

Dr. Matthias Rost

SOFTWARE ENGINEER · OPTIMIZATION EXPERT · RESEARCHER

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Qualifications Summary

My passion is optimization. Being an avid software engineer and an award-winning researcher with a deep mathematical background, my main expertise lies in solving challenging real-world optimization problems:

- 5+ years of cloud optimization research experience with 20+ peer-reviewed publications
- 10+ years of software development experience (Python, Java, C/C++, PL/SQL)
- Proven track record as algorithm engineer in 10+ projects (heuristics, approximations, exact algorithms)
- Mathematical optimization expert for (integer) linear programming and its applications (Gurobi, SCIP, CPLEX)
- Hands-on data science and visualization experience (NumPy, Matplotlib, Matlab, R)

Professional Experience

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|--|---|-------------------|
| Staff Software Engineer | OBSERVE, INC. | 09/2021 - present |
| My core task is to minimize costs by researching and implementing scheduling algorithms for Observe's backend. | | |
| Senior Cloud Optimization Developer | SAP SE | 01/2020 - 08/2021 |
| As one of four founding members of the Innovation Office of SAP's Global Cloud Services, my task was to architect scalable cloud optimization solutions to reduce the total cost of ownership for SAP's cloud offerings. | | |
| <ul style="list-style-type: none">• Within the first 9 months, I developed an end-to-end prototype (data gathering and cleaning, optimization, analysis). Given my results, SAP's board accepted our business case and the team is to grow to 30 FTEs by 2022.• My optimization library will be put into production by the end of 2021 to balance load within SAP's cloud clusters. | | |
| Postdoctoral Researcher | TECHNISCHE UNIVERSITÄT BERLIN (FG IMA) | 04/2019 - 01/2020 |
| As postdoc in the Internet Measurement and Analysis group led by Georgios Smaragdakis, my focus lies on optimizing wide-area analytics by devising online strategies for replicating data to minimize overall traffic. | | |
| Optimization Consultant | CYCLEVER GMBH | 03/2018 - 06/2018 |
| To validate the business model of delivering parcels using freight bicycles, I analyzed the potential gains of piggy-backing several parcels and derived insights into cost reductions when exchanging parcels on the fly. | | |
| Research and Teaching Assistant | TECHNISCHE UNIVERSITÄT BERLIN (FG INET) | 01/2014 - 03/2019 |
| Within the Internet Network Architectures group, led by Anja Feldmann until March 2018 and by Thomas Zinner afterwards, I mainly worked with Stefan Schmid on novel resource orchestration algorithms in cloud networks: | | |
| <ul style="list-style-type: none">• Successful completion of 10+ research projects on various cloud resource allocation problems, for example, virtual network embeddings, scheduling network updates, middlebox placement, and pathlet stitching• Solving decade-long research challenge by developing first approximations for embedding virtual networks | | |
| Student Research Assistant | TECHNISCHE UNIVERSITÄT BERLIN (FG INET) | 11/2011 - 12/2013 |
| Funded by the Telekom Innovation Laboratories and supervised by Anja Feldmann and Stefan Schmid, I worked on the design and analysis of algorithms for multicast and aggregation trees and the scheduling of network embeddings | | |
| Student Tutor / Teaching Assignments | FREIE UNIVERSITÄT BERLIN | 04/2009 - 09/2010 |
| I taught tutorials, created and corrected exercises and exams for undergraduate lectures on Computer Architecture (2009, 2010, 2011), Operating Systems and Computer Networks (2009), and Non-sequential Programming (2010). | | |
| Student Software Developer | IVU TRAFFIC TECHNOLOGIES AG, BERLIN | 08/2007 - 02/2009 |
| I worked on IVU.fleet.data, a C/C++ tool using Oracle to manage the core data of public transport companies and implemented extensions for customers and optimized PL/SQL queries. | | |

