Intel® Network Builders Insights Series

Cloud Native Packet Processing on Kubernetes with the Cloud Native Data Plane (CNDP)

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- No product or component can be absolutely secure.
- Your costs and results may vary.
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Cloud Native Definition

Cloud native technologies empower organizations to build and run scalable applications in modern, dynamic environments such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach.

These techniques enable loosely coupled systems that are resilient, manageable, and observable. Combined with robust automation, they allow engineers to make high-impact changes frequently and predictably with minimal toil.

Cloud Native Computing Foundation (CNCF) – https://github.com/cncf/foundation/blob/main/charter.md

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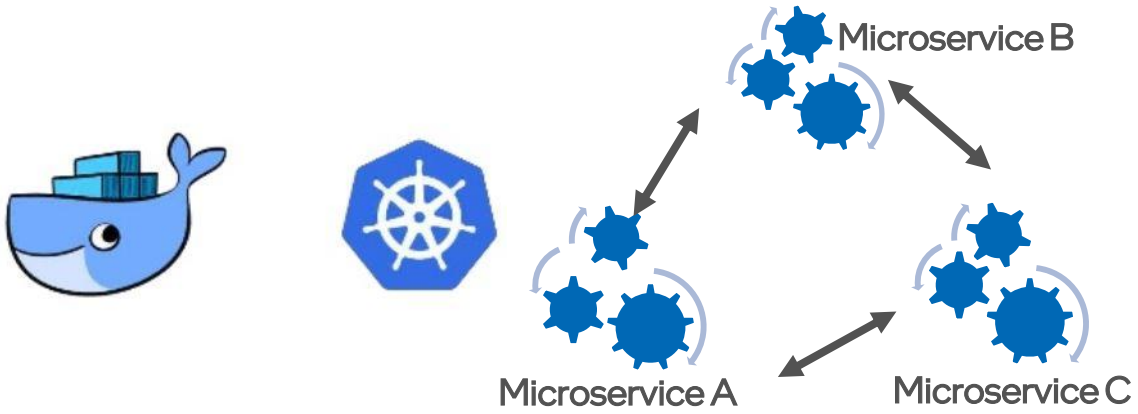
Evolution Toward Cloud Native

