Matthias Rost

Researcher · Optimization Expert · Software Engineer

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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 analyzing problems and engineering algorithms for solving them:

- 5+ years of research experience with 20 peer-reviewed publications in the field of network optimization
- 10+ years of software development experience (Python, Java, C/C++ and PL/SQL)
- Proven track record as algorithm engineer in 10+ projects (heuristics, approximations, exact algorithms)
- Expert on (integer) linear programming and its applications to solve real-world problems (Gurobi, SCIP, CPLEX)
- Hands-on data science, data analysis and visualization experience (NumPy, Matplotlib, Matlab, R)

Professional Experience

Postdoctoral Researcher Technische Universität Berlin (FG IMA) *04/2019 - present*

As postdoc in the Internet Measurement and Analysis group led by Georgios Smaragdakis, my focus lies on:

- Co-supervision of PhD student with focus on the analysis and development of algorithms
- Research on optimizing wide-area analytics by devising online data replication strategies

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 virtualized networks:

- Successful completion of 10+ research projects on various resource allocation problems in networks, for example, virtual network embeddings, scheduling network updates, middlebox placement, and pathlet stitching
- Publication of 18 peer-reviewed papers at top venues and awarding of best paper award at IFIP Networking 2018
- TU Berlin's algorithmic lead within the FP7 EU Project Unify on virtualizing ISP networks with 2 student workers
- Awarded a Software Campus grant (budget ≈ €100k) by the German Federal Ministry of Education and Research to further my research agenda on the first approximation algorithms for virtual network embeddings including funds to lead a team of 3 student workers to implement and evaluate them in a *large-scale algorithmic framework*
- Coordination of undergraduate lectures with up to 1000 students, 5 research assistants and 35 tutors and the design and implementation of a *tailored optimization suite* for efficiently assigning and scheduling tasks

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:

- Design and analysis of algorithms for multicast and aggregation trees and the scheduling of network embeddings
- Publication of 2 research papers and KuVS best master thesis prize for work on multicast and aggregation trees

Student Tutor / Teaching Assignments Freie Universität Berlin *04/2009 - 09/2010*

I taught tutorials, created and corrected exercise sheets and exams for undergrad. 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:

- Implementation of extensions including database changes, implementation of the backend logic and GUI design
- Analysis and otimization of PL/SQL queries to improve the tool's responsiveness

Awards and Grants

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*

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 Date:	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)

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 the Amnesty group at Freie Universität Berlin:

- I was the group's spokesperson from 10/2009 until 09/2010 and supervised projects and (fundraising) campaigns.
- I was one of the three head organizers of the first annual youth and student group meeting Jugend@Amnesty in 2008 with 150+ participants and led the smooth execution of the 3-day convention.
- As lead organizer of the Human Rights Lectures 2008 and 2009, a full-semester lecture series including panel discussions, my tasks comprised project management, fundraising, and public relations.

German Academic Scholarship Foundation — *10/2009 - 03/2013*

I participated in several excursions and took in 2011 part in a two-week course on field-programmable integrated circuits (FPGAs), where we implemented a VGA driver module which was connected to the Internet.

References

Prof. Anja Feldmann, Ph.D.
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Univ.-Prof. Dr.sc. Stefan Schmid
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Prof. Georgios Smaragdakis, Ph.D.
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Prof. Dr. Thomas Zinner
Norwegian University of Science and Technology
thomas.zinner@ntnu.no

Professional Services

Co-Supervision of Master Theses

Elias Döhne — Technische Universität Berlin — *08/2017 - 06/2018*

Title: Virtual Network Embedding via Decomposable LP Formulations: Orientations of Small Extraction Width and Beyond

Feras Fattohi — Technische Universität Berlin — *04/2017 - 02/2018*

Title: Competitive Online Virtual Cluster Embedding Algorithms

Expert Reviewer

IEEE/ACM Transactions on Networking	Reviews: 5	*2018-2019*
IEEE Transactions on Network and Service Management	Reviews: 6	*2016-2018*
Elsevier Computer Networks (ComNet)	Reviews: 3	*2017-2018*
IEEE Journal on Selected Areas in Communications (JSAC)	Reviews: 2	*2018*
IFIP Networking 2018	Reviews: 1	*2018*
IEEE International Conference on Computer Communications (INFOCOM)	Reviews: 1	*2017*
International Symposium on Algorithmic Aspects of Cloud Computing (AlgoCloud)	Reviews: 1	*2017*
International Journal of Network Management	Reviews: 2	*2015, 2017*

Peer-Reviewed Publications

Journal Articles

Parametrized Complexity of Virtual Network Embeddings: Dynamic & Linear Programming Approximations
Matthias Rost, Elias Döhne, Stefan Schmid
ACM SIGCOMM Computer Communication Review (CCR) 49.1 (Jan. 2019). 2019

Transiently Policy-Compliant Network Updates
Arne Ludwig, Szymon Dudycz, Matthias Rost, Stefan Schmid
IEEE/ACM Transactions on Networking (TON) 26.6 (Dec. 2018). 2018

Approximate and incremental network function placement
Tamás Lukovszki, Matthias Rost, Stefan Schmid
Journal of Parallel and Distributed Computing (JPDC) 120 (Oct. 2018). 2018

It's a Match!: Near-Optimal and Incremental Middlebox Deployment
Tamás Lukovszki, Matthias Rost, Stefan Schmid
ACM SIGCOMM Computer Communication Review (CCR) 46.1 (Jan. 2016). 2016

Beyond the Stars: Revisiting Virtual Cluster Embeddings
Matthias Rost, Carlo Fuerst, Stefan Schmid
ACM SIGCOMM Computer Communication Review (CCR) 45.3 (July 2015). 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 93 (Dec. 2015). 2015

Conference Proceedings

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 Science. 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

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

Presentations at Conferences

Approximating the Virtual Network Embedding Problem: Theory and Practice — *07/2018*
International Symposium on Mathematical Programming (ISMP), Bordeaux, France

Approximate Graph Embeddings in the Cloud — *06/2018*
Highlights of Algorithms (HALG), Amsterdam, Netherlands

Virtual Network Embedding Approximations: Leveraging Randomized Rounding — *05/2018*
IFIP Networking, Zurich, Switzerland

Charting the Complexity Landscape of Virtual Network Embeddings — *05/2018*
IFIP Networking, Zurich, Switzerland

An Approximation Algorithm for Path Computation and Function Placement in SDNs — *07/2016*
Int. Colloquium on Structural Information and Communication Complexity, Helsinki, Finland

Transiently Secure Network Updates — *06/2016*
ACM SIGMETRICS, Antibes Juan-Les-Pins, France

Stitching Inter-Domain Paths over IXPs — *03/2016*
ACM Symposium on SDN Research (SOSR), Santa Clara, USA

A MIP for Aggregation and Multicast Trees under Flexible Routing and Function Placement — *07/2015*
International Symposium on Mathematical Programming (ISMP), Pittsburgh, USA

KuVS Prize for the Best Master Thesis — *03/2015*
International Conference on Networked Systems (NetSys), Cottbus, Germany

It's About Time: On Optimal Virtual Network Embeddings under Temporal Flexibilities — *05/2014*
IEEE International Parallel and Distributed Processing Symposium (IPDPS), Phoenix, USA

VirtuCast: Multicast and Aggregation with In-Network Processing — *12/2013*
International Conference on Principles of Distributed Systems (OPDODIS), Nice, France