Curriculum vitae of Peter Herrmann

Personal information

Name:	Peter Herrmann		
Date of birth:	23.08.1962	Sex:	male
Nationality:	Germany		
Researcher unique identifiers:	ORCID: 0000-0003-3830-466X, ResearcherID: rid61780, Scopus Author ID: 34770730400		
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Education

Year	Faculty/department - University/institution - Country
1997	Doctorate in Natural Science (rer. nat.), Faculty of Computer Science, University of Dortmund, Germany
1990	Diploma in Computer Science, University of Karlsruhe, Germany

Positions - current and previous

Year	Job title – Employer - Country
2005-	Professor in Telecommunication Systems, Norwegian University of Science and Technology (NTNU), Trondheim, Norway
2001-2005	Postdoctoral Researcher at the University of Dortmund, Germany
1999-2001	Postdoctoral Awardee in the postgraduate research program “Modelling and Model-Based Design of Complex Technological Systems” at the University of Dortmund, Germany
1990-1999	Researcher at the University of Dortmund, Germany

Project management experience

Year	Project owner - Project - Role - Funder
2021	Representative for NTNU in the project “OPTIBILITY” funded by the European Commission within the project AI4Cities
2019-2021	Representative for NTNU in the project “IOT-STOP” funded by Innovasjon Norge within the PILOT-T program

2017-2020	Representative for NTNU and main PhD supervisor in the Nærings-PhD project "Realizing Context-aware Intelligent Mobile Services through Real-Time Indoor Location Tracking" (MobiTrack) funded by Norges Forskningsråd
2008-2012	Representative for NTNU and member of the steering committee in the large research project "Ubiquitous Computing for All Users" (UbiCompForAll) funded by Norges Forskningsråd
2007-2011	Representative for NTNU and member of the steering committee in the research and development project "Infrastructures for Integrated Services" (ISIS) funded by Norges Forskningsråd
2006-2008	Representative for NTNU and member of the project committee in the specific targeted research and innovation project "Semantic Interfaces for Mobile Services" (SIMS) funded by the European Commission within the Sixth Framework Program
2003-2005	Representative for the University of Dortmund in the Working Group "Trust Management in Dynamic Open Systems" (iTrust) funded by the European Commission

Supervision of students

Master's students	Ph.D. students	University/institution - Country
Around 30	9	Norwegian University of Science and Technology (NTNU), Norway
Around 10	1	University of Dortmund, Germany

Other relevant professional experiences

Year	Description - Role
2021-2023	Leader of the Discipline on Communication Technology at the Department of Information Security and Communication Technology, Norwegian University of Science and Technology (NTNU), Trondheim, Norway
2023	General Chair of the 15th System Modelling and Analysis Conference (SAM 2023), Västerås, Sweden
2013-2014, 2015, 2017, 2019	Visiting Professor at RMIT University, Melbourne, Australia
2016-	Leader of the NTNU Intelligent Transportation Systems Laboratory, Department for Information Security and Communication Technology, NTNU Trondheim, Norway
2010	Organizational and program committee co-chair for the 6th Workshop on System Analysis and Modelling (SAM 2010), Oslo, Norway
2008	General chair of the 2nd Joint IFIP iTrust and PST Conferences on Privacy, Trust Management and Security (IFIPTM), Trondheim, Norway

2007-	Treasurer of the IFIP WG 11.11 on Trust Management
2005	Program committee chair for the 3rd International Trust Management Conference, Paris, France
	Associate editor in Telecommunication Systems and the Electronic Commerce Research Journal, both published by Springer; editor of a two special issues of the Electronic Commerce Research Journal on security, privacy and trust in electronic commerce; program committee member for numerous conferences and workshops
	Member of IEEE, GI (Gesellschaft der Informatik), Germany, and the IFIP WG 11.11 on Trust Management

Track record

Total *number* of publications during the career:

- 130 in major national or international peer-reviewed journals, peer-reviewed conference proceedings, peer reviewed book chapters and/or monographs
- Two articles received best paper awards and another one was a nominee (see list below)
- h-index=24, i10-index=50 (Google Scholar), see https://scholar.google.no/citations?view_op=list_works&hl=no&user=6rzI3QMAAAAJ

