Gabriele Russo Russo
Curriculum Vitae

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Research Interests and Scientific Results

I am currently a Research Associate at the University of Rome Tor Vergata. My research interests are in the area of distributed computing systems, with particular emphasis on performance modeling and optimization for distributed applications.

My research activity as a PhD student focused on the problem of auto-scaling distributed data stream processing applications. In this context, I mainly contributed a two-layered hierarchical adaptation framework (see, J3) and reinforcement learning-based policies that minimize resource usage accounting for users' Quality-of-Service (QoS) requirements (see, J3 and C9). Since 2021, I have been investigating mechanisms and control policies to support the deployment and execution of serverless applications in Edge and Fog computing environments (see, C1).

Since 2017, I have co-authored 4 papers published in international journals, 12 papers published in international conference and workshop proceedings, and 2 peer-reviewed book chapters. As at December 2022, Google Scholar reports 241 citations of my papers, with a h-index equal to 7; Scopus reports 162 citations, with a h-index equal to 6.

Since November 2021, I am a member of the Review Board of *IEEE Transactions on Parallel and Distributed Systems*.

Education and Positions

2022–	**Research Assistant** ("Assegnista di Ricerca"), University of Rome Tor Vergata. *Project*: "Earth In The Cloud, POR FESR Lazio 2014-2020". *Coordinator*: Prof. Francesco Quaglia.
2021–22	**Research Assistant** ("Assegnista di Ricerca"), University of Rome Tor Vergata. *Project*: "Self-adaptive Deployment of Data Stream Processing Applications in Edge and Serverless Environments". *Coordinator*: Prof. Valeria Cardellini.
2017–21	**PhD student** in Computer Science, University of Rome Tor Vergata. Final examination grade: *Excellent*. Winner of a grant financed by the Italian *Ministry for Education, University, and Scientific Research*. *Advisors*: Prof. Valeria Cardellini and Prof. Francesco Lo Presti. *Thesis*: "Model-based Auto-Scaling of Distributed Data Stream Processing Applications".
2019	**Visiting PhD student**, Imperial College London (UK), August–September 2019. Hosted by Dr. Giuliano Casale
2017	**Post-graduate scolarship**, University of Rome Tor Vergata, July–September 2017. *Topic:* "Distributed elastic control of data stream processing applications in Storm". *Supervisor:* Prof. Valeria Cardellini.
2014–17	**Laurea Magistrale** (MSc equivalent) in Computer Engineering, University of Rome Tor Vergata, 110/110 *cum laude*. *Thesis*: "Optimal Deployment and Run-Time Reconfiguration for Data Stream Processing". *Advisors*: Prof. Valeria Cardellini and Prof. Francesco Lo Presti.

2011–14 **Laurea** (BSc equivalent) in Computer Engineerinig, University of Rome Tor Vergata, 110/110 *cum laude*.
Thesis: "Analysis and Implementation of Energy-Aware Routing Algorithms for Ad-Hoc Wireless Networks".
Advisor: Prof. Francesco Lo Presti.

Honors and Awards

2023 **Best Paper Award** in the Special Session on Compute Continuum at PDP '23, with the paper C2.

2019 Selected for participation to the 7th **Heidelberg Laureate Forum** as a young researcher.

2011 **Alfiere del Lavoro**.
Awarded by Italian President Giorgio Napolitano and *Federazione Nazionale Cavalieri del Lavoro*. I was included in the list of the 25 Italian students completing high school with the highest grades.

Student Travel Grants

2019 Travel grant sponsored by SAP for attending the *13th ACM Conference on Distributed and Event-Based Systems (DEBS 2019)* in Darmstadt (Germany).

2018 Travel grant sponsored by ACM Council of European Chapter Leaders for attending the Symposium *Being human with algorithms* in Heidelberg (Germany).

2017 Travel grant for attending the Summer School on *Latency Control for Internet of Services* organized by COST Action 1304 *Autonomous Control for a Reliable Internet of Services* (ACROSS), in Karlstad (Sweden).