Education

Ph.D. in Computer Science (Dr. rer. nat.)	TECHNISCHE UNIVERSITÄT BERLIN	01/2014 - 03/2019
Thesis:	Virtual Network Embeddings: Theoretical Foundations and Provably Good Algorithms ↗	
Committee:	Rolf Niedermeier · Thomas Zinner · Stefan Schmid · Anja Feldmann · Harald Räcke	
Defense:	March 25, 2019	
Grade:	SUMMA CUM LAUDE (WITH DISTINCTION)	
Master of Science in Computer Science	TECHNISCHE UNIVERSITÄT BERLIN	04/2011 - 01/2014
Thesis:	Optimal Virtualized In-Network Processing with Applications to Aggregation and Multicast ↗	
Advisors:	Anja Feldmann · Andreas Bley · Stefan Schmid	
Final mark:	1.3 (VERY GOOD)	
Study of Mathematics (undergraduate level)	FREIE UNIVERSITÄT BERLIN	10/2010 - 09/2013
Study of Computer Science (graduate level)	FREIE UNIVERSITÄT BERLIN	10/2009 - 09/2010
Bachelor of Science in Computer Science	FREIE UNIVERSITÄT BERLIN	10/2006 - 09/2009
Thesis:	Modeling and Solving Evacuation Problems using Network Flows (translated)	
Advisors:	Günther Rote · Martin Skutella	
Final mark:	1.2 (VERY GOOD)	

Awards and Grants

Best PhD Thesis Prize	COMMUNICATION AND DISTRIBUTED SYSTEMS GROUP (KUVS)	05/2020
Best Paper Award	IFIP NETWORKING CONFERENCE 2018	05/2018
Hackathon Winner	GTM ³ HACKATHON @ OPERATIONS RESEARCH 2017	09/2017
Software Campus Grant	GERMAN FEDERAL MINISTRY OF EDUCATION AND RESEARCH	03/2016
Best Master Thesis Prize	COMMUNICATION AND DISTRIBUTED SYSTEMS GROUP (KUVS)	03/2015
Scholarship	GERMAN ACADEMIC SCHOLARSHIP FOUNDATION	10/2009 - 3/2013

Software Campus Management Trainings

Conflicts in Leadership Positions	DEUTSCHE POST AG	11/2016
Moderation for Professionals: Mastering Complex and Tough Situations	DATEV EG	11/2016
New as Executive - Basics for Tomorrow's Executive	HOLTZBRINCK PUBLISHING	09/2016
Projectmanagement Basics using the PMI-Standard	SCHEER HOLDING	04/2016
Intercultural Awareness	SAP SE	04/2016
Business meets Technology: Business Understanding for Engineers and Non-Economists	SIEMENS AG	03/2016

Extracurricular Activities

Amnesty International Deutschland e.V.	10/2007 - present
I was particularly active from 2007 to 2011 and mainly volunteered at Freie Universität Berlin's group and was the group's spokesperson, led the organization of lecture series and of the first Jugend@Amnesty event in Germany.	
German Academic Scholarship Foundation	10/2009 - 03/2013
I participated in excursions and a two-week course on field-programmable integrated circuits (FPGAs).	

Peer-Reviewed Publications

JOURNAL ARTICLES

On the Hardness and Inapproximability of Virtual Network Embeddings

Matthias Rost, Stefan Schmid

IEEE/ACM Transactions on Networking (TON). 2020

Parametrized Complexity of Virtual Network Embeddings: Dynamic & Linear Programming Approximations

Matthias Rost, Elias Döhne, Stefan Schmid

ACM SIGCOMM Computer Communication Review (CCR). 2019

Virtual Network Embedding Approximations: Leveraging Randomized Rounding

Matthias Rost, Stefan Schmid

IEEE/ACM Transactions on Networking (TON). 2019

Transiently Policy-Compliant Network Updates

Arne Ludwig, Szymon Dudycz, Matthias Rost, Stefan Schmid

IEEE/ACM Transactions on Networking (TON). 2018

Approximate and incremental network function placement

Tamás Lukovszki, Matthias Rost, Stefan Schmid

Journal of Parallel and Distributed Computing (JPDC). 2018

It's a Match!: Near-Optimal and Incremental Middlebox Deployment

Tamás Lukovszki, Matthias Rost, Stefan Schmid

ACM SIGCOMM Computer Communication Review (CCR). 2016

Beyond the Stars: Revisiting Virtual Cluster Embeddings

Matthias Rost, Carlo Fuerst, Stefan Schmid

ACM SIGCOMM Computer Communication Review (CCR). 2015

Network Service Chaining with Optimized Network Function Embedding supporting Service Decompositions

Sahel Sahhaf, Wouter Tavernier, Matthias Rost, Stefan Schmid, Didier Colle, Mario Pickavet, Piet Demeester

Computer Networks. 2015

CONFERENCE PROCEEDINGS

Optimal Virtual Network Embeddings for Tree Topologies

Aleksander Figiel, Leon Kellerhals, Rolf Niedermeier, Matthias Rost, Stefan Schmid, Philipp Zschoche

