DR. ROBERTO RODRIGUES FILHO

roberto.filho@ufsc.br • linkedin.com/in/roberto-rodrigues-filho-91020310/ • robertovrf.github.io

SUMMARY

Dr. Rodrigues Filho is currently an Assistant Professor in the Department of Computing (DEC) at the Federal University of Santa Catarina (UFSC). Before that, he worked as a Postdoctoral Researcher in the Computer Networks Laboratory (LRC) at University of Campinas, Brazil, where he studied autonomous service placement in edge-cloud infrastructures. He worked as a Postdoctoral Researcher at the Federal University of Goiás, Brazil (2020-2022), and as a Research Associate at Lancaster University, UK (2017-2020). He was also a Visiting Researcher at IRISA/INRIA Université de Rennes 1, in France, during the summer of 2019. He obtained a Ph.D. in Computer Science from Lancaster University (2018) and holds an M.Sc. and a B.Sc. in Computer Science from the Federal University of Goiás (2013).

EDUCATION

Ph.D., Computer Science   2014 – 2018
Lancaster University, Lancaster, UK
Supervisors: Dr. Barry Porter and Prof. Gordon Blair
Thesis: Emergent Software Systems

MSc., Computer Science   2011 – 2013
Federal University of Goiás, Goiânia-GO, Brazil
Supervisors: Dr. Iwens Sene Jr. and Dr. Renato Bulcão Neto
Dissertation: An Emulator for a Body Sensor Network Hardware Architecture

BSc., Computer Science   2006 – 2010
Federal University of Goiás, Goiânia-GO, Brazil
Supervisors: Prof. Fábio M. Costa
Monograph: A Study of Model-driven Approaches Applied to Middleware

EXPERIENCE

Federal University of Santa Catarina, Araranguá-SC, Brazil: Assistant Professor   July 2023 – Current

Roberto is currently an Assistant Professor in the Department of Computing at the Federal University of Santa Catarina. He is currently responsible for teaching the Introduction to Computer Programming module for the Energy Engineering undergraduate course, Distributed Systems and Wireless Networking for the Computer Engineering undergraduate course. He also conducts research on Self-adaptive and Autonomic Computing techniques to support Self-distributing applications on the Computing Continuum.

University of Campinas, Campinas-SP, Brazil: Postdoctoral Researcher   July 2022 – Dec 2022

Roberto works on service placement in the edge-cloud infrastructure to support video streaming applications. He also worked on further developing the Self-distributing Systems (SDS) concept to support the development and management of applications on the computing continuum. During this time, he also supervised undergrad students in their final year projects and acted as a guest-lecturer in the Distributed Systems undergrad-level course.

Federal University of Goiás, Goiânia-GO, Brazil: Postdoctoral Researcher   June 2020 – May 2022

Roberto worked on developing the concept of Emergent Microservices and Emergent IoT networks. Emergent Microservices are microservices able to change their own internal composition at runtime to better handle incoming requests. Emergent IoT Networks are the result of the combination of Intent-driven networks and SDN platforms. We use application-defined intents to (re)configure the IoT network behavior to better address application requirements whilst maintaining network constraints.

Lancaster University, Lancaster, UK: Postdoctoral Research Associate   December 2017 – May 2020

Roberto worked on the definition of Self-distributed systems (SDS). SDS are systems written to execute locally and at runtime, and autonomously (guided by a reinforcement learning algorithm) the system distributes its constituent components to find the most suitable distributed composition for the observed operating condition.

IRISA/INRIA Université de Rennes 1, Rennes, France: Visiting Researcher   July 2017 – September 2019

Roberto spent 3 months visiting the WIDE Research Group led by Prof. François Taïani.

Lancaster University, Lancaster, UK: Teaching Assistant   September 2014 – February 2018

Roberto assisted in lab sessions by answering students' questions and marking students' lab assignments.

Federal University of Goiás, Goiânia-GO, Brazil: Teaching Assistant   March 2012 – July 2012

Roberto taught lectures on Computer Networks for undergrad students.

AWARDS

- First place in the public competitive examination for the position of Professor Adjunto (equivalent to Assistant Professor) at the Federal University of Santa Catarina (2023).
- Co-supervised Bruna Cordeiro who wrote the best master's dissertation of the 2022 Graduate Program in Computer Science in the Institute of Informatics at the Federal University of Goiás.
- Honorable Mention - Distinguished Artifact Evaluation Committee Member Award, Eurosys, 2022
- Audience Choice Award (best paper chosen by the audience), ACSOS, 2021.
- People's Choice Award (best paper chosen by the audience), ACSOS, 2020.
- Full Postdoctoral Scholarship, Leverhulme, UK, 2017.
- Fulbright Ph.D. Scholarship, CAPES, Brazil, 2013.

