TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Computer Science, Operating Systems Group

Mikrokerne als Universalbetriebssystem

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TECHNISCHE UNIVERSITÄT DRESDEN

Dresden OS Group

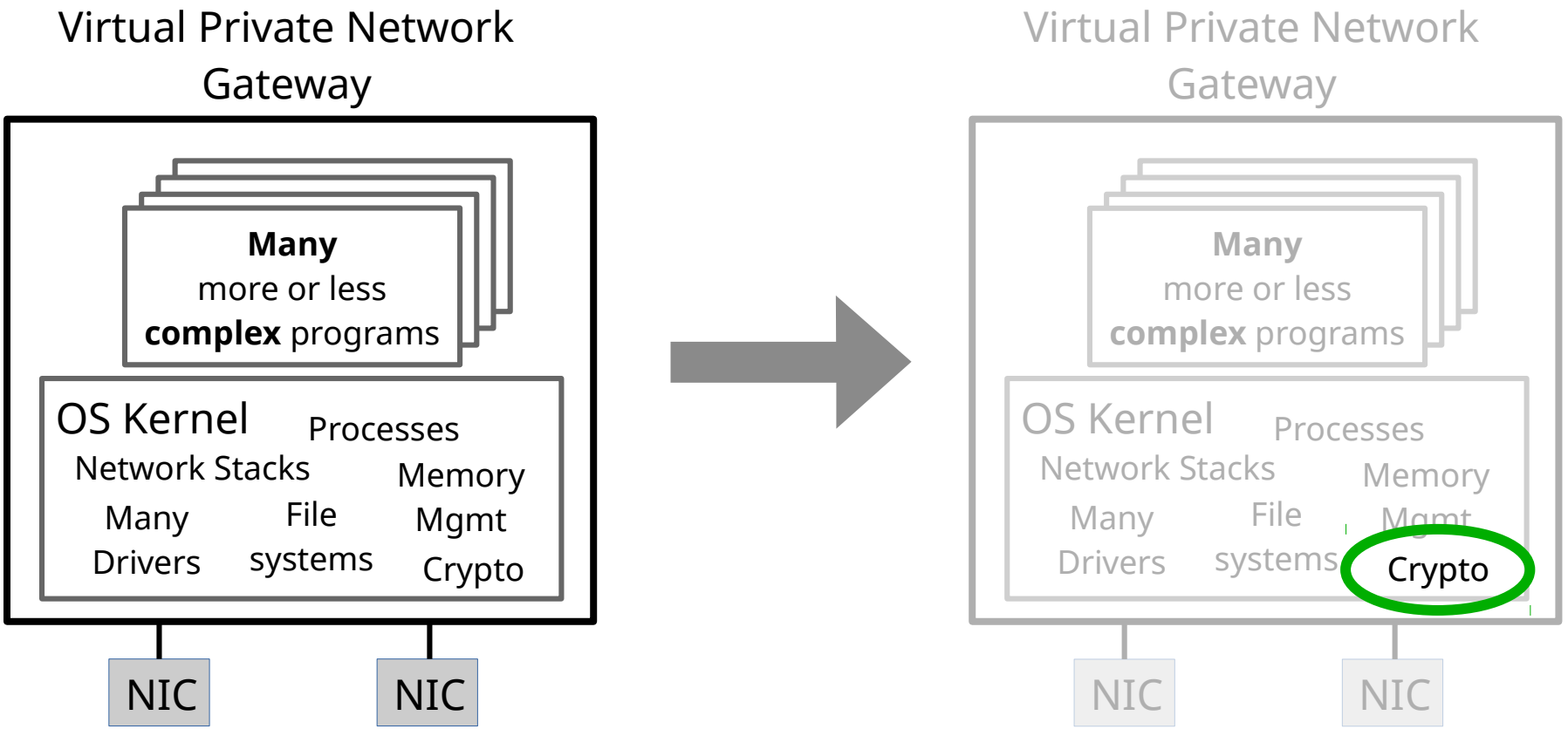
- Operating System Group within
  the Institute of System Architecture
  of Faculty of Computer Science
- Since 1994
- Head: Prof. Hermann Härtig
- Currently 3 Post-Docs & 9 PhD students

Focus Areas

- Operating System design and construction
- Microkernels and microkernel-based systems
- Virtualization
- System security
- Real-time / Scheduling
- Energy
- Resilience / Reliability
- Novel, distributed operating system designs
- Operating systems in High-Performance-Computing

Overall Idea: Split Applications

- Separate „important“ from “unimportant” functionality
  - `sizeof(unimportant) >> sizeof(important)`



