P4 and IO Visor for Building Datacenter Infrastructure Components

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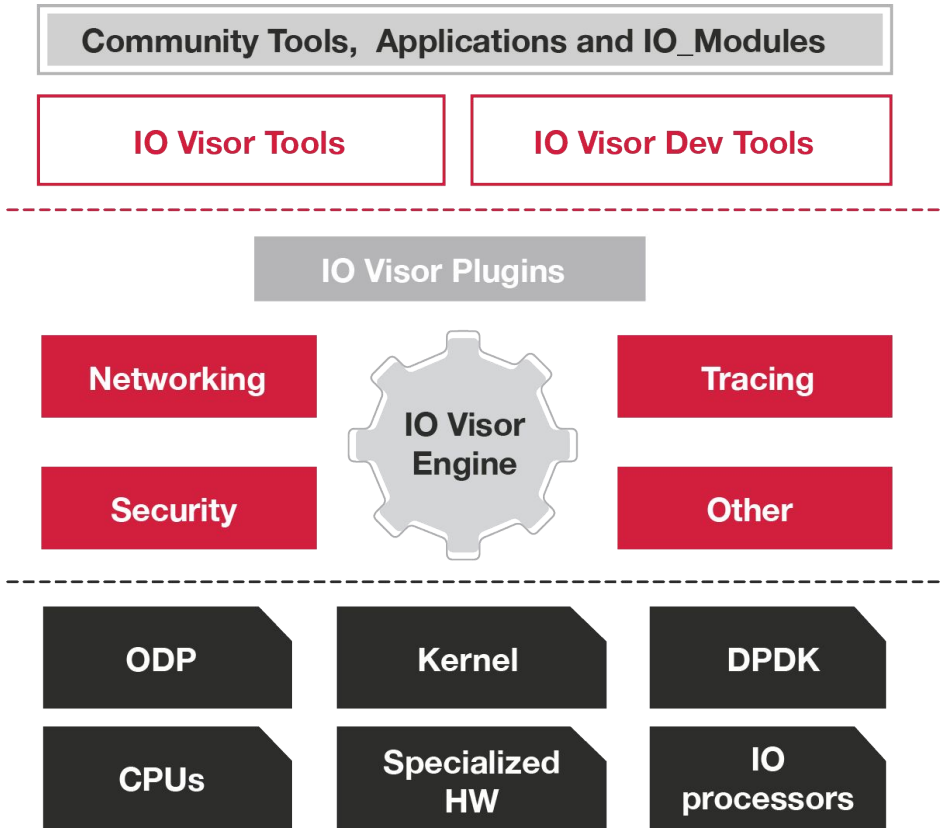
Founding Members

THE LINUX FOUNDATION

Motivation

- Modern flexible datacenter is leveraging programmability in all levels of network hierarchy
- Applications at the network edge create demand for high velocity feature implementation
- Linux based hypervisors and container hosts are fertile ground for quickly developing such features
- but...
- Linux kernel programming is hard

IO Visor Project, What is in it?



- A set of development tools, **IO Visor Dev Tools**
- A set of **IO Visor Tools** for management and operations of the IO Visor Engine
- A set of Applications, Tools and open **IO Modules** build on top of the IO Visor framework
- A set of possible use cases & applications like **Networking, Security, Tracing & others**