A list of relevant publications in major international journals, conference proceedings, book chapters and/or monographs (all peer-reviewed) that are cited in the description of my research activities below:

1. M. Oplenskedal, P. Herrmann, A. Taherkordi. DeepMatch2: A Comprehensive Deep Learning-based Approach for In-Vehicle Presence Detection. In *Information Systems*, Article No. 101927, November 2021.
2. E. Puka, P. Herrmann. Simulating a Context-Aware Message Flooding Protocol to Mitigate Cellular Dead Spots with Realistic Drivers' Behavior. In *24th IEEE International Conference on Intelligent Transportation (ITSC)*, pages 1041-1048, Indianapolis, IN, USA, IEEE, September 2021.
3. P. Herrmann, E. Puka, T.R. Skoglund. Machine Learning-based Uptime-Prediction for Battery-friendly Passenger Information Displays. In *8th IEEE International Conference on Smart City and Informatization (iSCI)*, pages 49-59, Guangzhou, China (Virtual), IEEE, December 2020/January 2021.
4. J.A.E. Meyer, E. Puka, P. Herrmann. Utilizing Connectivity Maps to Accelerate V2I Communication in Cellular Network Dead Spots. In C. H. Hsu, S. Kallel, K. C. Lan, Z. Zheng (eds.), *6th International Conference on Internet of Vehicles (IOV)*, pages 76-87, Kaohsiung, Taiwan, LNCS 11984, Springer-Verlag, November 2019. This article was nominated for the Best Paper Award of IOV 2019.
5. Z. A. Khan, P. Herrmann. Recent Advancements in Intrusion Detection Systems for the Internet of Things. In *Security and Communication Networks*, 2019(2019)7, 19 pages, Article ID 4301409.
6. M. K. Oplenskedal, A. Taherkordi, P. Herrmann. Automated Product Localization through Mobile Data Analysis. In *20th IEEE Conference on Mobile Data Management (MDM)*, pages 18-26, Hong Kong, IEEE Computer, June 2019.
7. P. Herrmann, J. O. Blech, F. Han, H. Schmidt. Model-based Development and Spatiotemporal Behavior of Cyber-Physical Systems. In L.-J. Zhang, Y. Ning (eds.), *Innovative Solutions and Applications of Web Services Technology*, pages 69-93, IGI Global, October 2018.
8. S. Hordvik, K. Øseth, H. H. Svendsen, J. O. Blech, P. Herrmann. Model-based Engineering and Spatiotemporal Analysis of Transport Systems. In *Evaluation of Novel Approaches to Software Engineering*, pages 44-65, Communications in Computer and Information Science (CCIS), vol. 703. Springer-Verlag, April 2017 (A previous version of this paper received the Best Paper Award of the

11th International Conference on Evaluation of Novel Approaches to Software Engineering (ENASE) 2016.)