Small Trusted Computing Base

- Trusted Computing Base (TCB):

  Any code that needs to be trusted for a functionality

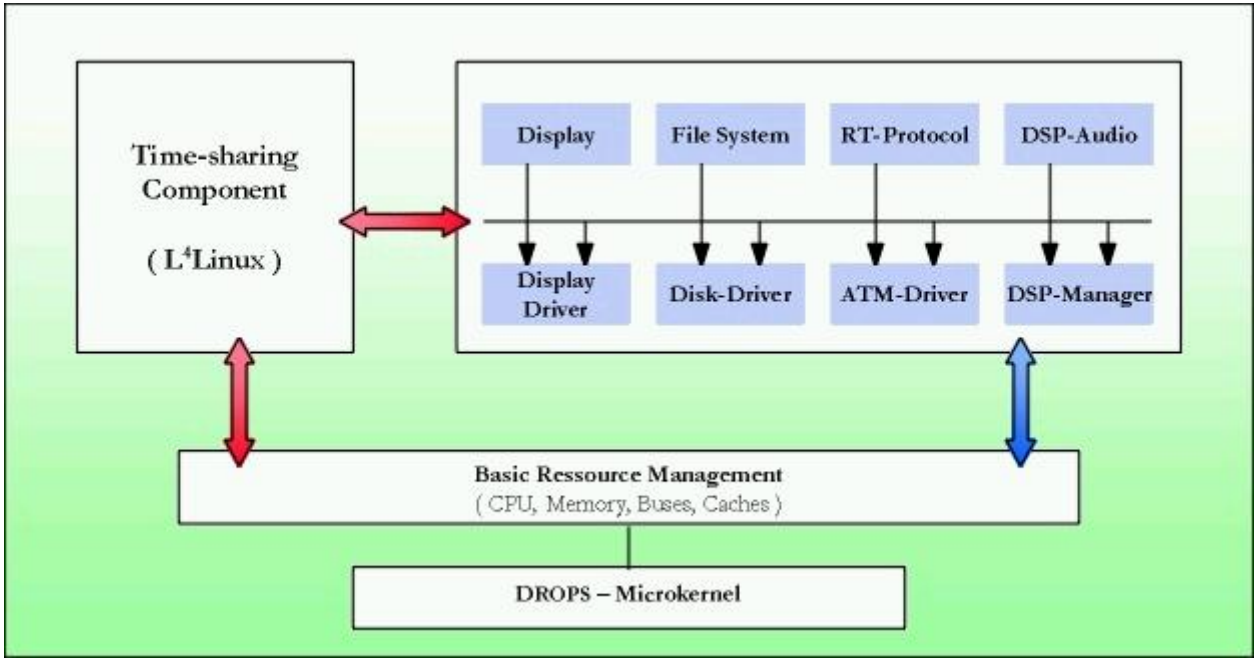
- Small TCB → Good TCB

Dresden OS Group Approach

- Use standard hardware (desktop-like)
- From the ground up with our own OS
- Initial focus: Real-time
- Followed by: include Security
- Virtualization
- OS builds upon the L4 microkernel idea
- Microkernel & Framework for Applications

DROPS

- Initial OS project
- “Dresden Real-time Operating System”
- Use real-time and best-effort components on the same system
- L⁴Linux (~1996)



Framework Required

- Tedious writing programs
- Requires framework
  - libc, starting threads and programs, stacks, paging, allocators etc.

→ L4Env

First framework for running and developing applications on the Fiasco microkernel

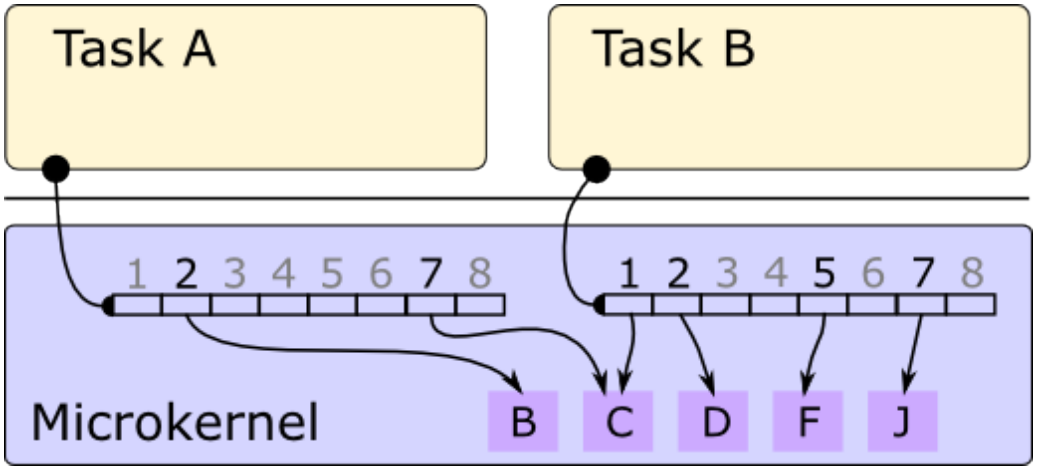
The Next Step: Security

- Funding shifted focus to security
- Initial L4 interface lacks important security properties
- Switch to capability-based interface

