiast

Doctorate in Computer Science
Master in Mechanical Engineering
Master in Pedagogy

Wireless Embedded Systems
Automatic Control
Engineering Sciences

5.2 FTE of research activities*

Education

2015–2019

Doctorate in Computer Science
“Leveraging Synchronous Transmissions for the
Design of Real-time Wireless Cyber-Physical System”
Supervised by Prof. Lothar Thiele
ETH Zurich, Switzerland

2011–2014

Master in “Engineering of Complex Systems”
Advised by Prof. Jean-Jacques Lesage
École Normale Supérieure (ENS) de Cachan, France

2012–2013

Agrégation in Industrial Science—Mechanics major
French national exam for higher education teachers

Master in “Faculty Training for Higher Education”
École Normale Supérieure (ENS) de Cachan, France

2010–2011

Bachelor in Mechanical Engineering
Université Pierre et Marie Curie (UPMC, Paris 6), France

Experience

2020–current

Postdoctoral Researcher
Networked Systems Group, headed by Prof. Laurent Vanbever
ETH Zurich, Switzerland

2015–2020

Doctoral Student and Scientific Assistant
Computer Engineering group, headed by Prof. Lothar Thiele
ETH Zurich, Switzerland

2013–2014

Visiting Scholar
Vehicle Dynamics and Control laboratory, headed by Prof. Karl J. Hedrick[†]
University of California (UC) Berkeley, CA, USA

2012–2013

Scientific Consultant
Project with **Aldebaran-Robotics**, creators of Nao the humanoid robot
Paris, France

2012

Research Intern
Automation research group, supervised by Prof. Martin Fabian
Chalmers University of Technology, Göteborg, Sweden

¹ romainjacob.net/baloo

² tw.ethz.ch
github.com/romain-jacob/drp

³ [10.1145/3302509.3311046](https://doi.org/10.1145/3302509.3311046)

⁴ [10.1145/3302506.3312483](https://doi.org/10.1145/3302506.3312483)

⁵ www.stiftung-ewaldmarquardt.de/de/der_zukunftspreis

⁶ [10.5281/zenodo.3464273](https://zenodo.org/record/3464273)

⁷ [10.5281/zenodo.3451417](https://zenodo.org/record/3451417)

⁸ Presentation: osf.io/aktn7/

⁹ Presentation: osf.io/m7a6w/

¹⁰ [10.5281/zenodo.3354717](https://zenodo.org/record/3354717)

¹¹ [10.3929/ethz-b-000442044](https://doi.org/10.3929/ethz-b-000442044)

¹² explore-st-data.ethz.ch

Contribution to the generation of knowledge

During my doctoral studies, I demonstrated that the wireless communication technique known as **synchronous transmissions** (*ST*) allows designing (wireless) cyber-physical systems with provable end-to-end real-time guarantees. To facilitate the use and adoption of that technique, I developed *Baloo*,¹ a tool providing a high-level programming interface to design communication protocols based on *ST*. *Baloo* allows a non-expert to specify the communication protocol logic (i.e., when each device sends its packets) without worrying about the low-level radio control, which is particularly challenging due to the stringent time synchronization requirements of the technique (orders of μs). This facilitates the application of synchronous transmissions to new domains and contexts. Using synchronous transmissions, I designed two wireless cyber-physical systems providing real-time guarantees for distributed cyber-physical system applications. These systems have been implemented and are openly available.² In particular, the Time-Triggered Wireless design has been used to demonstrate the **first-ever remote closed-loop control of inverted pendulums over a multi-hop wireless network**. This work received the ICCPS Best Paper³ and IPSN Best Demo⁴ awards in 2019, as well as one of the Future Prizes of the Ewald Marquardt Foundation⁵ recognizing “its potential for innovation and industrial applications” (yet to be announced publicly).

In addition, I worked on improving the **replicability of networking experiments**, which is made particularly challenging by the inherent variability of the experimental conditions. I explored the statistics literature to identify appropriate approaches and used these to define a concrete and rationale methodology for the design and analysis of experiments. This methodology has been implemented in a framework called *TriScale*⁶ which is openly available for the different networking communities to use, extend, and build upon.⁷ In 2020, I was invited to present this work at the EWSN conference⁸ and the CROSS symposium.⁹

I strongly believe in **openness and sharing in science**. I strive to publish tools and datasets to enable the community to build upon my own research; one of our datasets shows more than 800 downloads¹⁰ which illustrates the community’s need for such contributions. In a similar spirit, I invested some efforts to realize a replication study¹¹—an underrated research contribution in our field. We not only published our code and dataset; we went the extra mile and released an online app to visualize and explore the data.¹²

Contribution to the development of projects and individuals

I see research as a collaborative endeavor that benefits from the expertise of multiple people. During my doctorate, most of my projects were **international collaborations** in which I had the driving seat; I believe I efficiently managed those projects, collected opinions before making decisions, distributed tasks, and ultimately drove these projects toward a satisfactory conclusion. The largest project I have been involved in (IoT Bench, see “Wider research community” below) brought together more than ten professors and young researchers from around the world. While still a doctoral student, I took on the responsibility of managing this project for a couple of years, after the initiator left academia.