9. Z. A. Khan, P. Herrmann. A Trust-based Distributed Intrusion Detection Mechanism for Internet of Things. In *IEEE 31st International Conference on Advanced Information Networking and Applications (AINA)*, pages 1169-1176, Taipei, IEEE Computer, March 2017.
10. P. Herrmann, J.O. Blech, F. Han, H. Schmidt. A Model-based Toolchain to Verify Spatial Behavior of Cyber-Physical Systems. In *International Journal of Web Services Research (IJWSR)*, 13(2016)1, 40-52. (A previous version of this paper was awarded the Best-Track Paper Award of the Special Track on Reliability Technologies and Tools for Services-Based Systems of the *2014 Asia-Pacific Services Computing Conference (APSCC)*, IEEE Computer Society Press, 2014.)
11. M. Vasilevskaya, L.A. Gunawan, S. Nadjm-Tehrani, P. Herrmann, Integrating Security Mechanisms into Embedded Systems by Domain-specific Modelling. In *Security and Communication Networks* 7(2014)12, 2815-2832.
12. V. Slåtten, P. Herrmann, F.A. Kraemer, Model-Driven Engineering of Reliable Fault-Tolerant Systems - A State-of-the-Art Survey. Chapter 4 in A. Memon (ed.) *Advances in Computers* 91(2013)119-205.
13. Han F., P. Herrmann, Modeling Real-Time System Performance with Respect to Scheduling Analysis. In Proceedings of the *6th IEEE International Conference on Ubi-Media Computing (UMEDIA 2013)*, pages 663-671, Aizu-Wakamatsu, Japan, IEEE Computer Society Press, September 2013.
14. L.A. Gunawan, P. Herrmann, Compositional Verification of Application-Level Security Properties, in Proceedings of the *International Symposium on Engineering Secure Software and Systems (ESSoS 2013)*, pages 75-90, Paris, February/March 2013, LNCS, Springer-Verlag.
15. F.A. Kraemer, P. Herrmann. Reactive Semantics for Distributed UML Activities. In J. Hatcliff, E. Zucca, Formal Techniques for Distributed Systems, Proceedings of the *Joint 12th IFIP WG 6.1 International Conference (FMOODS 2010) and 30th IFIP WG 6.1 International Conference (FORTE 2010)*, Amsterdam, LNCS 6117, Springer-Verlag, June 2010.
16. F.A. Kraemer, V. Slåtten, P. Herrmann. Tool Support for the Rapid Composition, Analysis and Implementation of Reactive Services. In *The Journal of Systems and Software* 82 (2009) 2068-2080.
17. F.A. Kraemer, P. Herrmann. Automated Encapsulation of UML Activities for Incremental Development and Verification. In Proceedings of the *12th International Conference on Model Driven Engineering Languages and Systems (MODELS 2009)*, pages 571-585, Denver, LNCS 5795, Springer-Verlag, October 2009.
18. P. Herrmann, G. Herrmann. Security-Oriented Refinement of Business Processes. In *Electronic Commerce Research Journal*, Springer-Verlag, 6(2006)3-4, 305-335.
19. P. Herrmann. Trust-Based Protection of Software Component Users and Designers. In Proceedings of the *1st International Conference on Trust Management*, pages 75-90, LNCS 2692, Heraklion, May 2003, Springer-Verlag.
20. P. Herrmann, H. Krumm, O. Drögehorn, W. Geisselhardt. Framework and Tool Support for Formal Verification of High Speed Transfer Protocol Designs. In *Telecommunication Systems*, Kluwer Academic Publisher, 20(2002)3-4, 291-310.
21. P. Herrmann. Information Flow Analysis of Component-Structured Applications. In Proceedings of the *17th Annual Computer Security Applications Conference (ACSAC'2001)*, pages 45-54, ACM SIGSAC, New Orleans, December 2001. IEEE Computer Society Press.
22. P. Herrmann, H. Krumm. A Framework for Modeling Transfer Protocols. In *Computer Networks*, 34(2000)2, 317-337.
23. P. Herrmann, H. Krumm. A Framework for the Hazard Analysis of Chemical Plants. In Proceedings of the *11th IEEE International Symposium on Computer-Aided Control System Design (CACSD2000)*, pages 35-41, Anchorage, Alaska, USA, IEEE CSS, September 2000. Omnipress.
24. P. Herrmann, H. Krumm. Modular Specification and Verification of XTP. In *Telecommunication Systems*, 9(1998)2, 207-221.
25. P. Herrmann. Problemnaher korrektheitssichernder Entwurf von Hochleistungsprotokollen. Deutscher Universitätsverlag, 1998 (Dissertation in German).

Awards:

- 2015: The Department of Telematics, with Frank Kraemer, Peter Herrmann, Finn Arve Aagesen and Øivind Kure, was awared the prize of learning environment of the year 2015
- 1999-2001: Two years stipendium for a postdoctoral researcher in the postgraduate research program "Modelling and Model-Based Design of Complex Technological Systems" of the University of Dortmund

Research Activities

My research career since 1990 can be structured into the following areas, that will be shortly discussed below:

Year	Research Area
1990-2001	Constraint-oriented specification and verification of distributed systems using temporal logic
2001-2005, 2017-2019	Security and trust management of software components
2005-	Model-based development of distributed systems
2013-	Formal techniques-based design of control software and proof of spatiotemporal properties
2016-	Communication technology aspects in Intelligent Transportation Systems

Constraint-oriented specification and verification of distributed systems using temporal logic:

After some project work, my research in this area was started with my Ph.D. project [25] carried out between 1993 and 1997. Lamport's well-known Temporal Logic of Actions (TLA) was extended to the version *compositional TLA* (cTLA), that is suited to the creation of constraint-oriented specifications and modular verification. This allowed me to create a framework of cTLA specifications modelling both, protocol mechanisms used in transport protocols and service properties. Moreover, by temporal logic deductions, I could prove that particular combinations of protocol mechanisms implement certain service properties.

