Extremely Fast and Efficient NFV with Unikraft

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UNICORE

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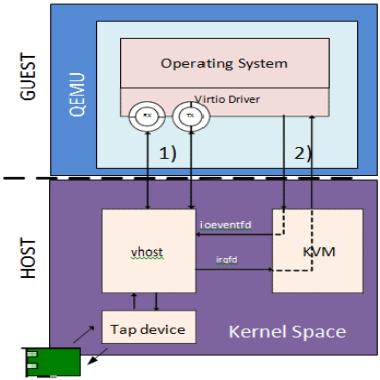
Overview

VNF with DPDK Ecosystem



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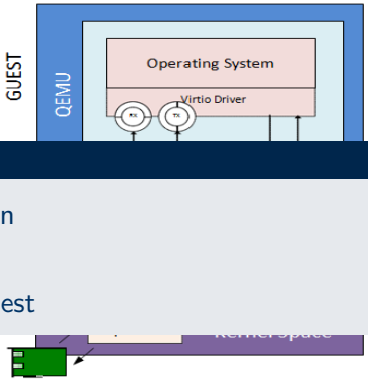

Can we do better?

- ⇝ Guest OS specialization
- ⇝ Boot Time
- ⇝ Isolation within the guest

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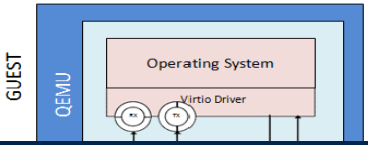

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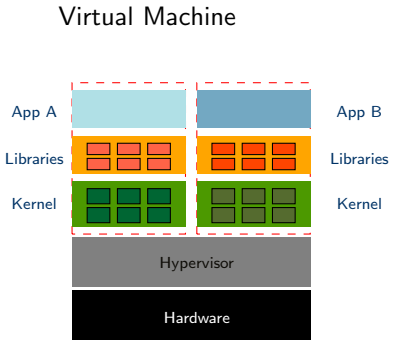
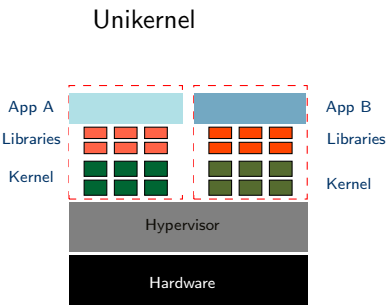
Let's discuss Unikernel...

Unikernel - Do One Thing and Do It Well





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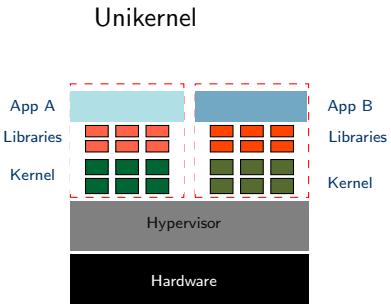

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  - Single image with application, specific kernel primitives

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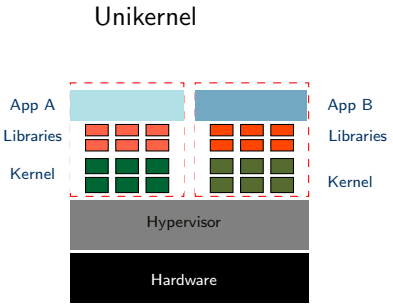

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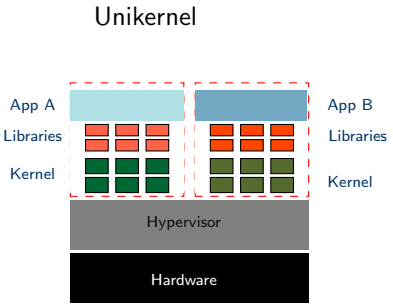

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- Reduced attack surface
  - Small trusted compute base
  - Strong isolation by hypervisor

La-la Land

So, Unikernel

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The problem with Unikernel development:

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Ooops!!

That's not an effective way of doing things!

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Objectives

- ⇝ Support wide range of use cases
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- ▶ Unikraft's two components:
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Unikraft says Hi!!

