

Unikernels

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Goals

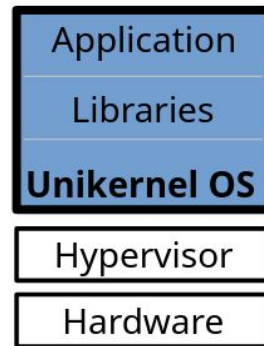
1. Bare Metals
2. Virtualization
3. Containers
4. **Unikernels/MicroVM**

Unikernel

- **Unikernel: application + dependencies + thin OS compiled as a static binary running on top of a hypervisor**
- **Single-***
 - Single purpose: run 1 application
 - Want to run multiple applications? run multiple unikernels
 - Single process
 - Want to run a multi-process application? run multiple unikernels
 - However, SMP (multicores) and multithreading are supported
 - Single binary and single address space for application + kernel
 - No user/kernel protection needed

Unikernel

- **A form of lightweight virtualization**
 - Contain and run only what is absolutely necessary to the application
 - Cost advantage: memory/disk footprint reduction
 - Considered as a secure alternative to containers
 - Unikernels are virtual machines!
- Per-application tailored kernel (LibOS/Exokernel model)
 - Specialization for lightweights but also performance
- Reduced OS noise, increased performance
 - Low system call latency: app + kernel in ring 0, system calls are function calls
 - Sub-second boot time



Unikernel

- Cloud applications: servers, micro-services, SaaS
- Embedded virtualization, Edge computing, IoT
- Network Function Virtualization, HPC, VM introspection, malware analysis, secure Desktop applications
- etc.
- Contrary to containers which are a mature and widespread technology, unikernels are still at the stage of research prototypes

Unikernel

- **Unikernels are lightweight AND secure, why didn't I heard of them?**
- Because it's hard to port existing applications!
 - a. Proprietary software → source code not available
 - b. Incompatible language
 - c. Unsupported features
 - d. Porting is hard, needs knowledge about both application and unikernel
 - e. Complex built toolchains