3rd generation microkernel system
Fiasco.OC & L4Re

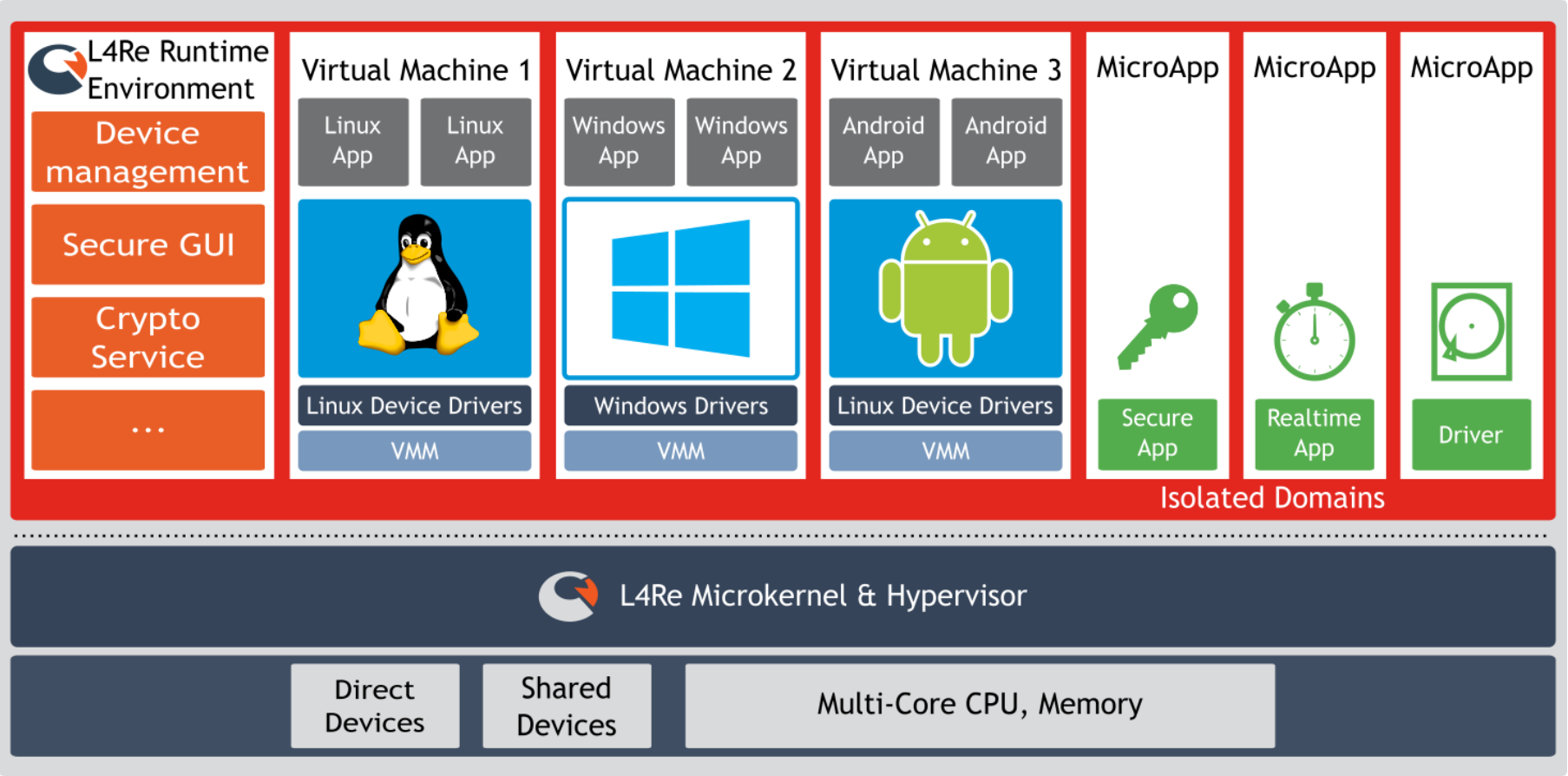
Object Capabilities

- State of the art on OS design
- Name spaces for applications (local naming)
  - Capabilities per task / address space
- Local vs. Global visibility of objects
  - Entities in the system cannot infer about existence of other entities