Source is BSD-licensed

Kconfig based build system

libukforest - Unikraft System Overview

- Take an existing application
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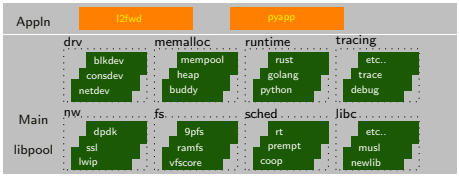

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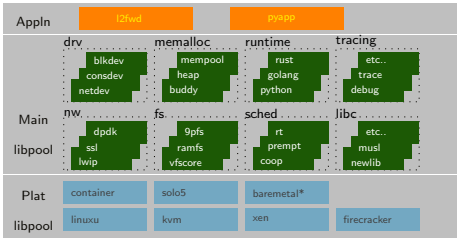

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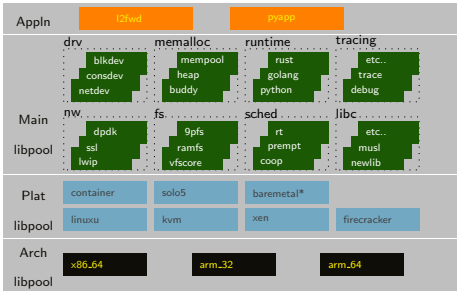

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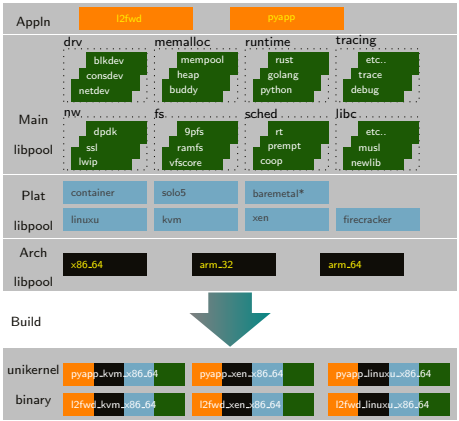

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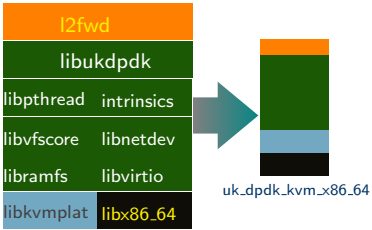

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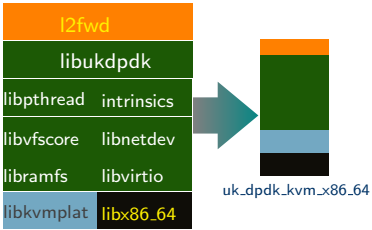

Challenges!!

- Build System Integration
- Specialization of Guest OS
- Minimize modification to DPDK library

Build DPDK as an Unikraft Library

Unikraft Build system

- Config.uk (Kconfig based)
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DPDK Build System

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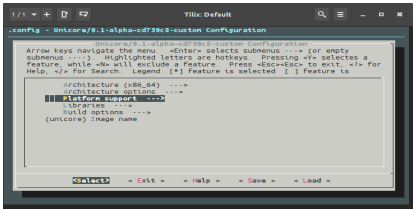

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- Add dpdk specific configuration file.

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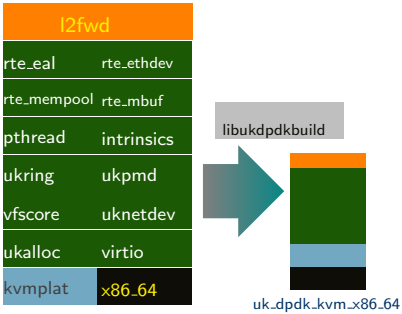

Unikraft as EAL in DPDK

Specialize the Guest OS

- Memory management
- Bus/Device Management
- CPU Scheduling and CPU Features

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Memory Management

- Unikraft: flat page table since boot
- Huge pages based 2MB sized pages
- Memory region can be explicitly assigned to the Application
- Custom memory allocator per memory region

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Bus/Device Management

- A simpler bus/device interface
- Directly attached device and usable by DPDK with unikraft

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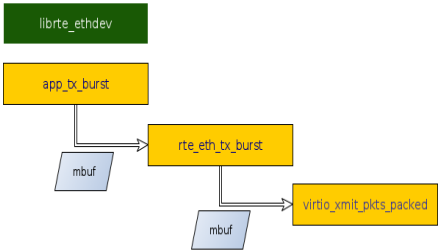
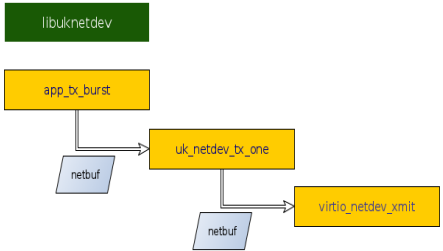
CPU Scheduling and CPU Features

- Application decides on scheduling on the core.
- Minimal interference / resource usage for other purpose within guest.

