# Dr Philipp Andelfinger

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**SUMMARY**

Philipp Andelfinger is a postdoctoral research associate at Nanyang Technological University (NTU), Singapore in the group of Prof Wentong Cai. He received his diploma and Ph.D in Computer Science in 2011 and 2016 from Karlsruhe Institute of Technology (KIT), Germany.

**RESEARCH INTERESTS**

High-performance computing, GPU-based and heterogeneous computing, parallel and distributed simulation, reversible computing, machine learning, simulation-based optimization, performance evaluation, agent-based modeling and simulation, wireless networks and peer-to-peer networks, network modeling and simulation, and intelligent transportation systems.

**RESEARCH EXPERIENCE**

**Nanyang Technological University (NTU)**, Singapore

- Postdoctoral research associate in the group of Prof Wentong Cai May 2017 – Today
  - Scientific supervision and mentoring of NTU staff in the computer science group of the TUMCREATE program
  - Research focus: microscopic road traffic simulation, agent-based simulation methodology, large-scale simulation using heterogeneous hardware, crowd modeling, simulation-based optimization

**Karlsruhe Institute of Technology (KIT)**, Germany

- Research associate in the "Decentralized Systems and Network Services Research Group" of Prof Hannes Hartenstein May 2011 – Apr 2017
  - Research focus: large-scale parallel and distributed network simulation, simulation using heterogeneous hardware, peer-to-peer networks
- Research assistant in the group of Prof Hannes Hartenstein Sep 2009 – Apr 2011
  - Research focus: design and implementation of tools for measurements in large-scale peer-to-peer networks

**BEST PAPER AWARDS**

**IEEE/ACM DS-RT 2018**

- "Exploring Execution Schemes for Agent-Based Traffic Simulation on Heterogeneous Hardware"

**ACM SIGSIM PADS 2018**

- "Fast-Forwarding Agent States to Accelerate Microscopic Traffic Simulations"

**IEEE ATC 2016**

- "Timing Analysis for Inferring the Topology of the Bitcoin Peer-to-Peer Network"

**IFIP/IEEE DISSECT 2015**

- "A Simulation Model for Analysis of Attacks on the Bitcoin Peer-to-Peer Network"

**EDUCATION**

**Ph.D** (Dr.rer.nat.) in Computer Science May 2011 – Feb 2016

- Thesis: "Identifying and Harnessing Concurrency for Parallel and Distributed Network Simulation"
- Adviser: Prof Hannes Hartenstein, External referee: Dr Kalyan Perumalla (Oak Ridge National Laboratory)
- Focus: Discrete-event simulation, parallel and distributed simulation, wireless networking, peer-to-peer networking

**B.Sc and M.Sc.** (Diploma) in Computer Science Oct 2004 – Apr 2011

- Thesis: "Analysis and Evaluation of the Potential of GPGPUs on Network Simulation Runtime Optimization"

**PROPOSALS**

**"From Virtual Reality to Simulation: User-Centred Design of Dynamic Guidance Systems for Transit Hubs"**

- Collaboration among Singapore ETH Centre (SEC)/Future Cities Laboratory (FCL), TUMCREATE Ltd, and Nanyang Technological University, total budget: S$249,600
- Successfully acquired funding by National Research Foundation, Singapore.
- Took part in proposal writing, currently acting as Co-PI
- PIs: P. Mavros (ETH/FCL), Dr H. Cornet (TUMCREATE), Co-PIs: S. Stadler, R. Dubey (TUMCREATE), Dr P. Andelfinger (NTU/TUMCREATE), Asst Prof H. Xu (NTU), Prof C. Hölscher (ETH/FCL)

**TEACHING**

**Lectures**

- KIT: "Modeling and Simulation of Networks and Distributed Systems"
  - Summer term 2016: formal teaching appointment, gave lecture in its entirety
  - 2013-2016: preparation of slide sets, assisted during oral exams