SAME GOAL AS NFV. BUILD ON YEARS OF INDUSTRY EXPERIENCE AND USE CLOUD NATIVE TECHNOLOGIES TO ACCELERATE INDUSTRY GOALS

Drive Rapid Innovation with Cloud Native

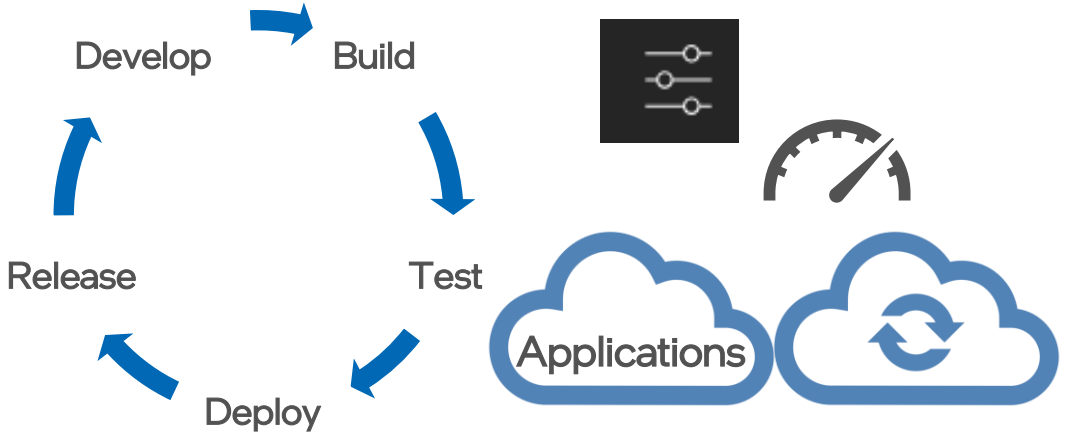
APPLICATION DECOMPOSITION

CONTAINERIZED | MICROSERVICES



LIFE CYCLE AUTOMATION

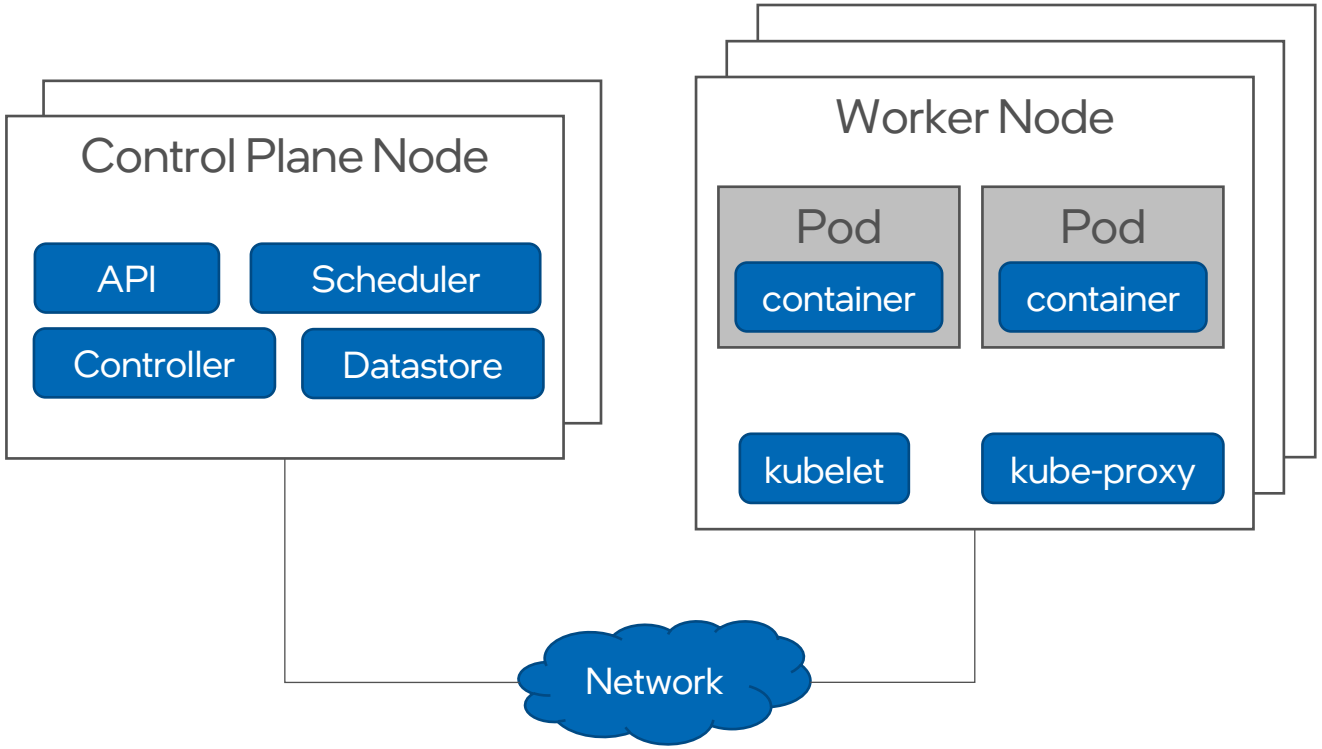
CI/CD | CLOUD MANAGED



CLOUD NATIVE AGILE APPROACH ENABLES INNOVATION AND SERVICES VELOCITY

Kubernetes

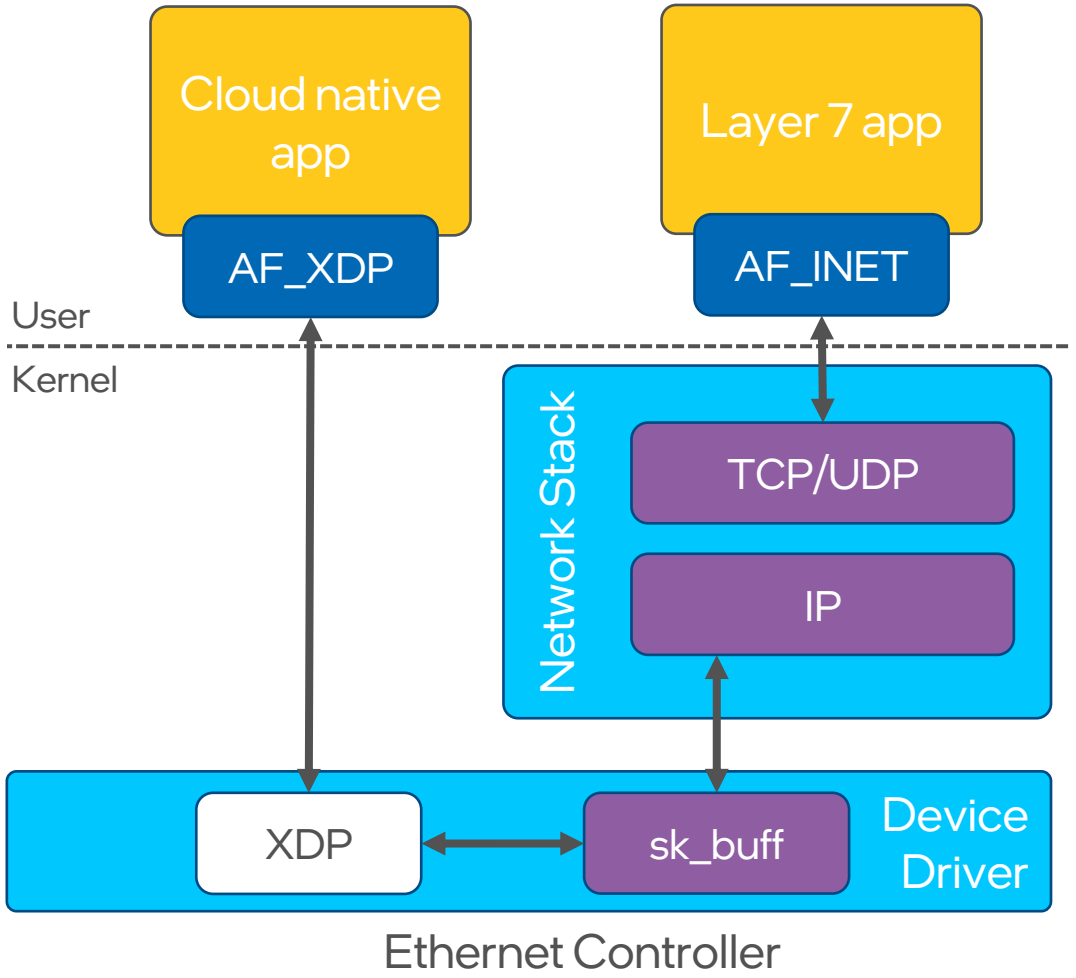
- Kubernetes (K8s) is an open-source system for automating deployment, scaling, and management of containerized applications.[1]
- Control plane manages state of cluster
- Workers run pods



[1] https://kubernetes.io

AF_XDP

- Address family optimized for high performance packet processing
- XDP_REDIRECT action to direct ingress frames to user space
- UMEM shared between kernel and user for zero-copy packet transfer
- First introduced in Linux* kernel version 4.18



https://www.kernel.org/doc/html/latest/networking/af_xdp.html

Cloud Native Data Plane (CNDP)

