PETER OKELMANN

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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 and P4 compiler for FPGA-based network functions that supports hardware protocol stacks (RDMA, TCP) and efficiently co-locates functions as vFPGAs on a single physical FPGA.
- **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
- @ Technical University of Munich
- ✉ pramod.bhatotia@cit.tum.de

Prof. Dr. Antoine Kaufmann
- @ MPI for Software Systems, Saarbrücken
- ✉ antoinek@mpi-sws.org

Prof. Dr. Redha Guicem
- @ RTWH Aachen
- ✉ pramod.bhatotia@cit.tum.de

Dr.-Ing. Istemi Ekin Akkus
- @ Nokia Bell Labs, Stuttgart
- ✉ istemi_ekin.akkus@nokia-bell-labs.com

Dr. Masanori Misono
- @ Technical University of Munich
- ✉ masanori.misono@cit.tum.de