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Romain Jacob

Postdoctoral Researcher – Open Science Enthusiast

Doctorate in Computer Science	Wireless Embedded Systems
Master in Mechanical Engineering	Automatic Control
Master in Pedagogy	Engineering Sciences

6.1 FTE of research activities*

*Academic age as defined by the SNSF

Main qualifications

Low-power Wireless Communication	Networking protocols
Computer Networks	Real-time Scheduling
Embedded and Cyber-Physical Systems	Formal Methods

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 Superieure (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 Superieure (ENS) de Cachan, France

2010–2011 — Bachelor in Mechanical Engineering
Université Pierre et Marie Curie (UPMC, Paris 6), France

Languages

Native — French

Fluent — English

Basic proficiency (B1) — German

Basic proficiency (A2) — Spanish

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

Distinctions

2019
Best Paper Award, ACM ICCPS
Best Demo Award, ACM/IEEE IPSN
Future Prize, second prize, Ewald Marquardt Foundation

2017
Finalist, Famelab Switzerland

2016
Finalist, "My Thesis in 180s" competition organized by Nano-Tera.ch

2014
Ranked 1st at the Agrégation in Industrial Science (national exam)

2013
Research scholarship from the French Academy (Walter-Zellidja Foundation)

Supervision

Doctoral [D], master [M] semester [S] and bachelor theses [B] I (co-)supervised.
Undergraduate projects that led to a peer-reviewed publication are marked with ●

Ongoing	[D]	Alexander Dietmüller
	[D]	Tobias Bühler
2022	[S]	Lukas Röllin Advancing Predictions for Video Streaming with Transformers
2021	[S]	Zhengqing Liu Replication of 'Data Driven Connectivity' in P4
	[S]	Kévin Selänne Process Mining for Networking
	[B]	Fredrik Nestaas In Search of Network Shifts
2020	[M]	Raphael Schnider Pushing the Internet to the Edge
2019	[M] ●	Anna-Brit Schaper Truth be told: Benchmarking BLE and IEEE 802.15.4
	[S]	Jan Müller Low-Power Network Design: Work Hard, Play Hard (I)
	[S]	Anna-Brit Schaper Low-Power Network Design: Work Hard, Play Hard (II)
	[S]	Antonios Koskinas Is low-power wireless networking a reproducible science?
2018	[M]	Jonathan Candel Dynamic Range Low-power Wireless Protocols for Environmental Monitoring
	[M] ●	Jonas Bächli Creating a Flexible Middleware for Low-Power Flooding Protocols
2017	[S]	Andreas Biri Unleashing the Potential of Real-Time Internet of Things
	[S]	Alexander Dietmüller Fault-Tolerance Mechanisms for Glossy-Based Wireless Communication Networks
	[S]	Fabian Walter Real-Time Network Functions for the Internet of Things
2016	[S]	Jonas Bächli A Protocol Gateway for the Internet of Things

Teaching

2021
Discrete Event Systems
ETH Zurich (Switzerland)
Co-lecturer

2021
Seminar in Communication Networks
ETH Zurich (Switzerland)
Co-lecturer

2020 – 2021
Advanced Topics in Communication Networks
ETH Zurich (Switzerland)
Coordinator

2017–2019
Embedded Systems
ETH Zurich (Switzerland)
Teaching assistant—Laboratory classes

2017–2019
Low-Power System Design
ETH Zurich (Switzerland)
Teaching assistant—Laboratory classes

2015–2017
Discrete Event Systems
ETH Zurich (Switzerland)
Teaching assistant—Exercises

2014
Second year Mechanics course—kinematics, kinetics, and dynamics
Institute of Technology of Tremblay-en-France (France)
Lecturer—Lectures, exercises, and laboratory classes

Invited talks

Tutorial
Supporting ReplicableNetworking Experiments with TriScale
4th CPS-IoTBench Workshop, Virtual (May 2021)

Tutorial
ACM SIGCOMM (August 2021)

Invited talk
IoTBench: Reproducibility challenge in wireless networking research
5th CROSS Symposium, Virtual (October 2020)