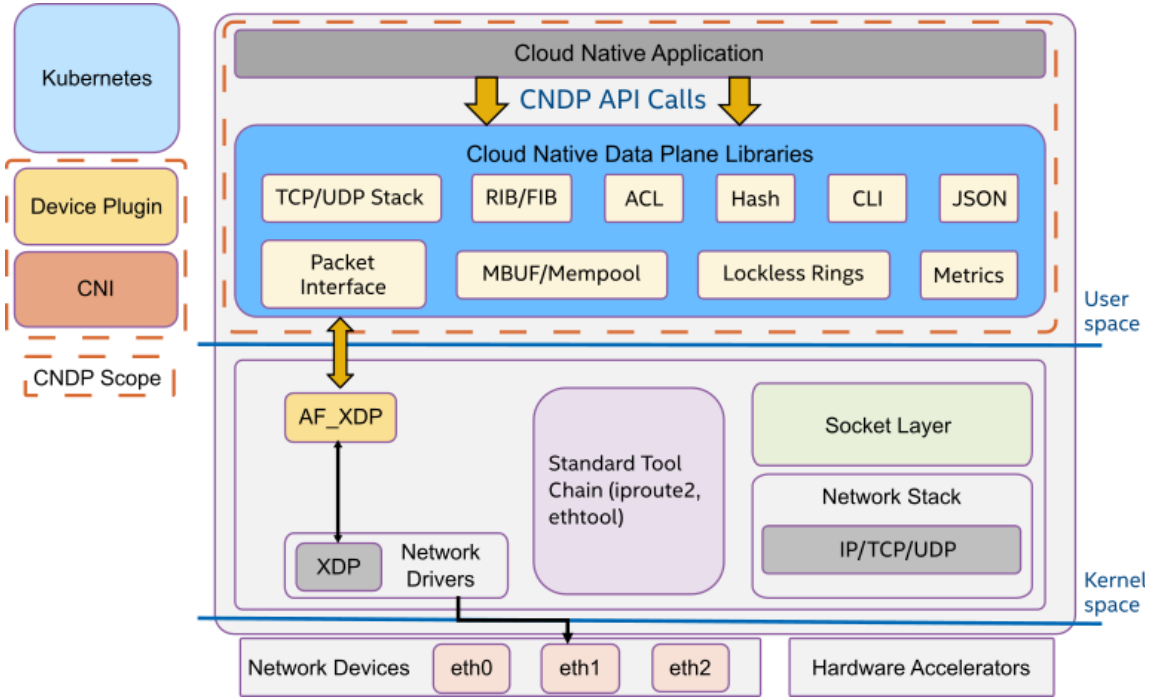
https://cndp.io

Why CNDP?

- Packet processing applications can be difficult to efficiently automate and orchestrate by a cloud native platform, especially when deploying across different environments spanning private, hybrid, and public clouds.
- CNDP addresses this gap by providing a lightweight packet processing framework, designed and built for cloud native applications.

CNDP Introduction

- User space libraries to accelerate packet processing for cloud applications
- Packet I/O layer primarily built on AF_XDP
- Custom TCP/UDP stack and libraries for Buffer Mgmt., RIB, FIB, ACL, Hash, JSON, etc.
- Built-in metrics and telemetry with examples to deploy services on Kubernetes*.



CNDP Libraries

v22.04

Core libs
- cne
- osal
- log
- pktdev
- xskdev
- mmap
- mempool
- ring
- pktmbuf
- txbuff
- hash
- kvargs
- events

Application libs
- cli
- jcfg
- metrics
- ACL
- RIB
- FIB
- DSA
- meter
- thread
- graph
- timer
- utils
- vec
- cthreads
- hmap

Cloud Native Stack (CNET)
- IPv4
- UDP
- Chnl (socket like)
- IPv6 $
- TCP $
- QUIC (quicly)$