ACADEMIC PROJECTS

Orchestrating Applications on Edge Computing   2022 – 2022

This pilot project aims to investigate a service placement orchestrator to explore the potential of the edge and cloud computing infrastructure. This project is divided into three main stages. The first is dedicated to investigating and assembling a testbed to simulate an edge-cloud infrastructure and define a use case for experiments. The second stage is dedicated to exploring technologies and concepts to help define and build the service orchestrator, a microservices-based video streaming application, and to conduct experiments in a controlled environment. Finally, the last stage is dedicated to conducting experiments with the orchestrator in the edge-cloud infrastructure considering user mobility. Also, as part of the last stage, we aim to explore ideas about a self-monitoring system and QoE composable model for applications running in the edge-cloud continuum.

- **Funding Agency**: Ericsson Researcher, Sweden.
- **Institution**: University of Campinas (UNICAMP), Brazil.
- **Role**: Researcher (Postdoctoral Researcher).

Autonomous Composition of Software for Smart Cities   2020 – 2022

Contemporary systems are often deployed in highly volatile and heterogeneous operating environments which make them greatly complex. Smart Cities are a notable example that illustrates all aspects of the complexity of contemporary systems. In the software development process of Smart Cities, we often use technologies that aim to mitigate problems related to the creation and management of modern systems, such as the application of microservices to construct the software platform that abstracts the device infrastructure spread throughout the city, and Software Defined Networks (SDN) for the Internet of Things (IoT) to provide more flexibility for interconnecting devices. However, these technologies, when used to support software adaptation at runtime, still demand the definition of the system's adaptation logic that determines when and to which software configuration the system must adapt. The manual definition of the adaptation logic is not desirable when considering large scale systems, for which it is hard to predict the events in the operating environment that impact the system's performance and require adaptation. A promising approach that enables systems in any application domain to learn at runtime their own adaptation logic, and thus deals with uncertainty in the operating environment, is named Emergent Software Systems (ESS). Therefore, this proposal aims to explore the ESS concept in tandem with microservices and SDN for IoT to autonomously compose software modules for Smart Cities, dealing with the high dynamicity and uncertainty of the operating environment that is characteristic of this application domain. At last, we aim to contribute to the advancement of the state-of-the-art of self-adaptive/autonomic systems and their role in managing the complexity in the current software ecosystem of Smart Cities.

- **Funding Agency**: The São Paulo Research Foundation, FAPESP, Brazil.

- **Institution**: Federal University of Goiás (INF-UFG), Brazil.
- **Role**: Researcher (Postdoctoral Fellow).

The Emergent Self-Aware Data Centre   2017 – 2020

This is a Leverhulme-funded project examining fully automated, continuous self-assembly of large distributed systems at scale. Our approach offers a strategy that generalises to software as a whole, but focuses on data centre infrastructures as a timely example for which enhanced efficiency will have very broad impact. This research takes a novel approach that inverts the software development process to put computers in the leading role. Using this approach, entire distributed software systems will autonomously self-assemble from a large set of small behaviours, to satisfy a given goal. Once assembled, these systems will continually discover their own capabilities by learning about the different ways in which they can assemble themselves and how those assemblies affect their performance under different conditions. This happens while a target software system is live, running in its normal production environment, so that everything is learned based on the reality to which the system is actually subjected. This work builds upon the EPSRC Deep Online Cognition project and its introduction of the emergent software systems concept. We use the Dana platform (http://www.projectdana.com/) to provide a highly-adaptive substrate for emergent software.

- **Funding Agency**: The Leverhulme Trust, UK.
- **Institution**: Lancaster University (SCC), UK.
- **Role**: Researcher (Postdoctoral Research Associate).

Deep Online Cognition in Modular Software   2015 – 2017

This research has developed the world's first approach to runtime emergent software - these are software systems which assemble themselves from small component models, and continually re-assemble themselves from other parts as they learn which combinations of behaviour work best in the current environment in which they are operating. We have developed both the fundamental software-building technology to enable this, and the broader machine learning / AI models to orchestrate it. We have demonstrated our work using data centre software such as web servers, showing that such software can rapidly learn how best to design itself in real-time to maximise its own efficiency, without any human guidance on how to do this. EPSRC Reference: EP/M029603/1.

- **Funding Agency**: EPSRC, UK.
- **Institution**: Lancaster University (SCC), UK.
- **Role**: Researcher (PhD Student).