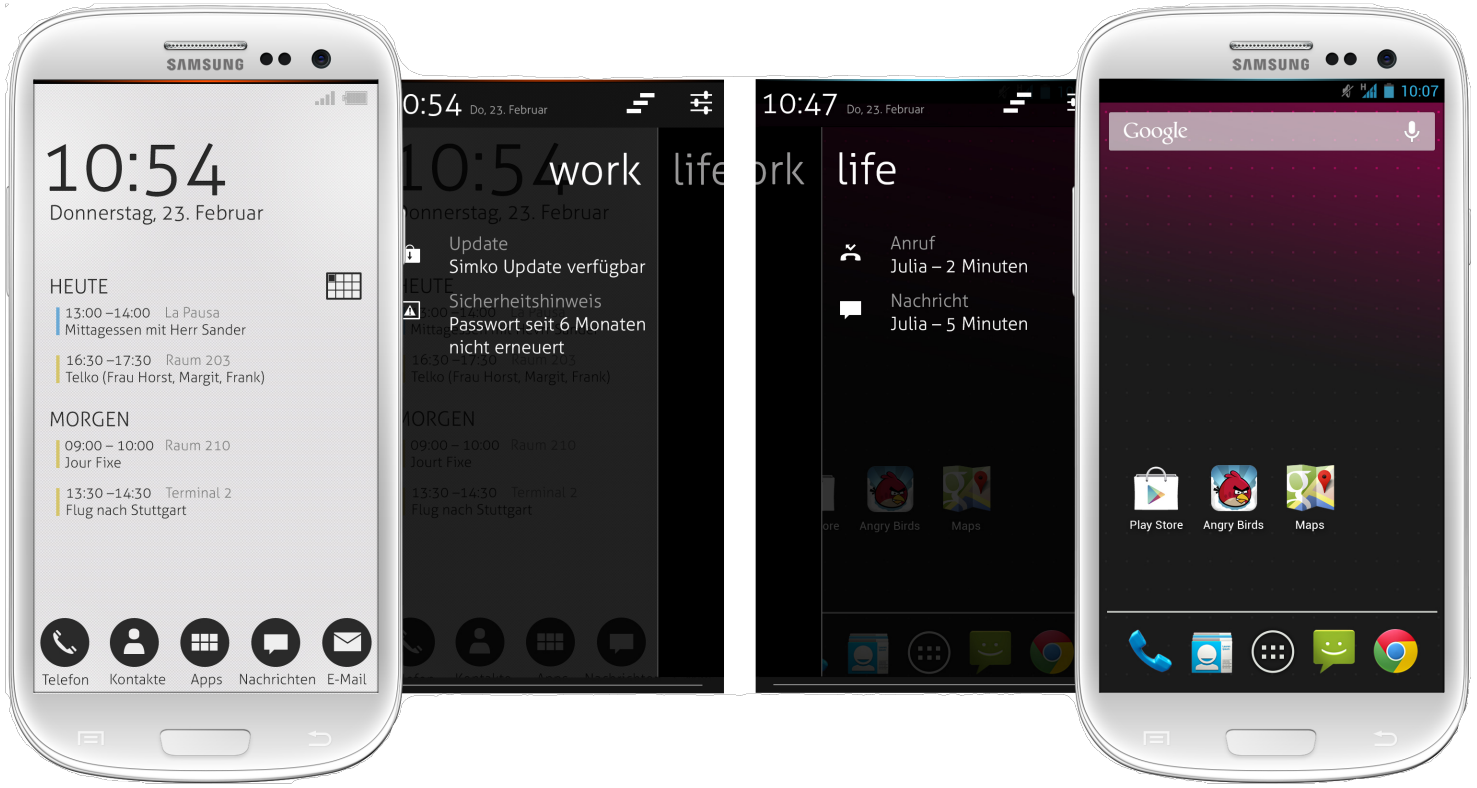


Be a Hypervisor

- Virtualization is must-have functionality
- „Generic virtualization“
  - Para-virtualization and hardware-assisted