Professional service

Conference and Workshop Organization

○ *Publicity & Social Media Co-Chair* – International Conference on Performance Engineering (ICPE) (2023)
○ *TPC Member* – International Conference on Scalable Computing and Communications (ScalCom) (2023)
○ *TPC Chair* – International Workshop on Self-Protecting Systems (SPS) (2022)
○ *TPC Member* – ACM Distributed and Event-based Systems (DEBS) (2022)
○ *Shadow TPC Member* – EuroSys (2021)

Reviewer for Journals and Conferences

I reviewed manuscripts submitted to the following international journals:
○ IEEE Transactions on Parallel and Distributed Systems (2021–2023)
○ Journal of Systems and Software, Elsevier (2023)
○ Parallel Computing, Elsevier (2022–2023)
○ Cluster Computing, Springer (2019–2023)
○ ACM Computing Surveys (2022)
○ IEEE Transactions on Network and Service Management (2022)
○ IEEE Transactions on Mobile Computing (2022)
○ IEEE Transactions on Cloud Computing (2022)

- Journal of Parallel and Distributed Computing, Elsevier (2022)
- IEEE Internet of Things Journal (2021,2022)
- Journal of Grid Computing, Springer (2020–2022)
- Information Systems, Elsevier (2021)
- Science of Computer Programming, Elsevier (2020)
- Future Generation Computer Systems, Elsevier (2019)
- Expert Systems with Applications, Elsevier (2018)

Since November 2021, I am a member of the ***Review Board*** of **IEEE Transactions on Parallel and Distributed Systems**.

I also reviewed manuscripts submitted to the following international conferences:
- ACM Distributed and Event-based Systems (2019,2022)
- ACM/SPEC International Conference on Performance Engineering (2021)
- IEEE/ACM International Conference on Utility and Cloud Computing (2020,2021)
- IEEE Vehicular Technology Conference (2018)

Teaching

I have been involved in the following teaching activities (at the University of Rome Tor Vergata, if not explicitly stated):

Graduate and Master Degree Courses

- *Hands-on Cloud Computing Services*, supplementary course (10 hours) for the MSc in *Computer Engineering* (from 2019/20 to 2022/23).
- *Hands-on Big Data & Hadoop* (12 hours), 2nd Level Master degree in *Customer Experience & Social Media Analytics (CESMA)* (2019, 2020, 2021, 2022).
- *Hands-on Big Data* (16 hours), 1st Level Master degree in *Data Science (2022)*.

Undergraduate Courses

- *Fundamentals of Programming and Data Analytics* (27 hours), BSc course at the Department of Engineering, Roma Tre University. (2022/23).
- *MIPS Assembler Programming*, supplementary course (10 hours) for the BSc in *Computer Engineering* (2021/22).
- TA for the *Computer Architecture* course, BSc in *Computer Engineering* (from 2016/17 to 2020/21).

Thesis Supervision

I have co-supervised 13 *Laurea Magistrale* (MSc) theses.

2022   A. Graziani, "A QoS-Aware Broker for Multi-Provider Serverless Applications". Supervisor: Valeria Cardellini.

2022   A. Pusceddu, "Policies for Cold Start Frequency Reduction in Function-as-a-Service Platforms" (Italian). Supervisor: Valeria Cardellini.

2022   A. Conidi, "Library for Monitoring and Prediction of Execution Time of Serverless Functions" (Italian). Supervisor: Valeria Cardellini.

2022   T. Mannucci, "Serverledge: a Function-as-a-Service Platform for Edge-Cloud Environments" (Italian). Supervisor: Valeria Cardellini.

2021   A. Milani, "Priority-based Scheduling of Serverless Functions in Apache OpenWhisk" (Italian). Supervisor: Valeria Cardellini.

2021   A. Sanzo, "Elastic Data Stream Processing on Heterogeneous Infrastructures with Apache Flink" (Italian). Supervisor: Valeria Cardellini.

2020   A. Schiazza, "Mechanisms and Policies for Elastic Functions in Apache Pulsar" (Italian). Supervisor: Valeria Cardellini.

2020   S. Mancini, "Elastic Data Stream Processing on Heterogeneous Resources using Deep Reinforcement Learning" (Italian). Supervisor: Valeria Cardellini.

2019   E. Serrao, "Elasticity Control Policies for Data Stream Processing in the Fog: A Reinforcement Learning Approach" (Italian). Supervisor: Francesco Lo Presti.

2019   A. Ponte, "A Scalable Architecture for Real-Time Data Analytics based on Akka" (Italian). Supervisor: Valeria Cardellini.

2019   M. Calzetta, "Mechanisms and Reinforcement Learning-based Policies for Elastic Data Stream Processing in Apache Flink" (Italian). Supervisor: Valeria Cardellini.

2019   F. Di Giacomo, "Operator Migration Policies for Data Stream Processing in a Fog Environment" (Italian). Supervisor: Francesco Lo Presti.