ACM Symposium on Parallelism in Algorithms and Architectures (SPAA). 2021

Cost-Efficient Embedding of Virtual Networks With and Without Routing Flexibility

Balázs Németh, Yvonne-Anne Pignolet, Matthias Rost, Stefan Schmid, Balázs Vass

IFIP Networking. 2020

A Constant Approximation for Maximum Throughput Multicommodity Routing And Its Application to Delay-Tolerant Network Scheduling

Mengxue Liu, Andrea Richa, Matthias Rost, Stefan Schmid

IEEE Conference on Computer Communications (INFOCOM). 2019

Modeling Adaptive Video Streaming Using Discrete-Time Analysis

Susanna Schwarzmann, Paula Breitbach, Thomas Zinner, Matthias Rost

International Teletraffic Congress (ITC). 2019

Charting the Complexity Landscape of Virtual Network Embeddings

Matthias Rost, Stefan Schmid

IFIP Networking. 2018

Virtual Network Embedding Approximations: Leveraging Randomized Rounding

Matthias Rost, Stefan Schmid

IFIP Networking. 2018

An Approximation Algorithm for Path Computation and Function Placement in SDNs

Guy Even, Matthias Rost, Stefan Schmid

Structural Information and Communication Complexity (SIROCCO). 2016

Stitching Inter-Domain Paths over IXPs

Vasileios Kotronis, Rowan Klöti, Matthias Rost, Panagiotis Georgopoulos, Bernhard Ager, Stefan Schmid, Xenofontas Dimitropoulos

ACM Symposium on SDN Research (SOSR). 2016

Transiently Secure Network Updates

Arne Ludwig, Szymon Dudycz, Matthias Rost, Stefan Schmid

ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Systems. 2016

It's About Time: On Optimal Virtual Network Embeddings under Temporal Flexibilities

Matthias Rost, Stefan Schmid, Anja Feldmann

IEEE International Parallel and Distributed Processing Symposium (IPDPS). 2014

VirtuCast: Multicast and Aggregation with In-Network Processing

Matthias Rost, Stefan Schmid

Principles of Distributed Systems (OPODIS). 2013

WORKSHOPS, POSTERS, AND SHORT PAPERS

It's Good to Relax: Fast Profit Approximation for Virtual Networks with Latency Constraints

Robin Münk, Matthias Rost, Harald Räcké, Stefan Schmid

IFIP Networking. 2021

Edge Replication Strategies for Wide-Area Distributed Processing

Niklas Semmler, Matthias Rost, Georgios Smaragdakis, Anja Feldmann

ACM International Workshop on Edge Systems, Analytics and Networking (EdgeSys@EuroSys). 2020

Fast and Efficient Network Service Embedding Method with Adaptive Offloading to the Edge

Balázs Németh, Mark Szalay, Janos Doka, Matthias Rost, Stefan Schmid, Laszlo Toka, Balázs Sonkoly

IEEE INFOCOM Workshop on Int. Edge Computing, Caching, and Offloading in Next Generation Networks. 2018

Efficient service graph embedding: A practical approach

Balázs Németh, Balázs Sonkoly, Matthias Rost, Stefan Schmid

IEEE Conference on Network Function Virtualization and Software Defined Networks (NFV-SDN). 2016

Investigating the Potential of the Inter-IXP Multigraph for the Provisioning of Guaranteed End-to-End Services

Vasileios Kotronis, Rowan Klöti, Matthias Rost, Panagiotis Georgopoulos, Bernhard Ager, Stefan Schmid, Xenofontas Dimitropoulos

ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Systems. 2015

Good Network Updates for Bad Packets: Waypoint Enforcement Beyond Destination-Based Routing Policies

Arne Ludwig, Matthias Rost, Damien Foucard, Stefan Schmid

ACM Workshop on Hot Topics in Networks (HotNets). 2014

Towards Unified Programmability of Cloud and Carrier Infrastructure

P. Sköldström, B. Sonkoly, A. Gulyás, F. Németh, M. Kind, F. J. Westphal, W. John, J. Garay, E. Jacob, D. Jocha, J. Elek, R. Szabó, W. Tavernier, G. Agapiou, A. Manzalini, M. Rost, N. Sarrar, S. Schmid

European Workshop on Software Defined Networks (EWSDN). 2014