Language bindings
- Go: Metrics, Prometheus
- Rust: Metrics, wireguard

K8s
- Ansible playbooks
- CNI
- Device Plugin

$ - WIP

PMDs
- AF_XDP
- Ring
- memif
- af_packet

Functional Test
- testcne

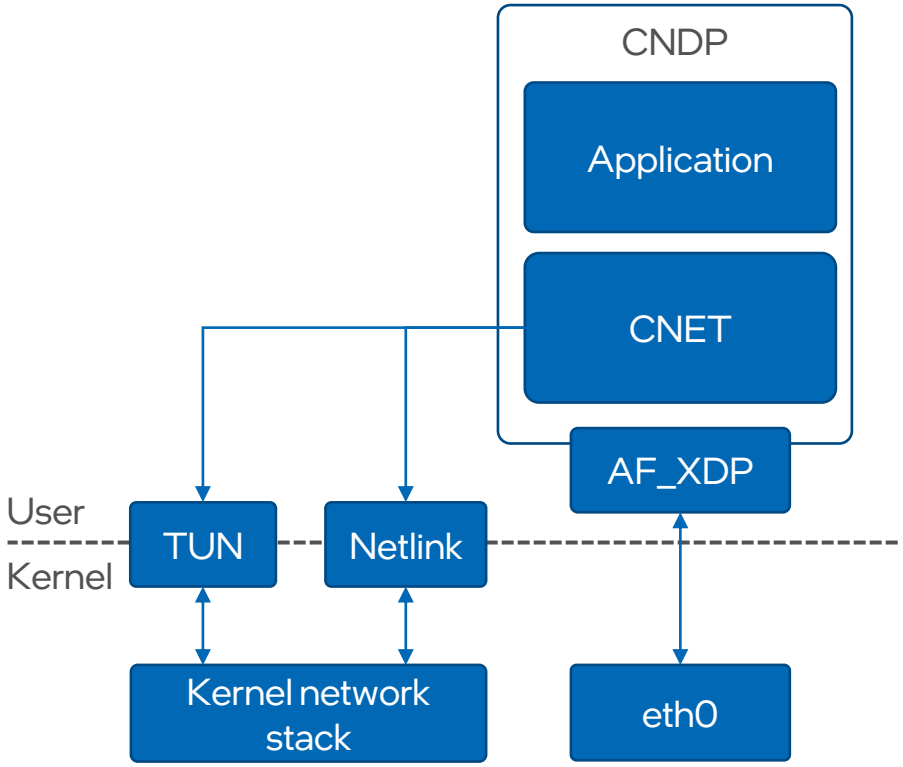
Traffic generator
- txgen

Examples
- cli
- helloworld
- l3fwd-graph
- phil
- cnet-graph
- timer
- vpp-plugin
- cnet-quic
- dlb-test
- ibroker
- cndpfwd