COMMUNITY SERVICES

Journals

- **Review Editor**: Frontiers in the Internet of Things (2022-current)
- **Reviewer**: Journal of Network and Systems Management (2022-current)
- **Reviewer**: Future Generation of Computer Systems (FGCS) (2020-current)
- **Reviewer**: ACM Transactions on Software Engineering and Methodology (2022)
- **Reviewer**: IEEE Computer (2021)

Conferences

- **Technical Program Committee Member**: SBCUP (2023)
- **Publicity Co-Chair**: ACSOS (2023)
- **Senior Program Committee Member**: ACSOS (2023)
- **Doctoral Symposium Committee Member**: ACSOS (2023)
- **Shadow Program Committee Member**: EuroSys (2023)
- **Technical Program Committee Member**: IEEE MetaCom (2023)
- **Technical Program Committee Member**: FiCloud (2022 - 2023)
- **Artefact Evaluation Committee Member**: EuroSys (2022)

Workshops

- **Technical Program Committee Member**: MSSiS Workshop - CBSoft (2021 - current)
- **Technical Program Committee Member**: CloudAM Workshop - UCC (2021 - 2022)

- **Technical Program Committee Member**: WCGA Workshop - SBRC (2021)

STUDENTS

Masters

- Bruna Michelly Cordeiro (2019 - 2022) - UFG, Brazil. (Co-supervisor)

Undergraduates (Internships)

- Renato Dias (2021 - 2022) - UFG, Brazil. (Co-supervisor)

Undergraduates (Final Year Projects)

- Renato Dias (2022 - 2023) - UFG, Brazil. (Co-supervisor)
- João Seródio (2022) - UNICAMP, Brazil. (Co-supervisor)
- Bruno Berbare and Felipe Guardão (2022) - UNICAMP, Brazil. (Co-supervisor)
- André Papoti and Ricardo Koaro (2022) - UNICAMP, Brazil. (Co-supervisor)
- Luiz Mattos (2021 - 2022) - UFG, Brazil. (Co-supervisor)
- Gabriel Oswaldo (2021) - UNICAMP, Brazil. (Co-supervisor)

TEACHING

Graduate courses

- Guest-lecturer: Elements of Distributed Systems (2022) - Lancaster University, UK.
- Guest-lecturer: Distributed Systems (2022) - UFG, Brazil.
- Lecturer: Summer School on Emergent Software Systems (2019) - UFG, Brazil.
- Teaching Assistant: Elements of Distributed Systems (2014-2018) - Lancaster University, UK.

Undergraduate courses

- Lecturer: Distributed Systems (2023-current) - UFSC, Brazil.
- Lecturer: Wireless Networking (2023-current) - UFSC, Brazil.
- Lecturer: Introduction to Computer Programming (2023-current) - UFSC, Brazil.
- Guest-lecturer: Distributed Systems (2022) - UNICAMP, Brazil.
- Guest-lecturer: Mobile and Ubiquitous Computing (2022) - UFG, Brazil.
- Teaching Assistant: Distributed Systems (2014-2018) - Lancaster University, UK.
- Teaching Assistant: Computer Networks (2012) - UFG, Brazil.

SELECTED PUBLICATIONS

Journals

1. "STEER: An Architecture to Support Self-adaptive IoT Networks for Indoor Monitoring Applications". Cordeiro, B. M. O. S.; **Rodrigues Filho, R.**; Sene-Júnior, I.; and Costa, F. M. 2023, In: *Journal of Internet Services and Applications (JISA)*.
2. "Hatch: Self-Distributing Systems for Data Centers". **Rodrigues Filho, R.** and Porter, B. F., In: *Future Generation Computer Systems, 2022*.
3. "Defining emergent software using continuous self-assembly, perception and learning". **Rodrigues Filho, R.** and Porter, B. F., 09/2017, In: *ACM Transactions on Autonomous and Adaptive Systems. 12, 3, 25 p., 16*.
4. "A body sensor network simulation platform for medical applications." **Rodrigues Filho, R.**, Neto, R. F. B. and Sene Junior, I. G., 2/06/2016, In: *IEEE Latin America Transactions. 14, 4, p. 1835-1841 7 p.*
5. "An Evaluation Method of Research on Wearable Wireless Body Area Network in Healthcare". **Rodrigues Filho, R. V.**; Bulcão-Neto, R. F. ; Silvestre, B. O. ; Oliveira, L. L. G. ; Oliveira, R. O. ; Sene Junior, I. G. . *International Journal of Computer Science and Information Technology (Print), v. 5, p. 65-78, 2013*.