**Lab courses**

- KIT: "Modeling and Simulation of Networks and Distributed Systems"
  - 2015-2016: supervision and mentoring of students, grading of assignments
- KIT: "Software engineering practice"
  - 2011, 2012, 2014: Definition of projects, supervision and mentoring of student teams

**Seminars**

- KIT, 2011-2016: prepared and helped conduct seminars on performance evaluation, modeling and simulation methodology, distributed systems

**Tutorials**

- NTU, Sep–Nov 2018: gave tutorials accompanying the lecture "Operating Systems"

**THESIS SUPERVISION**

**Co-supervised the following Master's and Diploma theses**

- "Design and Performance Analysis of Batched Event Execution in Discrete Event Simulations", M. Leinweber, 2017
- "Optimistic Synchronization Schemes for Parallel Discrete-Event Simulation on Graphics Processing Units", X. Liu, 2016
- "Analysis and Performance Evaluation of Priority Queues for Parallel Simulation on Graphics Processing Units", N. Baudis, 2016
- "Execution schemes for Fully GPU-based Wireless Network Simulation", P. Pfaffe, 2014

**Co-supervised the following Bachelor's theses**

- "Determining IT Security Metrics for an Automated Daily Overview", D. Ziegler, 2016
- "Onion Routing-based Anonymizing Peer-to-Peer Networks on the Internet - a Scalability Study", A. Schiebel, 2012

**PRESENTATIONS**

**Invited Talks**

- "Identifying and Harnessing Concurrency for Parallel and Distributed Simulation", Nanyang Technological University, January 2018.
- "Accelerating Large-Scale Simulations of Networked Systems and Road Traffic: GPU-based Parallelization and Fast-Forwarding", Oak Ridge National Laboratory, September 2018

**Conference Presentations**

- More than 10 international venues: IEEE/ACM DS-RT 2018, ACM PADS 2013, 2015, 2017, and 2018, IEEE MASCOTS 2011 and 2017, INFORMATIK 2016, IEEE/ACM/INFORMS WSC 2014 and 2018, ICST SIMUTools 2014, ACM CSCW 2014

**Posters**

- IEEE MASCOTS 2011, ACM CSCW 2014

**DEMONSTRATIONS**

**"Pedestrian Simulation as a Design Tool"**, TUMCREATE Ltd, Singapore, October 2018

- Agent-based simulation tool to support industrial designers in evaluating interior layout designs of autonomous vehicles with respect to required dwell time at stations
- Collaboration with industrial designers within TUMCREATE program
- Designed agent-based model of passenger behavior during boarding and alighting process, supervised implementation work by research associate Boyi Su

**"BitMON: A Tool for Automated Monitoring of the BitTorrent DHT"**, IEEE P2P, Delft, Netherlands, August 2010

- Co-developed a monitoring tool for Kademlia-based peer-to-peer networks
- Presented by co-developer Konrad Jünemann at IEEE P2P

**DEVELOPED/ CO-DEVELOPED SOFTWARE PACKAGES**

**CityMoS-Heterogeneous** (C++, OpenCL, OpenMP): Variant of the CityMoS city-scale microscopic road traffic simulator for CPU/GPU co-execution and fully GPU-based execution

**NEST-GPU** (C++, OpenCL): extension to NEST spiking neural network simulator for GPU acceleration and automatic code transformation of user-defined neuron models

**GPUTW** (C++, NVIDIA CUDA): GPU-based discrete-event simulation engine supporting conservative and optimistic synchronization, reversible random number generation, and parameter auto-tuning

**GPUPQ** (C++, NVIDIA CUDA): Collection of GPU-based priority queue implementations

**SONSim** (C++, MPI): Performance prediction tool for distributed simulations

**Bitcoin network simulator** (C++): Discrete-event simulator to study attacks on the Bitcoin network

**PeerSim-MPI-Kademlia** (Java, MPI): Extension to network simulator PeerSim to support distributed simulation of large-scale Kademlia-based networks

