PETER OKELMANN

Systems Research Lab, Technical University of Munich

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EDUCATION

Ongoing: Dr. rer. nat. Informatics (PhD)

Technical University of Munich

Mar 2022 – anticip. Dec 2026 Munich, DE

Secure and High-performance Network Virtualization Stacks
Advisor: Prof. Pramod Bhatotia

MSc in Informatics

Technical University of Munich

Apr 2020 – Oct 2022 Munich, DE

Thesis: Building Lightweight VMs for Function as a Service
Advisors: Prof. Pramod Bhatotia, Dr. Jörg Thalheim source

BSc in Informatics

Technical University of Munich

Oct 2015 – Mar 2022 Munich, DE

Thesis: Performance Analysis of the VPP Software Router
Advisors: Prof. Georg Kahle, Dr. Paul Emmerich source

PUBLICATIONS

Conference Articles

- vMux: A Unified Network Device Virtualization Architecture
  Peter Okelmann, *Masanori Misono, Redha Gouicem, Antoine Kaufmann, Pramod Bhatotia*
  Under review: EuroSys'26
- MorphOS: An Extensible Networked Operating System
  Peter Okelmann, *Ilya Meignan--Masson, Masanori Misono, Pramod Bhatotia*
  CoNEXT'25 [paper], [code]
- uIO: Lightweight and Extensible Unikernels
  Masanori Misono, ***Peter Okelmann***, *Charalampos Manias, Pramod Bhatotia*
  SoCC'24 [paper], [code]
- VMSH: Hypervisor-agnostic Guest Overlays
  Jörg Thalheim, ***Peter Okelmann***, *Redha Gouicem, Pramod Bhatotia*
  EuroSys'22 [paper], [code]

TALKS

- Confidential Network Function Virtualization
  Oct 2025, Internship Presentation at Nokia Bell Labs
- VMSH: Hypervisor-agnostic Guest Overlays
  Jun 2022, Invited talk at IBM Watson Research Center
- VMSH: Hypervisor-agnostic Guest Overlays
  May 2022, Invited talk at Intel Labs - Datacenter Security Group
- VMSH: Hypervisor-agnostic Guest Overlays
  Apr 2022, Conference talk at EuroSys'22

EMPLOYMENT

Scientific Staff

Technical University of Munich

Mar 2022–present Munich, DE

- Research at the systems research group to pursue a PhD

Internship

Nokia Bell Labs

Jun 2025–Oct 2025 Stuttgart, DE

- Software and data systems research lab
- Research on confidential virtual network functions
- Advisors: Dr. Istemi Ekin Akkus, Dr. Riuchuan Chen

Full Stack Developer and Consultant

Moonlight GmbH & Co. KG

Nov 2020–Jan 2021 Augsburg, DE

- Design, development, and deployment of digital signage systems
- Cloud architecture consulting

Embedded Software Developer

IKudrus GmbH

Oct 2020–Nov 2020 Augsburg, DE

- Embedded development for experiment automation

AWARDS

Best Artifact Award
Honorable Mention: VMSH: Hypervisor-agnostic Guest Overlays

SKILLS

Topics: Networking Virtualization Operating Systems

Primary programming languages: C/C++ Rust Python Nix Java/Kotlin

RESEARCH PROJECTS

- **MorphOS: An Extensible Networked Operating System**
  An extensible OS that brings reconfigurability to networked unikernel applications through verified eBPF, enabling dynamic VNF updates without service disruption through out-of-band verification and hardware-assisted isolation.
- **vMux: A Unified Network Device Virtualization Architecture**
  A unified virtualization architecture that consolidates heterogeneous VM pools and enables full hardware offloading across emulation, passthrough, and mediation modes while maintaining reliability through process isolation.
- **Slick: Confidential Network Function Virtualization**
  A high-performance network I/O virtualization system for confidential VNFs that leverages hardware-based CVM partitioning to improve throughput for VNF chaining while minimizing the trusted compute base.
- **CXL-XTrack: Distributed Memory with Cross-Rack Cache Coherency**
  A tiered memory system that expands CXL memory from intra-rack to cross-datacenter scales using FPGA-accelerated per-rack caches and RDMA-optimized cache coherency protocols.
- **POS: Virtualizing Monolithic P4 Programs on FPGAs**
  An operating system that decomposes monolithic P4 programs into modular, deployable components on FPGAs, achieving 100 Gbps line-rate processing while enabling dynamic service composition and resource sharing.
- **uIO: Lightweight and Extensible Unikernels**
  A safe overlay abstraction for unikernels that enables runtime extensibility through loadable programs while maintaining performance and security using hardware-assisted memory isolation (MPK) and language-based safety (eBPF).

TEACHING

- Introduction to Software Engineering
  Head Teaching Assistant: lecture, 2050 students, SS 2024
- Cloud Software Engineering
  Instructor: practical course, WS 2023/24
- Operating Systems and Virtualization
  Seminar, SS 2023
- Introduction to Software Engineering
  Teaching Assistant: lecture, 2200 students, SS 2023
- Interactive Learning and Systems Management
  Instructor: practical course, SS 2023
- Computer Systems Lab
  Instructor: practical course, WS 2022/23
- Distributed Systems Management
  Instructor: practical course, WS 2022/23
- Operating Systems and Virtualization
  Seminar, WS 2022/23
- Advanced Systems Programming in C/Rust
  Instructor: practical course, 90 students, SS 2022
- Advised student theses
  - Rethinking IO emulation architectures for VMs
    Sandro-Alessio Gierens, Bachelor's Thesis.
  - Automated Measurement of IoRegionFd and vMux Performance
    Sandro-Alessio Gierens, Guided Research.
  - Hyper-scalability of Network Interface Cards for Virtual Machines
    Florian Dominik Freudiger, Bachelor's Thesis.
  - vDPDK: A Para-Virtualized DPDK Device Model for vMux
    Dominik Kreutzer, Master's Thesis.

LANGUAGES

German ●●●●●

English ●●●●◐

Basic knowledge: Italian, Latin, Swedish, Japanese

REFERENCES

Prof. Dr. Pramod Bhatotia
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Prof. Dr. Antoine Kaufmann
@ MPI for Software Systems, Saarbrücken
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Prof. Dr. Redha Guicem
@ RTWH Aachen
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Dr.-Ing. Istemi Ekin Akkus
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