Book Chapter

1. "Emergent Software Systems: Theory and Practice." **Rodrigues Filho, R.**; Porter, B. ; Costa, F. M. ; Sene-Júnior, I., *Minicursos do XXXIX Simpósio Brasileiro de Redes de Computadores e Sistemas Distribuídos*.

Conferences

1. "A Self-distributing System Framework for the Computing Continuum". **Rodrigues Filho, R.**; Dias, R.; Seródio, J; Porter, B.; Costa, F. M.; Borin, E.; and Bittencourt, L. F. *32nd International Conference on Computer Communications and Networks (ICCCN), 2023.*

2. "Runtime Microservice Self-distribution for Fine-grain Resource Allocation". Dias, R.; **Rodrigues Filho, R.**; Bittencourt, L. F.; and Costa, F. M. *11th International Workshop on Cloud and Edge Computing, and Applications Management (CloudAM) In: Proceedings of 15th IEEE/ACM International Conference on Utility and Cloud Computing (UCC), 2022.*

3. "Exploiting the Potential of the Edge-Cloud Continuum with Self-distributing Systems". **Rodrigues Filho, R.**; Bittencourt, L. F.; Porter, B. and Costa, F. M. *11th International Workshop on Cloud and Edge Computing, and Applications Management (CloudAM) In: Proceedings of 15th IEEE/ACM International Conference on Utility and Cloud Computing (UCC), 2022.*

4. "STEER: Redes IoT Dirigidas por Intenções e Baseadas em SDN". Cordeiro, B. M. O. S.; **Rodrigues Filho, R.**; Sene-Júnior, I.; and Costa, F. M. *Anais do XIV Simpósio Brasileiro de Computação Ubíqua e Pervasiva. SBC, 2022.*

5. "Emergent Web Server: An Exemplar to Explore Online Learning in Compositional Self-Adaptive Systems". **Rodrigues Filho, R.**; Alberts, E.; Gerostathopoulos, I.; Porter, B.; and Costa, F. M. In: *17th Symposium on Software Engineering for Adaptive and Self-Managing Systems (SEAMS 2022).*

6. "A Programming Language for Sound Self-Adaptive Systems" Porter, B., and **Rodrigues Filho, R**. *International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS'21).*

7. "Autonomous State-Management Support in Distributed Self-adaptive Systems". **Rodrigues Filho, R.** and Porter, B., *4th Workshop on Self-Aware Computing (SeAC'20).*

8. "A Survey of Methodology in Self-Adaptive Systems Research". Porter, B., **Rodrigues Filho, R.** and Dean, P., *1st IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS'20).*

9. "Distributed Emergent Software: Assembling, Perceiving and Learning Systems at Scale". Porter, B. and **Rodrigues Filho, R.**, *13th International Conference on Self-Adaptive and Self-Organizing Systems (SASO). IEEE, p. 127-136 10 p.*

10. "Towards Emergent Microservices for Client-Tailored Design". **Rodrigues Filho, R. V.**, Pereira de Sa, M., Porter, B. F. & Costa, F., 10/12/2018, *17th Workshop on Adaptive and Reflective Middleware . ACM, 6 p. 2.*

11. "Hierarchical Self-awareness and Authority for Scalable Self-integrating Systems". Diaconescu, A., Porter, B. F., **Rodrigues Filho, R. V.** and Pournaras, E., 3/09/2018, *2018 IEEE 3rd International Workshops on Foundations and Applications of Self* Systems (FAS*W). IEEE, p. 168-175 8 p.*

12. "Experiments with a machine-centric approach to realise distributed emergent software systems". **Rodrigues Filho, R.** and Porter, B. F., 13/12/2016, *ARM 2016 Proceedings of the 15th International Workshop on Adaptive and Reflective Middleware. New York: ACM, 6 p. 1.*

13. "Losing control: the case for emergent software systems using autonomous assembly, perception and learning". Porter, B. F. and **Rodrigues Filho, R.**, *IEEE 10th International Conference on Self-Adaptive and Self-Organizing Systems (SASO). IEEE, p. 40-49 10.*

14. "REX: a development platform and online learning approach for Runtime emergent software systems". Porter, B. F., Grieves, M., **Rodrigues Filho, R.** and Leslie, D. S., *Proceedings of the 12th USENIX Symposium on Operating Systems Design and Implementation. USENIX Association, p. 333-348 16 p.*

15. "Environmental IoT: programming cyber-physical clouds with high-level system specifications". **Rodrigues Filho, R.**, Porter, B. and Blair, G., 12/2014, *Utility and Cloud Computing (UCC), 2014 IEEE/ACM 7th International Conference on. IEEE, p. 947-950 4 p.*