Invited talk
Confidence in experimental evaluations: Time to do better than “Believe me, it’s true!”
EWSN Conference, Lyon, France (February 2020)

Seminar
Leveraging Synchronous Transmissions for the
Design of Real-time Wireless Cyber-Physical Systems
INSA Lyon, Lyon, France (February 2020)

Invited talk
IoTBench—Past, present, and future of a community-driven benchmarking initiative
CPS-IoTBench Workshop, Montréal, Canada (April 2019)

Seminar
Providing Guarantees in Wireless Cyber-Physical Systems
TU Delft, Delft, The Netherlands (January 2018)

Seminar Chalmers, Göteborg, Sweden (August 2018)

Scientific service

2022	Editor-in-Chief (co)	JSys
	Member	ORCID Researcher Advisory Council
	PC Member	ECRTS—Artifact Evaluation
2021	Editor-in-Chief (co)	JSys
	PC Member	■ ACM SIGCOMM—Artifact Evaluation ■ ECRTS—Artifact Evaluation ■ JSys—Artifact Evaluation
2020	Organizer	CPSIoTBench Workshop
	Reviewer	■ PeerJ Computer Science ■ MDPI Sensors
	PC Member	■ ACM SIGCOMM—Artifact Evaluation ■ IEEE RTSS—Artifact Evaluation ■ DATA Workshop ■ FAILSAFE Workshop
2019	Organizer	CPSIoTBench Workshop
	Reviewer	MDPI Information
2018	Web chair	CPSBench Workshop
	Reviewer	MDPI Sensors
2017	Reviewer	Information Sciences

University service

2017–current	Co-president	VMITET—Representative of the scientific staff in my department
2020	Committee	Student panel for faculty hiring committee (twice)
2017–2020	Representative	International Forum, ETH Zurich
2019	Committee	Student panel for faculty hiring committee
	Workshop facilitator	ETH Symposium on Doctoral Supervision
2016–2018	Board member	AVETH—Leader of the Politics Team (2016–2017)
2014–2015	Representative	Scientific Council, ENS Cachan
2011–2013	Representative	Student Council, ENS Cachan

Selected publications

TriScale: A Framework Supporting Replicable Performance Evaluations in Networking
Romain Jacob, Marco Zimmerling, Carlo Alberto Boano, Laurent Vanbever, Lothar Thiele
Under submission (2020)

Webpage triscale.ethz.ch
Paper doi:10.5281/zenodo.3464273
Software github.com/romain-jacob/triscale
Video youtu.be/KVA0MZszI-4

The Time-Triggered Wireless Architecture
Romain Jacob, Licong Zhang, Marco Zimmerling,
Jan Beutel, Samarjit Chakraborty, Lothar Thiele
ECRTS (2020)

Paper doi:10.4230/LIPIcs.ECRTS.2020.19
Presentation doi:10.3929/ethz-b-000422402
Video youtu.be/WWWtUFUAcXQ
Software github.com/romain-jacob/TTW-Artifacts
Poster osf.io/jh9pg
Webpage ttw.ethz.ch

Feedback Control Goes Wireless:
Guaranteed Stability over Low-power Multi-hop Networks
Fabian Mager, Dominik Baumann, Romain Jacob,
Lothar Thiele, Sebastian Trimpe, Marco Zimmerling
ICCPS (2019)

Best Paper Award
Paper doi:10.1145/3302509.3311046
Video youtu.be/1i6oBsat_Ww

Synchronous Transmissions Made Easy: Design Your Network Stack with Baloo
Romain Jacob, Jonas Bächli, Reto Da Forno, Lothar Thiele
EWSN (2019)

Paper doi:10.3929/ethz-b-000324254
Presentation doi:10.3929/ethz-b-000328814
Software github.com/ETHZ-TEC/Baloo
Webpage romainjacob.net/baloo

End-to-End Real-Time Guarantees in Wireless Cyber-Physical Systems
Romain Jacob, Marco Zimmerling, Pengcheng Huang, Jan Beutel, Lothar Thiele
RTSS (2016)

Paper doi:10.3929/ethz-a-010881673
Presentation osf.io/ckdv4/
Software github.com/romain-jacob/drp

