Are Unikernels Ready for Serverless on the Edge?

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FaaS Runtimes

Containers (e.g., `runc`)

“Secure” Containers (e.g., `gVisor [1, 2]`)

microVMs (e.g., `Firecracker [3]`)
Unikernels

- Application is executed directly on top of a hypervisor, embedded into binary including OS primitives, virtual hardware drivers
- Lean, fast boot times, VM isolation, small attack surface
- POSIX-compatible unikernels (Nanos [4], OSv [5], Unikraft [6]) vs. language-based unikernels (Clive [7], runtime.js [8], Hermit [9])
Evaluation

- Lightweight FaaS sandbox experiment harness on a single node
- Go and Node.js microbenchmarks
- Evaluating for: cold start times, memory footprint, idle resource usage, IO performance...
- Comparing OSv, Nanos, gVisor, Linux on Firecracker, Docker
- Source: https://github.com/OpenFogStack/unikernel-edge-faas/
Results

- Unikernels are promising! Great cold start performance, OK memory footprint
- But: not mature enough! Performance bugs in Nanos (network IO, memory page deduplication) and OSv (idle CPU operations)
- `runc` is hard to beat in terms of performance (but considered insecure)
- gVisor has terrible performance
- Full results in our paper (under review)

https://arxiv.org/abs/2403.00515
References