I am really **passionate about teaching** and always welcome opportunities to help students learn. My first experience was in 2014 when I taught a second year university-level Mechanics course on kinematics, kinetics, and dynamics at the Institute of Technology of Tremblay-en-France (France). During my doctorate, I worked as a teaching assistant in

Embedded Systems, Low-Power System Design, and Discrete Event Systems lectures. I am currently responsible for the coordination of a Master-level course on *Advanced Topics in Communication Networks*, which we completely renewed and adapted to a fully-online format; a new—and time-consuming—but very interesting challenge! We plan to make our material openly available at the end of the semester.

I am also **active in research supervision**. I supervised a number of semester and master theses,¹³ always trying to set the students' learning opportunities first. As a postdoctoral researcher, I am currently co-supervising two doctoral students, one of which happen to have already done a semester thesis with me three years ago! Helping to nurture their research skills is one of the most satisfying part of my job at the moment.

Contribution to the wider research community

My research in wireless communication made me aware of the so-called “reproducibility crisis” that plagues many research fields and is particularly challenging in wireless experiments. This led me to be heavily involved in **IoT Bench**,¹⁴ a community-driven effort aiming to **establish benchmarks** for low-power wireless communication. With IoT Bench, we reflected on tools and methods to improve the replicability of experimental evaluations in our field, resulting in the *TriScale* work (see “Generation of knowledge”). In addition, we organized a series of international workshops¹⁵ to raise awareness in our community and discuss practical solutions. In this forum, I presented some of my own work as well as the vision and goals of IoT Bench.¹⁶

Naturally, I also serve as reviewer for the work of others. I have been involved in so-called Artifact Evaluation committees, which aim to foster research data and code sharing. I recently reviewed for such committees at the ACM SIGCOMM and IEEE RTSS conferences. I also served as program committee member for the FAILSAFE and DATA workshops.

I believe in the principles generally known as “**Open Science**.” In my work, this implies *e.g.*, favoring open and free software over commercial tools and submitting to open access conferences. Moreover, I try to systematically release data and code with all publications, aiming to make any plot or experiment reproducible by others; I believe this should be a standard in science. About a year ago, I wrote down my own objectives and expectations regarding the way I intend to do research; this has materialized into a “**Pledge to Open Science**” which is publicly available on my personal website.¹⁷ I will do my best to live and work by these principles because I believe this is the right thing to do.

In addition, I am involved in the launch of a **new diamond open access journal**¹⁸ (*i.e.*, free to read, free to publish) called JSys and covering the wide scope of computer science systems research. This project is entirely driven by researchers and aims to offer an inclusive, high-quality, and high-throughput venue for systems research, which is currently suffocating within the conference-based publishing model. The journal is hosted by the University of California Digital Library which provides infrastructure and support free of charge. The journal is just getting public now, and we expect the first call for papers to be published early 2021. This is a time-consuming commitment but I believe a worthy one; if we succeed, JSys will have an important impact in our research community in the long run.

¹³ romainjacob.net/students

¹⁴ iotbench.ethz.ch

¹⁵ cpsbench2018.ethz.ch
cps-iotbench2019.ethz.ch
cps-iotbench2020.ethz.ch
¹⁶ [10.3929/ethz-b-000339242](https://doi.org/10.3929/ethz-b-000339242)

¹⁷ romainjacob.net/pledge-to-open-science

¹⁸ jsysr.org

¹⁹ romainjacob.net/science-communication

²⁰ [10.3929/ethz-b-000262661](https://doi.org/10.3929/ethz-b-000262661)

²¹ vmitet.ethz.ch

Contribution to the broader society

I try to communicate about my research to a wide audience, which I consider being a part of my job as a scientist. In this spirit, I took part in various science communication activities, such as producing short videos and giving 3-minutes talks.¹⁹

During my doctorate, I actively contributed to the **representation of the scientific staff**. In 2016, I directed a survey on the supervision of doctoral students²⁰ which highlighted some systematic issues, triggered many discussions and actions taken by ETH, and resulted in a revision of the regulations of doctoral studies (currently ongoing). Since 2017, I co-preside VMITET, the association of the scientific staff in my department,²¹ where I have been actively involved in representation activities towards the department management.

Personal statement

As a scientist, I am very sensitive to the problems related to the **replicability of research findings**. If I become faculty, I want to raise awareness of these issues and mentor my students to produce replicable research and follow the principles of Open Science.

As a teacher, I want to be in close contact with students for both in teaching and mentoring. The most important thing I want to pass on is **critical thinking**: do not simply do as you are told; listen carefully to opinions and advice, but make up your own mind!

As a researcher and engineer, I want to work on some of today's concrete challenges. As such, I believe collaboration with **industry partners and governmental institutions** can be extremely useful and efficient. This is something I do not yet have experience with, but I would like to make this happen as a faculty.

Finally, as a leader, I want to foster a **healthy work environment**. Well-being is important not only for oneself but for the entire group; good time management, organization, and friendly co-workers go a long way in generating intrinsic motivation and driving the entire team to do great work. I want to help my mentees finding a right balance between work and other activities that are important to them; because it is human, and because I believe this is how one can have a successful yet sustainable life and career in the long run.