**JKad and BitMON** (Java): Protocol library and monitoring tool for Kademlia-based peer-to-peer networks

**TECHNICAL SKILLS**

**Tools**: LaTeX, R, Matlab, Mathematica, Microsoft Office
**Languages**: C, C++, Java, Python, Perl
**APIs and Libraries**: POSIX, CUDA, OpenCL, MPI, OpenMP, Boost, GSL

**LANGUAGES**

**English**: Fluent
**German**: Native

**TRAINING**

**Attended summer school** "Network coding: from theory to practice", Prof Frank Fitzek (Aalborg University), Prof Muriel Médard (Massachusetts Institute of Technology), Aalborg University, 2012

**SERVICE**

**Program committee**: ICCS 2019, ACM SIGSIM PADS 2019, ACM SIGSIM PADS 2018 (reproducibility initiative), WSC 2018
**Reproducibility Board Member**, ACM TOMACS
**Reviewer**

- Journals: ACM TOMACS, IEEE TPDS, SIMPAT, SIMULATION: Transactions of The SCS, Math. Problems in Eng.
- Conferences: ICCS 2019, IEEE/ACM/INFORMS WSC 2017–2018, ACM SIGSIM PADS 2019 and 2018, IEEE VNC 2017, ACM MSWiM 2017–2018, IEEE/ACM DS-RT 2017, IEEE ITSC 2017, IEEE LCN 2017

**External reviewer**: Discovery Grant proposal at Natural Sciences and Eng. Research Council of Canada
**Judge at PhD colloquium**, ACM SIGSIM PADS 2017

**PUBLICATIONS**

**Monographs**

[1] **Philipp Andelfinger**, Identifying and Harnessing Concurrency for Parallel and Distributed Network Simulation. KIT Scientific Publishing, 2016.

**Articles**

[1] Quang Anh Pham Nguyen, **Philipp Andelfinger**, Wentong Cai, and Alois Knoll. Transitioning Spiking Neural Network Simulators to Heterogeneous Hardware. To appear in: *Conference on Principles of Advanced Discrete Simulation (ACM SIGSIM PADS)*, 2019.

[1] Jiajian Xiao, **Philipp Andelfinger**, David Eckhoff, Wentong Cai, and Alois Knoll. A Survey of Agent-based Simulation using Hardware Accelerators. *ACM Computing Surveys*, 2019.

[2] Daniel Krauss, **Philipp Andelfinger**, Fabian Paus, Nikolaus Vahrenkamp, Tamim Asfour. Evaluating and Optimizing Component-Based Robot Architectures using Network Simulation. *Winter Simulation Conference (IEEE/ACM/INFORMS WSC)*, 2018.

[3] **Philipp Andelfinger**, Sajeev Udayakumar, David Eckhoff, Wentong Cai, Alois Knoll, Model Preemption Based on Dynamic Analysis of Simulation Data to Accelerate Traffic Light Timing Optimisation (invited). *Winter Simulation Conference (IEEE/ACM/INFORMS WSC)*, 2018.

[4] **Philipp Andelfinger**, Daniel Zehe, Yihao Chen, Boyi Su, David Eckhoff, Wentong Cai, Alois Knoll, Incremental Calibration of Seat Selection Preferences in Agent-Based Simulations of Public Transport Scenarios (invited). *Winter Simulation Conference (IEEE/ACM/INFORMS WSC)*, 2018.

[5] Jiajian Xiao, **Philipp Andelfinger**, David Eckhoff, Wentong Cai, and Alois Knoll. Exploring Execution Schemes for Agent-Based Traffic Simulation on Heterogeneous Hardware. *International Symposium on Distributed Simulation and Real Time Applications (IEEE/ACM DS-RT)*, 2018.

[6] Marc Leinweber, Hannes Hartenstein, **Philipp Andelfinger**. Enabling Cross-Event Optimization in Discrete-Event Simulation Through Compile-Time Event Batching. Technical Report. *Karlsruhe Reports in Informatics.*, 2018.

[7] **Philipp Andelfinger**, Yadong Xu, David Eckhoff, Wentong Cai, Alois Knoll. Fast-Forwarding Agent States to Accelerate Microscopic Traffic Simulations. In *Conference on Principles of Advanced Discrete Simulation (ACM SIGSIM PADS)*. 2018.

