Examples of Open Programmable Infrastructure (OPI) using IPDK

Intel Innovation - Sept 28 2022

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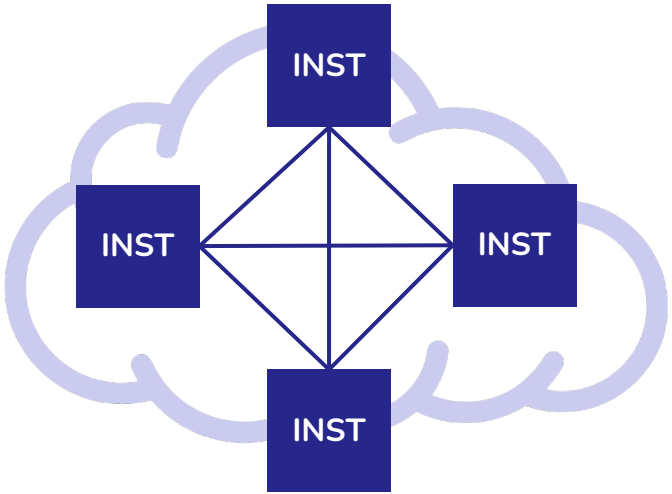
OPEN PROGRAMMABLE INFRASTRUCTURE PROJECT

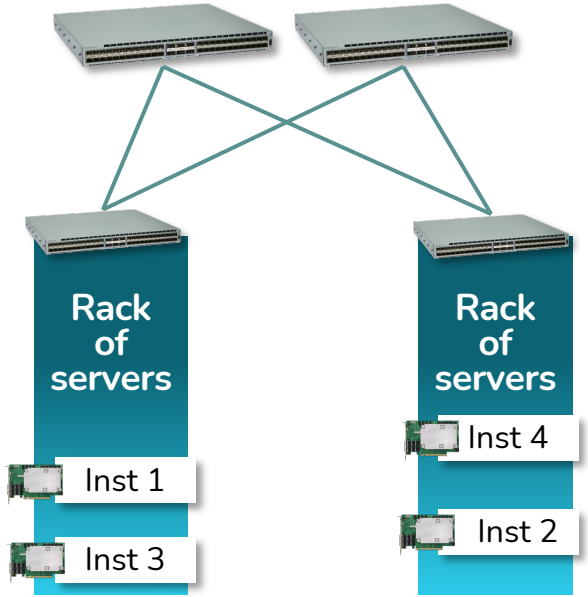
What is Infrastructure?

Tenant's Instances



Infrastructure-as-a-Service
Virtual Resources
Cloud Semantics
Enhanced Services

Provider's Physical Resources



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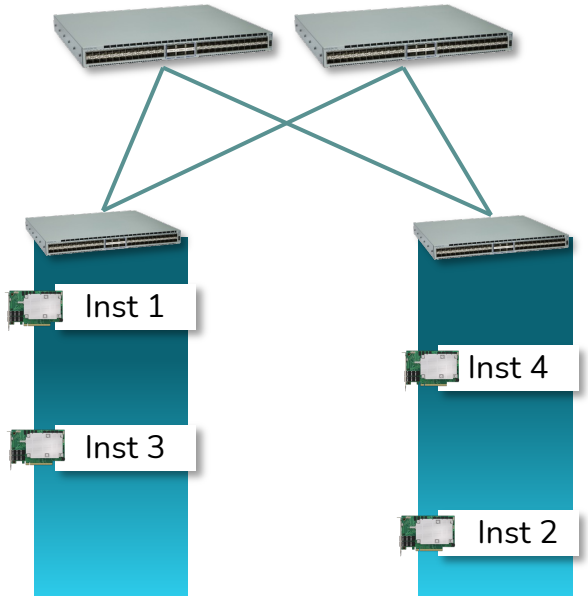
What is Infrastructure Programming?

