

# PETER OKELMANN

Systems Research Group, Technical University of Munich

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 Google Scholar

## 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 – Feb 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 2020  Munich, DE

Thesis: Performance Analysis of the VPP Software Router

Advisors: Prof. Georg Carle, 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 , 
- uIO: Lightweight and Extensible Unikernels  
*Masanori Misono, Peter Okelmann, Charalampos Manias, Pramod Bhatotia*  
SoCC'24 , 
- VMSH: Hypervisor-agnostic Guest Overlays  
*Jörg Thalheim, Peter Okelmann, Redha Gouicem, Pramod Bhatotia*  
EuroSys'22 , 

## 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. Istem Ekin Akkus, Dr. Ruichuan 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

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- **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

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- 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 THESES

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- 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.

# REFERENCES

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**Prof. Dr. Pramod Bhatotia**

@ Technical University of Munich

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**Prof. Dr. Antoine Kaufmann**

@ MPI for Software Systems, Saarbrücken

✉ antoinek@mpi-sws.org

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**Prof. Dr. Redha Guicem**

@ RWTH Aachen

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**Dr.-Ing. Istemı Ekin Akkus**

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**Dr. Masanori Misono**

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