[8] Mingyu Yang, **Philipp Andelfinger**, Wentong Cai, Alois Knoll. Evaluation of Conflict Resolution Methods for Agent-Based Simulations on the GPU. In *Conference on Principles of Advanced Discrete Simulation (ACM SIGSIM PADS)*. 2018.

[9] Xinhu Liu and **Philipp Andelfinger**. Time Warp on the GPU: Design and Assessment. In *Proceedings of the Conference on Principles of Advanced Discrete Simulation (ACM SIGSIM PADS)*. 2017.

[10] Nikolai Baudis, Florian Jacob and **Philipp Andelfinger**. Performance Evaluation of Priority Queues for Fine-Grained Parallel Tasks on GPUs. *International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (IEEE MASCOTS)*. 2017.

[11] Till Neudecker, Arsen Hayrapetyan, Alexander Degitz, and **Philipp Andelfinger**. Consideration of Values in the Design of Access Control Systems. In *Jahrestagung der Gesellschaft für Informatik*, 2016.

[12] Till Neudecker, **Philipp Andelfinger**, and Hannes Hartenstein. Timing Analysis for Inferring the Topology of the Bitcoin Peer-to-Peer Network. In *International Conference on Advanced and Trusted Computing (IEEE ATC)*. 2016.

[13] **Philipp Andelfinger** and Hannes Hartenstein. Model-Based Concurrency Analysis of Network Simulations. In *Conference on Principles of Advanced Discrete Simulation (ACM SIGSIM PADS)*. 2015.

[14] Till Neudecker, **Philipp Andelfinger**, and Hannes Hartenstein. A Simulation Model for Analysis of Attacks on the Bitcoin Peer-to-Peer Network. In *International Symposium on Integrated Network Management (IFIP/IEEE IM)*. 2015.

[15] **Philipp Andelfinger** and Hannes Hartenstein. Exploiting the Parallelism of Large-scale Application-layer Networks by Adaptive GPU-based Simulation. In *Proceedings of the 2014 Winter Simulation Conference (IEEE/ACM/INFORMS WSC)*. 2014.

[16] **Philipp Andelfinger**, Konrad Jünemann, and Hannes Hartenstein. Parallelism Potentials in Distributed Simulations of Kademlia-based Peer-to-Peer Networks. In *Proceedings of the International Conference on Simulation Tools and Techniques (ICST SIMUTools)*, 2014.

[17] **Philipp Andelfinger**, Matthias Keller, Holger Kühner, and Hannes Hartenstein. From Implicit to Explicit Knowledge: A Tool for Preserving and Sharing Mental Links in Science. In *Companion Publication of the Conference on Computer Supported Cooperative Work (ACM CSCW Companion)*, 2014.

[18] **Philipp Andelfinger** and Hannes Hartenstein. Towards Performance Evaluation of Conservative Distributed Discrete-Event Network Simulations Using Second-Order Simulation. In *Proceedings of the Conference on Principles of Advanced Discrete Simulation (ACM SIGSIM PADS)*, 2013.

[19] Konrad Jünemann, **Philipp Andelfinger**, and Hannes Hartenstein. Towards a Basic DHT Service: Analyzing Network Characteristics of a Widely Deployed DHT. In *Proceedings of the International Conference on Computer Communications and Networks (IEEE ICCCN)*, 2011.

[20] **Philipp Andelfinger**, Jens Mittag, and Hannes Hartenstein. GPU-Based Architectures and Their Benefit for Accurate and Efficient Wireless Network Simulations. In *International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems (IEEE MASCOTS)*, 2011.

[21] Konrad Jünemann, **Philipp Andelfinger**, Jochen Dinger, and Hannes Hartenstein. BitMON: A Tool for Automated Monitoring of the BitTorrent DHT. In *International Conference on Peer-to-Peer Computing (IEEE P2P)*, 2010.