Framework users can now create formal models of protocols and the services to be realized by them by instantiating and composing building blocks from the framework. Thanks to the already done verifications, it is now very easy to verify formally that the specified protocol indeed realizes the modelled service, since verifications can be subdivided into proof-steps that directly correspond to the verifications already carried out. This work is discussed in the articles [20, 22, 24].

Afterwards, within the postgraduate research program "Modelling and Model-Based Design of Complex Technological Systems" at the University of Dortmund, Germany, I extended this approach to the area of hybrid technical systems, now often called cyber-physical systems. Another cTLA framework was developed that made it possible to verify that technical systems in chemical engineering fulfill certain safety properties, e.g., preventing that a liquid is pumped against a closed valve, see [23]. This work was carried out between 1997 and 2001.

Security and trust management of software components:

From around 2001, I transferred my interest in composing systems from building blocks from formal models to real software components. Here, I selected security aspects, in particular, information flow as properties to be fulfilled by the components. Thus, this approach was less formal than my previous work and more dedicated to help the average software engineer to create systems that guarantee at least some security

properties. For that, proper behavioral interfaces of the components were defined. That allowed me to verify the correctness of the information flow between the components forming a distributed systems [18, 21].

In addition, the work in this area brought me into contact with members of the emerging trust management community who invited me into the EU Working Group "Trust Management in Dynamic Open Systems" (iTrust). I took the opportunity and brought trust management aspects into my work on monitoring software components. A typical example is to grant users access depending on the benevolence of their previous behavior, see [19]. The work on security and trust management lasted until my move to Trondheim in 2005.

The work on trust management was revived in the period between 2017 and 2019, when the ERCIM postdoctoral researcher Zeeshan Ali Khan showed interest to combine trust management with intrusion detection. This led to another approach, see [5, 9].

Model-based development of distributed systems:

After my start at NTNU, I joined forces with Frank Alexander Kraemer, who was in the initial phase of his Ph.D. project, as well as with my former colleague Professor Rolv Bræk. We advanced the idea, that using proper behavioral interfaces can be very helpful to guarantee that a software component fulfils certain functional and non-functional properties. In particular, we used the well-known UML diagram types *activities* and *state machines* and furnished them with a formal semantics [15]. That allowed us to develop recurrent code once in a so-called building block that is provided by a behavioral interface. Systems can be built by adding such building blocks in a "drag-and-drop"-fashion and combining their interface elements with each other, see [17]. Using a model checker, relevant properties can then be checked fully automatically [16].

Creating a toolset realizing this approach was a central aspect of the R&D project "Infrastructures for Integrated Services" (ISIS) funded by Norges Forskningsråd. Telenor was the leader of the consortium with NTNU, TellU, Ericsson, and the former HiA (now UiA) other partners. The result of NTNU's work in this project and our research let to the toolset *Reactive Blocks* that was commercialized within the spinoff company *BitReactive*.

Extensions on Reactive Blocks were carried out in some Ph.D. projects supervised by me. Vidar Slåtten created ways to use Reactive Blocks for building robust and fail-proof systems [12]. In the work of Linda Gunawan, the approach was adapted to prove certain security properties [11, 14]. Finally, Han Fenglin dedicated his Ph.D. research to the creation of real-time aspects [13] as well as cyber-physical systems [9].

I was also involved in the EU project "Semantic Interfaces for Mobile Services" (SIMS). This project was led by SINTEF. Other partners were NTNU, Gintel, Appear, Gentleware, the Polytechnical University of Warsaw, and France Telecom Espana. Here, we developed another model-based approach using behavioral interfaces.