Interface between Unikraft and DPDK





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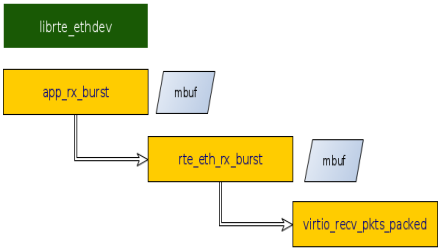

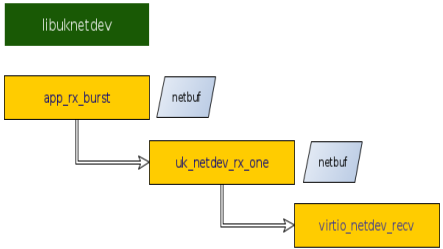

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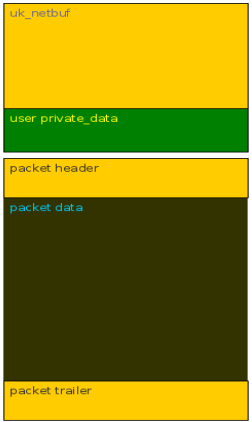

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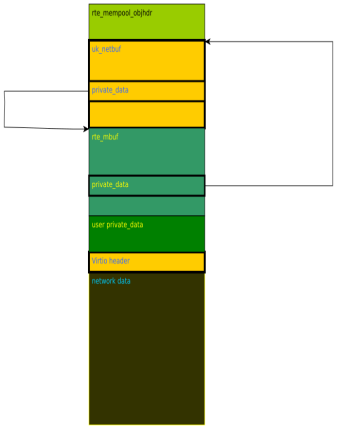


Test Setup

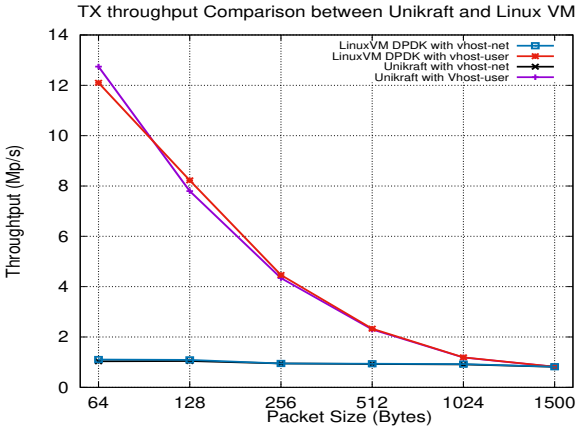
Unikraft/Linux GuestVM Setup

- CPU Family: Sandy Bridge (Server) (Family: 6 and Model: 45)
- CPU Model: Intel(R) Xeon(R) CPU E5-1650 0 @ 3.20GHz
- Nr of Cores: 6
- RAM : 16GB
- Nr of NUMA nodes: 1
- Host Linux Kernel: Debian 4.19
- Guest Linux Kernel: Debian 4.19
- Qemu Version: 4.0.0
- DPDK Version (vhost-user): 19.08

Packet Generator/Receiver Setup

- CPU Family: Ivy Bridge (Server) (Family: 6 and Model: 62)
- CPU Model: Intel(R) Xeon(R) CPU E5-1620 v2 @ 3.70GHz
- Nr of Cores: 4
- RAM : 16GB
- Nr of NUMA nodes: 1
- Host Linux Kernel: Debian 4.19
- DPDK Version (vhost-user): 19.08

Packet Send: Unikraft vs LinuxVM



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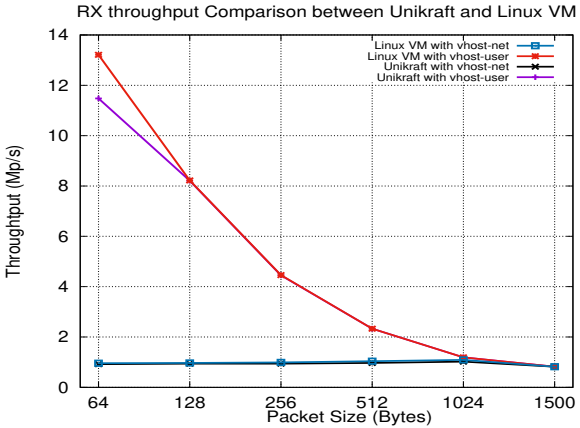

Key Value: Unikraft vs LinuxVM

Linux Guest VM	Unikraft using DPDK(mbuf)	Unikraft using Netdev(netbuf)
6.1Mp/s	6.1Mp/s	6.0Mp/s

Resource Usage: Unikraft vs LinuxVM

Parameters	Unikraft	Linux VM
Memory	1GB	6GB
Boot Times	87ms	12s
Image Size	1.4MB	2.5GB

Future Work

- Add SMP support
- Add NUMA support
- Use DPDK drivers directly

Join us!

Project Home Page

http://unikraft.org

Documentation

http://docs.unikraft.org/

Sources

https://github.com/unikraft

http://xenbits.xen.org/gitweb/ (Namespace: Unikraft)

What we think

Unikraft

- Support multiple platforms
- Specialized Guest OS
- Simpler Management Device

- Increased control for an application

DPDK

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