docs
- docker
- API
- guides

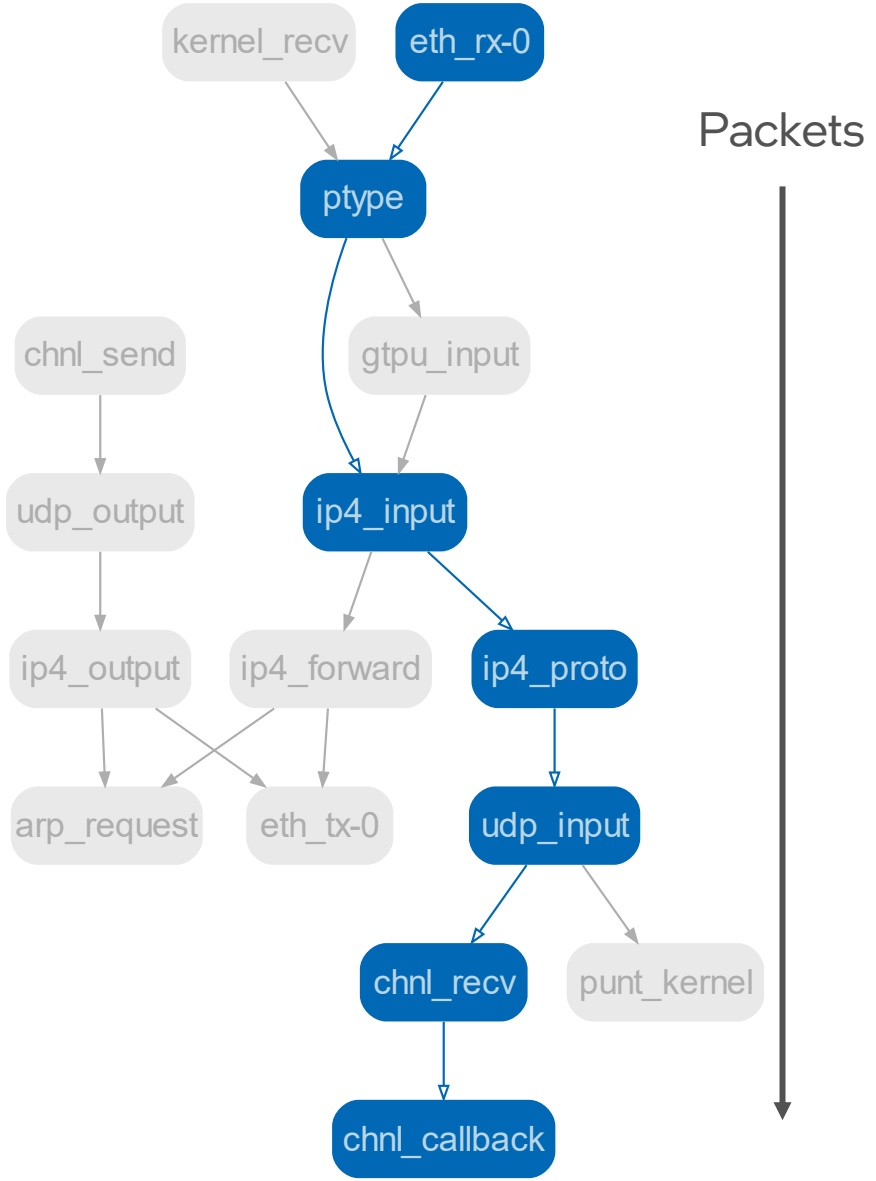
User Space Network Stack

- CNDP network stack (CNET) written as a set of graph nodes
- Sockets-like interface (called channels) with zero-copy
- Configuration uses standard Linux command line tools with Netlink reflector
- UDP/IPv4 (v22.04), TCP/IPv6 (TBD)
- QUIC example using quicly (https://github.com/h2o/quicly)