2018   G. Vertulli, "A Deep Reinforcement Learning-based Approach for Data Stream Processing Application Placement" (Italian). Supervisor: Valeria Cardellini.

Publications

International Journals

J1   V. Cardellini, F. Lo Presti, M. Nardelli, and G. Russo Russo. Run-time adaptation of data stream processing systems: The state of the art. *ACM Computing Surveys*, 54(11s), 2022. `doi:10.1145/3514496`

J2   G. Russo Russo, M. Nardelli, V. Cardellini, and F. Lo Presti. Multi-level elasticity for wide-area data streaming systems: A reinforcement learning approach. *Algorithms*, 11(9):134, 2018. `doi:10.3390/a11090134`

J3   V. Cardellini, F. Lo Presti, M. Nardelli, and G. Russo Russo. Decentralized self-adaptation for elastic data stream processing. *Future Generation Computer Systems*, 87:171–185, 2018. `doi:10.1016/j.future.2018.05.025`

J4   V. Cardellini, F. Lo Presti, M. Nardelli, and G. Russo Russo. Optimal operator deployment and replication for elastic distributed data stream processing. *Concurrency and Computation: Practice & Experience*, 30(9), 2018. `doi:10.1002/cpe.4334`

International Conferences and Workshops

C1   G. Russo Russo, T. Mannucci, V. Cardellini, and F. Lo Presti. Serverledge: Decentralized function-as-a-service for the edge-cloud continuum. In *Proceedings of IEEE International Conference on Pervasive Computing and Communications, PerCom 2023, Atlanta, GA, USA, March 13-17, 2023*. IEEE, 2023 (Accettato)

C2   G. Russo Russo, V. Cardellini, and F. Lo Presti. Serverless functions in the cloud-edge continuum: Challenges and opportunities. In *Proceedings of the 31st Euromicro International Conference on Parallel, Distributed and Network-based Processing, PDP 2023, Naples, Italy, March 1-3, 2023*. IEEE, 2023 (to appear). Best Paper Award (Special Session on Compute Continuum)

C3   C. Calavaro, G. Russo Russo, and V. Cardellini. Real-time analysis of market data leveraging apache flink. In *Proceedings of the 16th ACM International Conference on Distributed and Event-based Systems, DEBS 2022, Copenhagen, Denmark, June 27 - 30, 2022*, pages 162–165, 2022. `doi:10.1145/3524860.3539650`

C4   G. Russo Russo, A. Milani, S. Iannucci, and V. Cardellini. Towards qos-aware function composition scheduling in apache openwhisk. In *Proceedings of 2022 IEEE International Conference on Pervasive Computing and Communications Workshops and other Affiliated Events, PerCom 2022 Workshops, Pisa, Italy, March 21-25, 2022*, pages 693–698. IEEE, 2022. `doi:10.1109/PerComWorkshops53856.2022.9767299`

C5   G. Russo Russo, V. Cardellini, G. Casale, and F. Lo Presti. Mead: Model-based vertical auto-scaling for data stream processing. In *Proceedings of 21th IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing, CCGRID '21, Virtual Event, May 10-13, 2021*, pages 314–323, 2021. `doi:10.1109/CCGrid51090.2021.00041`

C6   G. Russo Russo, A. Schiazza, and V. Cardellini. Elastic pulsar functions for distributed stream processing. In *ICPE '21: ACM/SPEC International Conference on Performance Engineering, Virtual Event, France, April 19-21, 2021*, pages 9–16. ACM, 2021. `doi:10.1145/3447545.3451901`

C7   G. Russo Russo. Model-based auto-scaling of distributed data stream processing applications. In *Proceedings of the 21st International Middleware Conference Doctoral Symposium, Middleware 2020, Virtual Event / Delft, The Netherlands, December 07-11, 2020*, pages 5–8. ACM, 2020. `doi:10.1145/3429351.3431741`

C8   G. Russo Russo. Self-adaptive data stream processing in geo-distributed computing environments. In *Proceedings of the 13th ACM International Conference on Distributed and Event-based Systems, DEBS 2019, Darmstadt, Germany, June 24-28, 2019*, pages 276–279. ACM, 2019. `doi:10.1145/3328905.3332304`

C9   G. Russo Russo, V. Cardellini, and F. Lo Presti. Reinforcement learning based policies for elastic stream processing on heterogeneous resources. In *Proceedings of the 13th ACM International Conference on Distributed and Event-based Systems, DEBS 2019, Darmstadt, Germany, June 24-28, 2019*, pages 31–42, 2019. `doi:10.1145/3328905.3329506`