The aspect of easing the composition of service building blocks, in a way that also end-users, who are non-experts, can carry them out, was researched in the project "Ubiquitous Computing for All Users" (UbiCompForAll) funded by Norges Forskningsråd, in which I also participated. Here, also SINTEF was the consortium leader with NTNU, Gintel, and TellU being partners.

Formal techniques-based design of control software and proof of spatiotemporal properties:

A sabbatical leave at RMIT University in Melbourne, Australia, from 2013 to 2014 led to an in-depth research collaboration with the group of Professor Heinz Schmidt, in particular, with Dr. Jan Olaf Blech. This group was engaged in the "Australia-India Research Centre for Automation Software Engineering", a collaboration between RMIT and ABB in Australia and India. A part of the work of this center was the use of modeling in the design of control software for technical systems that has to fulfill spatiotemporal properties. Within this work, Dr. Blech developed the methodology *BeSpaceD* that allows for formal specification and verification of spatiotemporal aspects. We found out that it can be nicely combined with Reactive Blocks. Altogether, our collaborative research led to 20 joined publications (see, e.g., [7, 8, 10]) of which two got best paper awards for the conferences, they were published in.

Communication technology aspects in Intelligent Transportation Systems:

In 2016, I was asked to overtake the Intelligent Transportation Systems (ITS) Lab from my colleague Professor Steinar Andresen, who was retiring. Within this work, I took contact with public organizations like Statens Vegvesen (SVV), Jernbaneverket, Trøndelag Fylkekommune, and Skyss as well as private companies as FourC, Telenor, Aventi, and Sonitor. This cooperation led to various research and development activities:

Within the above-mentioned cooperation with the RMIT University, we used the model railway equipment of the ITS Lab to test the cooperation of Reactive Blocks and the spatiotemporal verification tool BeSpaceD, see [8].

A cooperation with SVV about checking the cellular network accessibility on the Norwegian road network inspired my Ph.D. student Ergys Puka to center his Ph.D. project around the mitigation of large areas without cellular network connectivity. One can find such areas called dead spots mostly in large sparsely populated countries like Australia or Canada. Under my supervision, Puka developed context-aware flooding protocols that allow vehicles passing each other in a dead spot to build up ephemeral networks in which messages to be delivered after leaving the dead spot can be exchanged between the vehicles. While connected, the vehicles also determine which of them will deliver the message. That should, of course, be the one supposed to leave the dead spot earliest. Using such context-aware protocols, one can reduce the average waiting time for delivering a message by 40% or more without creating too many copies that are delivered unnecessarily. The various stages of this work are described in [2, 4].

In cooperation with my colleague Professor Amir Taherkordi at the University of Oslo (UiO), we obtained the Nærings-PhD project “Realizing Context-aware Intelligent Mobile Services through Real-Time Indoor Location Tracking” (MobiTrack) funded by Norges Forskningsråd and Sonitor. Within this project, my Ph.D. student Magnus Oplenskedal worked on technologies that use machine learning for utilizing inhouse location systems. In particular, he worked on an automated system for localization goods in stores, see [6]. The main achievement of his work was the creation of reliable methods to find out if people ride in public transport vehicles, see [1]. Such systems will allow passengers to be correctly billed for their journeys without the need of any manual input.

I worked also in the project “IOT-STOP” funded by Innovasjon Norge. It was led by FourC with NTNU, Telenor, and Skyss being partners. The task of this project was the development of systems providing real-time passenger information at bus stops without electrical power supply, such that batteries have to be used. This makes power-preserving technologies relevant. Besides special technical equipment like ePapers and power-saving chipsets, we also used the reduction of idle listening to signals from a remote server. NTNU’s task was the development of a system that, using machine learning, predicts the times at which the likelihood, that a change of the expected arrival time of a bus has to be displayed to the waiting passengers, is exceeding a certain threshold. A reliable prediction allows us to switch off the listener of the control system until the time with a major change of the arrival time is reached, which can save a lot of battery power, see [3]. Similar predictions, however, for the need of user equipment like eScooters or eBikes in cities, were examined in the project “OPTIBILITY”.