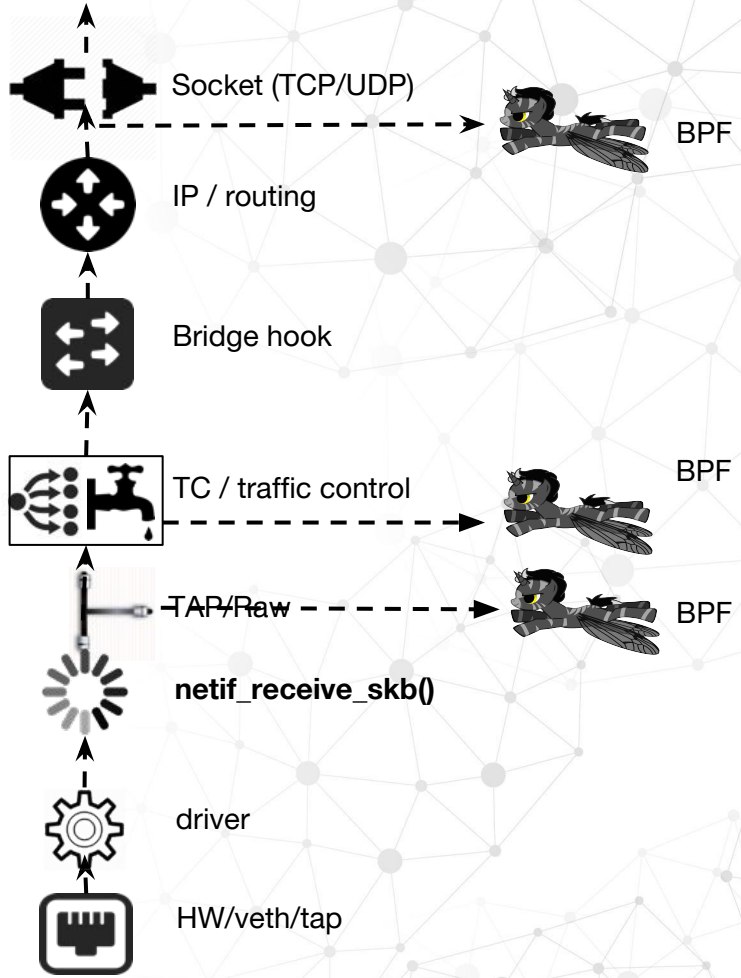
eBPF: Loading New Modules

BPF program written in C

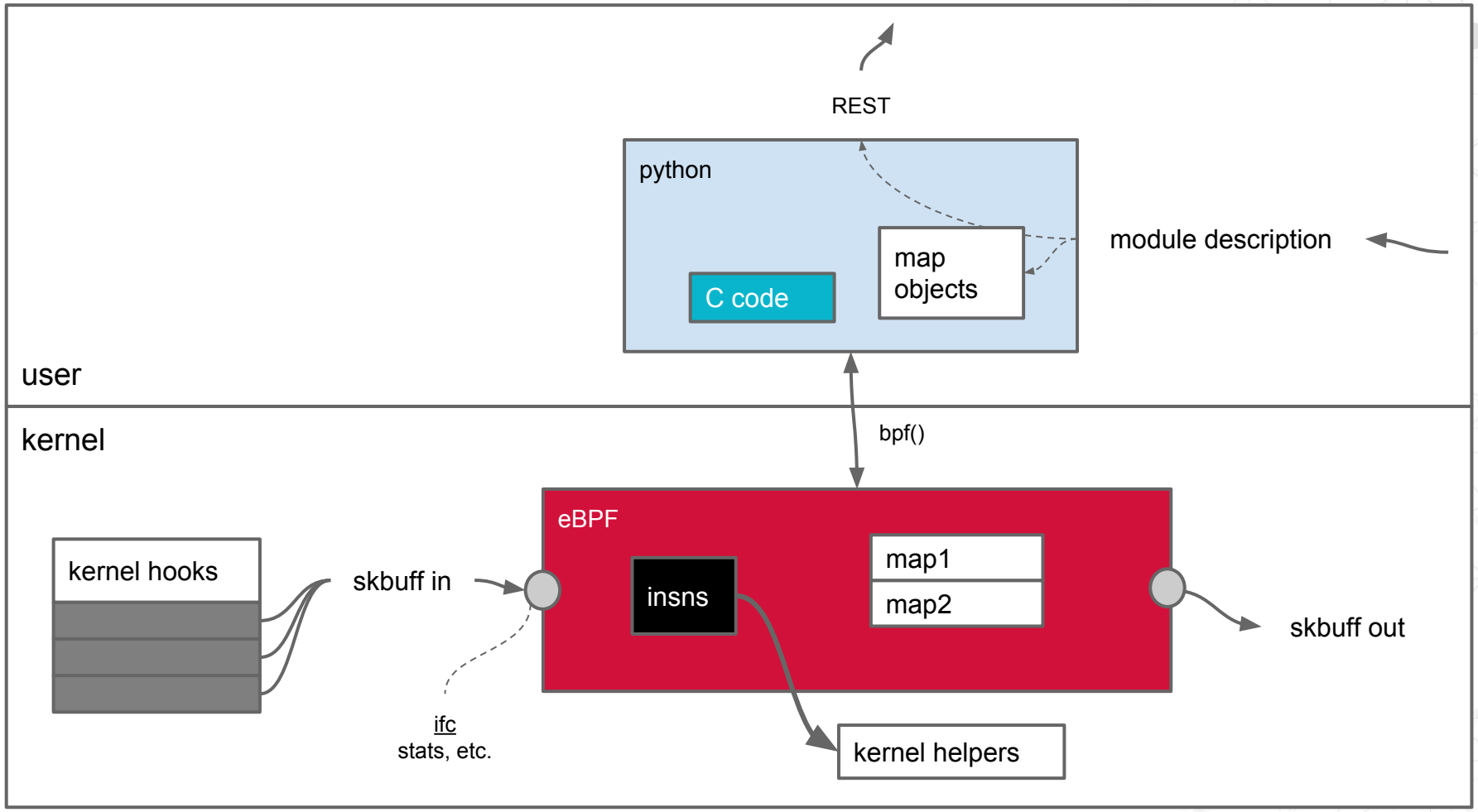
Translated into eBPF instructions (LLVM)

