

# 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 – 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 Karle, 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

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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. Istemi Ekin Akkus**

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**Dr. Masanori Misono**

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