Simko3 Security Smartphone

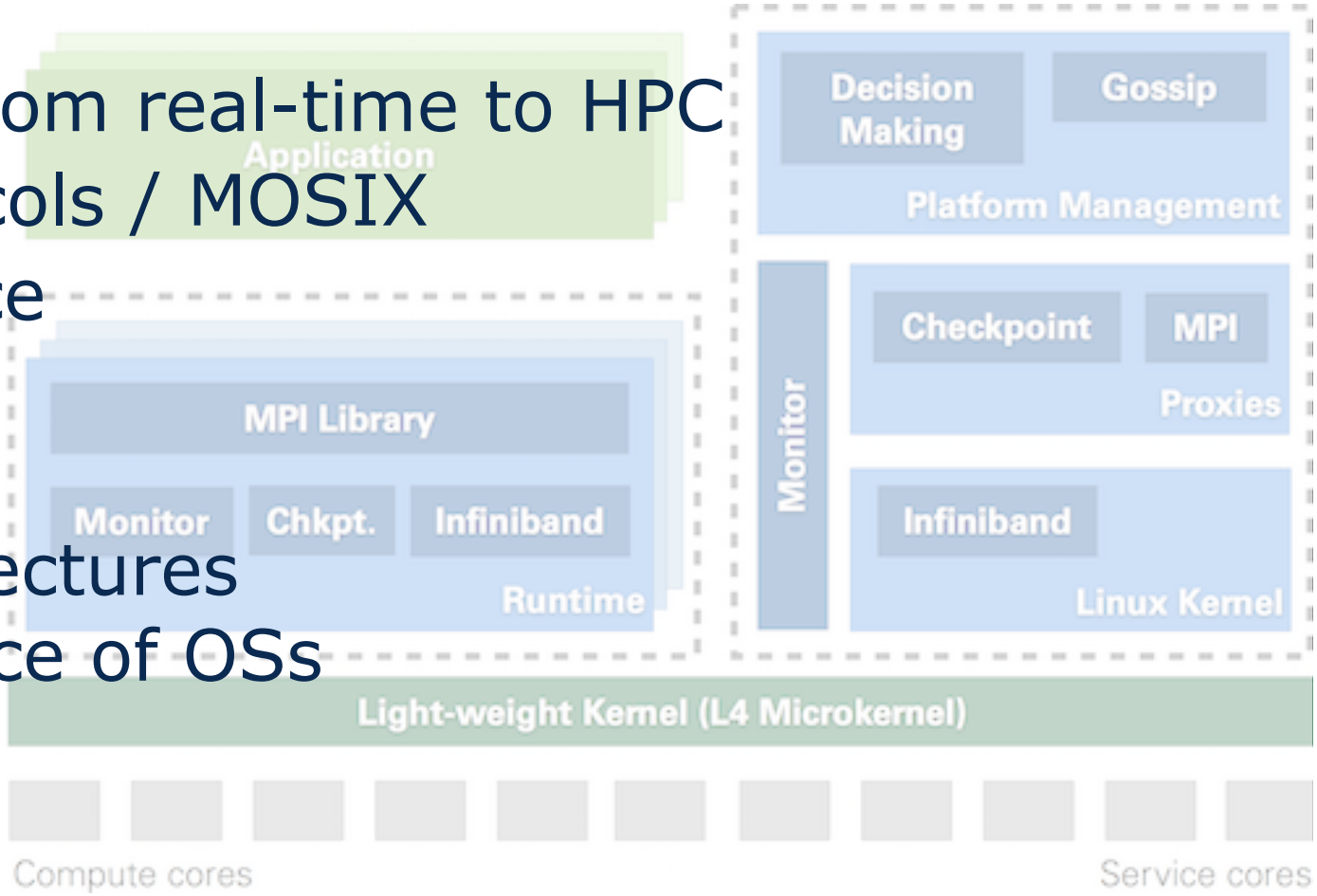


http://www.spiegel.de/netzwelt/gadgets/simko-3-sicherheits-handy-der-telekom-fuer-regierungseinsatz-zugelassen-a-921158.html

- Exascale systems
  - Many challenges ahead
  - OS Noise / Execution jitter

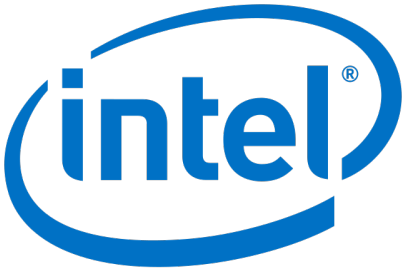
- Bring ideas from real-time to HPC
- Gossip protocols / MOSIX
- Fault tolerance
- File systems

- Future architectures
  and influence of OSs



Support

- Big support over the years



Going Live

- Spin-off from the university group
- Founded by core developers of Fiasco & L4Re

Summary

- Microkernel-based research in real-time, security, virtualization, reliability, and HPC
- Over 20 years of experience on building systems
- Available as open source: l4re.org

Virtual Private Network