Overview of discrete event systems opacity: Models, validation, and quantification
Romain Jacob, Jean-Jacques Lesage, Jean-Marc Faure
Annual Reviews in Control (2016)

Paper doi:10.1016/j.arcontrol.2016.04.015
Presentation osf.io/qtxra/

Open source projects

Dataset

Synchronous transmissions on Bluetooth 5 and IEEE 802.15.4
Dataset and analysis scripts of a replication study of
synchronous transmissions using the nRF52840 Dongle
10.5281/zenodo.3964354
Data visualization: explore-st-data.ethz.ch

Software

TriScale
Framework helping to make the experiment design and data analysis more replicable
github.com/TriScale-Anon/triscale (temporary repository)

Software

Time-Triggered Wireless Architecture
Public software and artifacts related to the Time-Triggered Wireless Architecture project
10.5281/zenodo.3759221

Dataset

Wireless Link Quality Estimation on FlockLab – and Beyond
Dataset of wireless link quality estimation for the FlockLab testbed
10.5281/zenodo.3354717

Software

Baloo
Design framework for network stacks based on Synchronous Transmissions
10.5281/zenodo.3510171

Software

The Distributed Real-time Protocol
Simulation code and experiment results for the Distributed Real-time Protocol project
10.5281/zenodo.3530757

Software

The Low-power Wireless Bus
Implementation of LWB for the TelosB mote
github.com/ETHZ-TEC/LWB-Baseline

References

Past and current collaborators

Prof. Dr. Lothar Thiele
ETH Zurich (Switzerland)
thiele@ethz.ch

Prof. Dr. Laurent Vanbever
ETH Zurich (Switzerland)
lvanbever@ethz.ch

Prof. Dr. Jean-Jacques Lesage
ENS Paris-Saclay (France)
jean-jacques.lesage@ens-paris-saclay.fr

Dr. Marco Zimmerling
TU Dresden (Germany)
marco.zimmerling@tu-dresden.de

Independent experts

Prof. Dr. Thiemo Voigt
Uppsala Universitet (Sweden)
RISE Computer Science (Sweden)
thiemo.voigt@it.uu.se

Prof. Dr. Martina Maggio
Saarland University (Germany)
Lund University (Sweden)
martina.maggio@control.lth.se

Prof. Dr. Sanjoy Baruah
Washington University in St. Louis (USA)
baruah@wustl.edu

Reference for university representation and outreach

Prof. Dr. Sarah Springman
ETH Zurich (Switzerland)
sarah.springman@sl.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 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 Paper[3] and IPSN Best Demo[4] awards in 2019, as well as one of the Future Prizes of the Ewald Marquardt Foundation[5] 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 apropriate 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 conference[8] 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 downloads[10] which illustrates the community's need for such contributions. In a similar spirit, I invested some efforts to realize a replication study[11]—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 (IoTBench, 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

[1] romainjacob.net/baloo

[2] ttw.ethz.ch
github.com/romain-jacob/drp

[3] 10.1145/3302509.3311046

[4] 10.1145/3302506.3312483

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

[6] 10.5281/zenodo.3464273

[7] 10.5281/zenodo.3451417

[8] Presentation: osf.io/aktn7/

[9] Presentation: osf.io/m7a6w/

[10] 10.5281/zenodo.3354717

[11] 10.3929/ethz-b-000442044

[12] explore-st-data.ethz.ch

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.

[13] romainjacob.net/students

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 **IoTBench**,[14] a community-driven effort aiming to **establish benchmarks** for low-power wireless communication. With IoTBench, 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 workshops[15] 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 IoTBench.[16]

[14] iotbench.ethz.ch

[15] cpsbench2018.ethz.ch
cps-iotbench2019.ethz.ch
cps-iotbench2020.ethz.ch

[16] 10.3929/ethz-b-000339242

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.

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

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

[18] jsysr.org

we succeed, JSys will have an important impact in our research community in the long run.

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 students[20] 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.

[19] romainjacob.net/science-communication

[20] 10.3929/ethz-b-000262661

[21] vmitet.ethz.ch