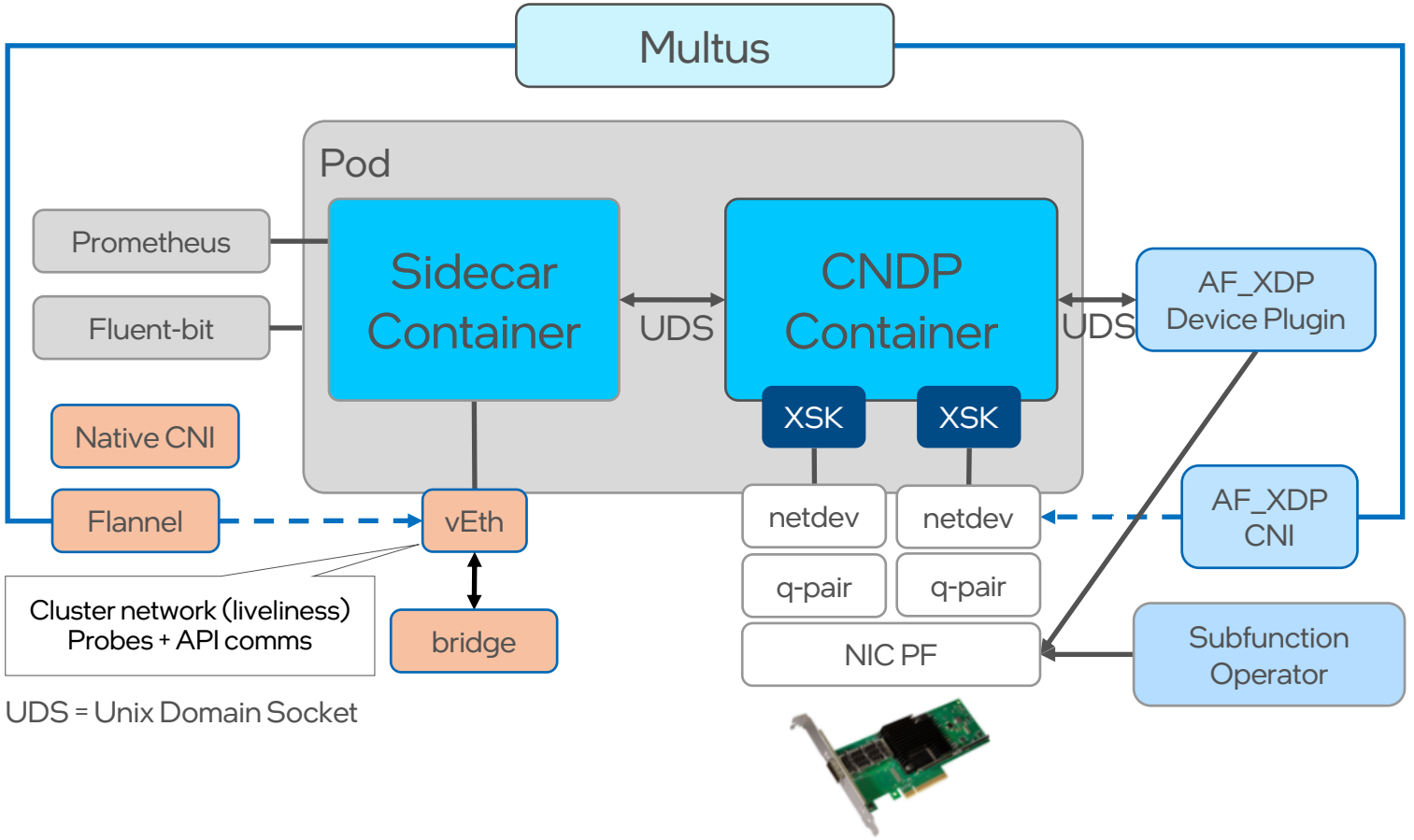


User Space Network Stack

- Packets pass through a directed graph, where each graph node processes multiple packets at a time.
- Highlighted example shows IPv4 UDP host receive path from Ethernet input (eth_rx-0) to Channel receive (chnl_callback).



AF_XDP Device Plugin and CNI



Summary

Cloud native is an application development approach that uses cloud computing delivery models

Working with existing and evolving Linux and Kubernetes mechanisms, we achieve a balance of performance and abstraction for container network functions

CNDP provides a framework to develop cloud native packet processing applications

Find Out More

LEARN

About Kubernetes Networking Technologies, please click on:

https://networkbuilders.intel.com/intel-technologies/container-experience-kits

About Network Transformation Solutions, please click on:

https://networkbuilders.intel.com/network-technologies/network-transformation-exp-kits

EXPLORE

About the Containerized 5G Core, please click on:

https://www.intel.com/content/www/us/en/communications/why-containers-and-cloud-native-functions-paper.html

Free foundational 5G training from Intel® Network Academy *

https://networkbuilders.intel.com/university/coursescategory/intel-network-academy

* Registration required

ENGAGE

Intel Containers Bare Metal Kubernetes Reference Architecture

Container Bare Metal for 2nd Generation Intel® Xeon® Scalable Processor Reference Architecture

Please contact your Intel representative

Questions?

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Join Us Next Time

June 1st @ 8am PDT


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