Loaded in kernel
JIT to native instructions

Hooked at different levels of Linux Networking Stack



Components of an IO Module



The eBPF Instruction Set - In Kernel

Instructions

- 10x 64bit registers
- small stack
- 1-8B load/store
- conditional jump
- arithmetic
- function call

Helper functions

- forward/clone/drop packet
- load/store packet data
- load/store packet metadata
- checksum (incremental)
- push/pop vlan
- map lookup/update/delete
  - hash, array, others in future

All upstreamed in Linux Kernel

P4 to eBPF using BCC

P4 Program

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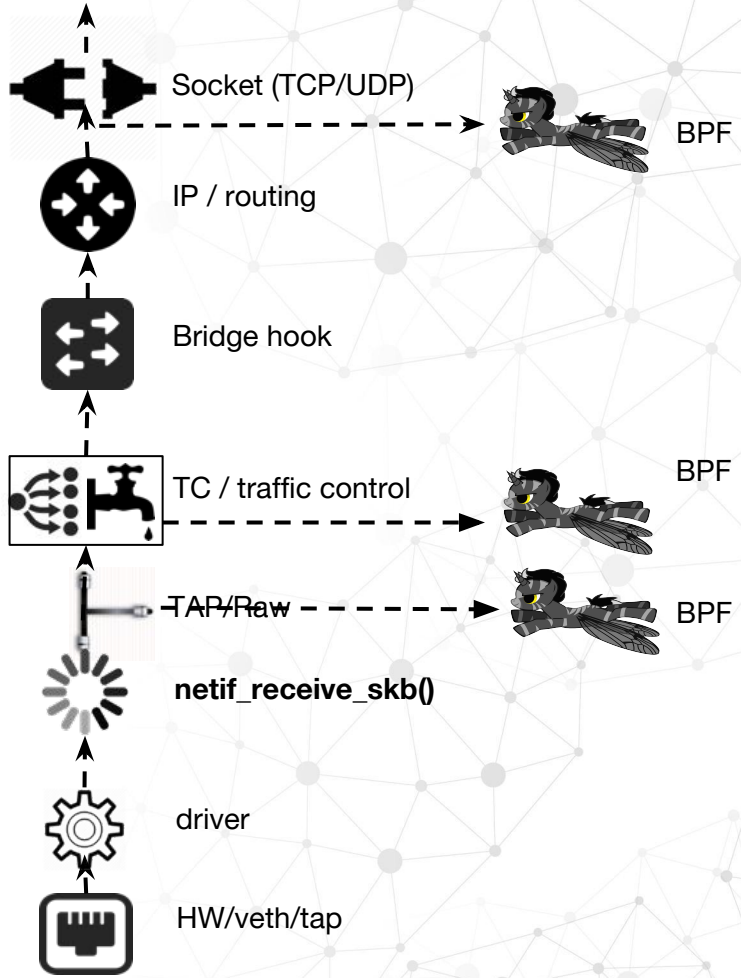
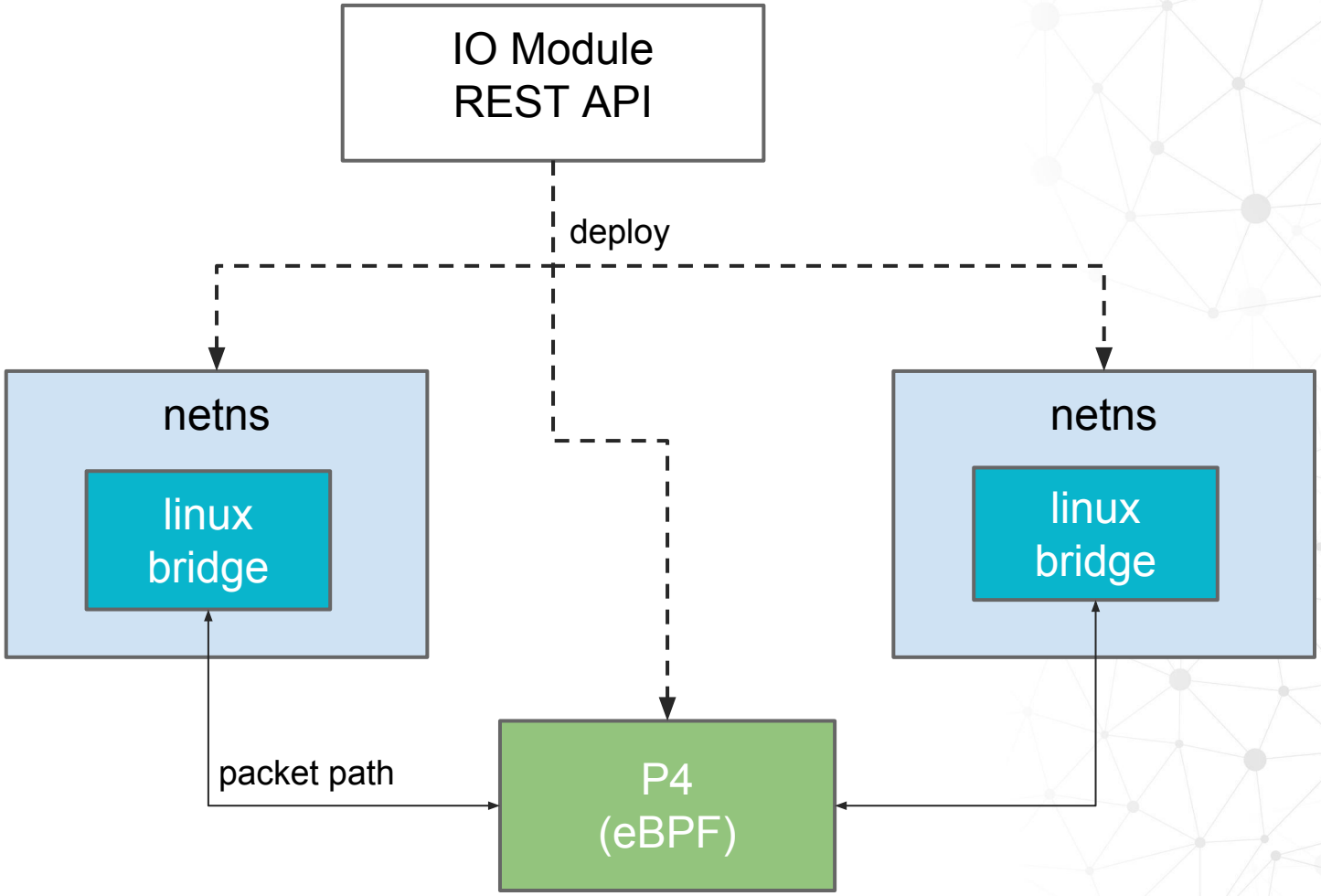


Demo


IO Module
REST API
deploy
netns
linux
bridge
netns
linux
bridge
packet path
P4
(eBPF)

TODO

- Language features
  - Checksum
  - Add/Remove header
  - Ternary/LPM table support
  - Counters/Meters
  - Many other primitive actions
  - v1.1
- Remove C translation step
  - Direct P4 -> LLVM IR
- API for control plane table access
- Write applications!

Learn More and Contribute

- https://iovisor.org
- https://github.com/iovisor
- #iovisor irc.oftc.net
- @IOVisor

Questions