C10 M. Nardelli, G. Russo Russo, V. Cardellini, and F. Lo Presti. A multi-level elasticity framework for distributed data stream processing. In *Euro-Par 2018: Parallel Processing Workshops - Euro-Par 2018 International Workshops, Turin, Italy, August 27-28, 2018, Revised Selected Papers*, volume 11339 of *Lecture Notes in Computer Science*, pages 53–64. Springer, 2018. `doi:10.1007/978-3-030-10549-5\_5`

C11 G. Russo Russo. Towards decentralized auto-scaling policies for data stream processing applications. In *Proceedings of the 10th Central European Workshop on Services and their Composition, Dresden, Germany, February 8-9, 2018*, volume 2072 of *CEUR Workshop Proceedings*, pages 47–54. CEUR-WS.org, 2018. URL: `http://ceur-ws.org/Vol-2072/paper8.pdf`

C12 V. Cardellini, F. Lo Presti, M. Nardelli, and G. Russo Russo. Towards hierarchical autonomous control for elastic data stream processing in the fog. In *Euro-Par 2017: Parallel Processing Workshops - Euro-Par 2017 International Workshops, Santiago de Compostela, Spain, August 28-29, 2017, Revised Selected Papers*, volume 10659 of *Lecture Notes in Computer Science*, pages 106–117. Springer, 2017. `doi:10.1007/978-3-319-75178-8\_9`

C13 V. Cardellini, F. Lo Presti, M. Nardelli, and G. Russo Russo. Auto-scaling in data stream processing applications: A model-based reinforcement learning approach. In *New Frontiers in Quantitative Methods in Informatics - 7th Workshop, InfQ 2017, Venice, Italy, December 4, 2017, Revised Selected Papers*, volume 825 of *Communications in Computer and Information Science*, pages 97–110. Springer, 2017. `doi:10.1007/978-3-319-91632-3\_8`

Book Chapters

B1   A. Alnafessah, G. Russo Russo, V. Cardellini, G. Casale, and F. Lo Presti. Ai-driven performance management in data-intensive applications. In N. Zincir-Heywood, Y. Diao., and M. Mellia, editors, *Communications Network and Service Management in the Era of Artificial Intelligence and Machine Learning*. Wiley, 2021. `doi:10.1002/9781119675525.ch9`

B2   G. Russo Russo, V. Cardellini, F. Lo Presti, and M. Nardelli. Towards a security-aware deployment of data streaming applications in fog computing. In Wei Chang and Jie Wu, editors, *Fog/Edge Computing For Security, Privacy, and Applications*, pages 355–385. Springer International Publishing, Cham, 2021. `doi:10.1007/978-3-030-57328-7_14`

PhD Thesis

G. Russo Russo. *Model-based Auto-Scaling of Distributed Data Stream Processing Applications*. PhD thesis, University of Rome Tor Vergata, 2021

Conference Tutorials

2021   F. Lo Presti, G. Russo Russo, V. Cardellini, "Reinforcement learning for run-time performance management in the Cloud/Edge", *39th International Symposium on Computer Performance, Modeling, Measurements and Evaluation 2021 (Performance 2021)*, Milan, Italy, 8-12 November, 2021.

Talks

2022   I presented [C4] online at *LESS '22.
2021   I presented [C5] online at CCGRID '21.
2021   I presented [C6] online at the AutoDaSP workshop.
2020   I presented [C7] online at ACM Middleware '20.
2019   I presented [C8] and [C9] at ACM DEBS '19, Darmstadt, Germany.
2019   "Self-Adaptive Data Stream Processing in Geo-Distributed Computing Environments" at the *9th Workshop of the Italian group on Quantitative Methods in Informatics* (InfQ '19), Caserta, Italy.
2018   I presented [C10] at AutoDaSP '18, Turin, Italy.
2018   I presented [C11] at ZEUS '18, Dresden, Germany.
2017   I presented [C13] at InfQ '17, Venice, Italy.

Participation in Research Projects

2022   **Earth In The Cloud** , POR FESR Lazio 2014-2020 (Azione 1.2.1)
Role: research scientist, contributing to the definition and evaluation of scheduling algorithms for workflow execution in public Cloud platforms.
Local Project Leader: Prof. Francesco Quaglia.

Rome, March 3, 2023