Tenant Requirements

24 instances
Split across 2 networks
Assign disks
Assign virtual accelerators

Service Provider Abstraction

Virtualization
Placement
I/O Connectivity
Security
Resiliency



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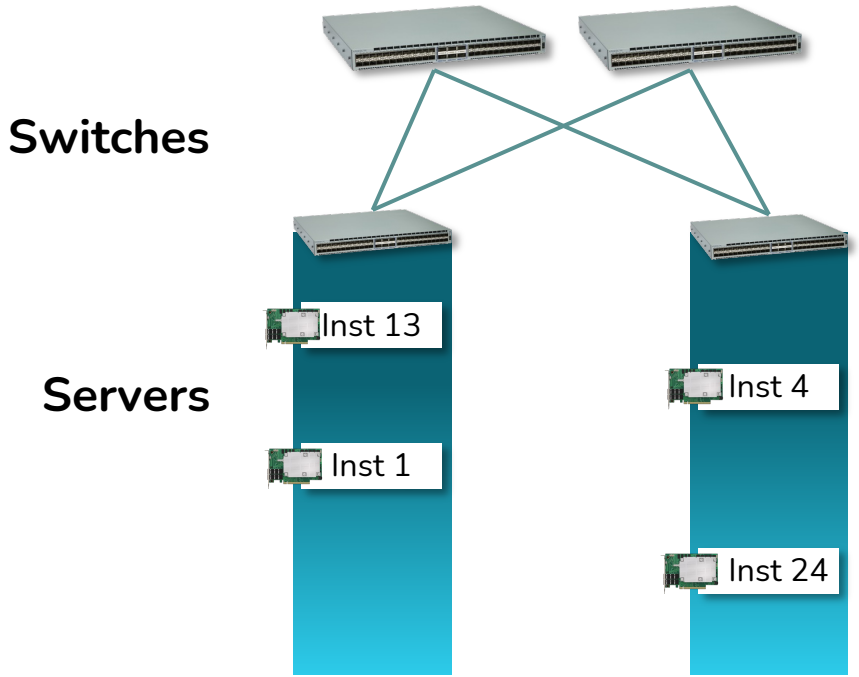
What is Programmed?



New!
DPUs & IPUs

The objective of the Open Programmable Infrastructure Project is to foster a community-driven standards-based ***open ecosystem*** *for next generation architectures and frameworks based on* ***DPU/IPU-like technologies****.*

https://opiproject.org https://github.com/opiproject

https://lists.opiproject.org/g/opi

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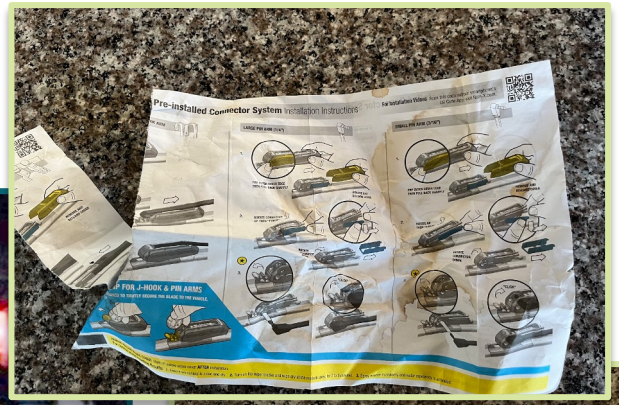
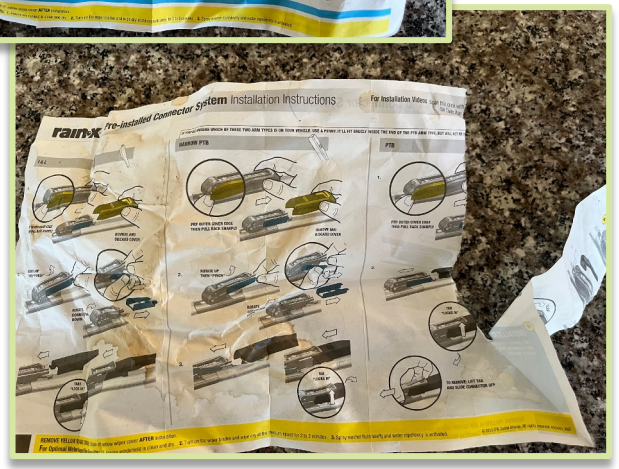
Why OPI?



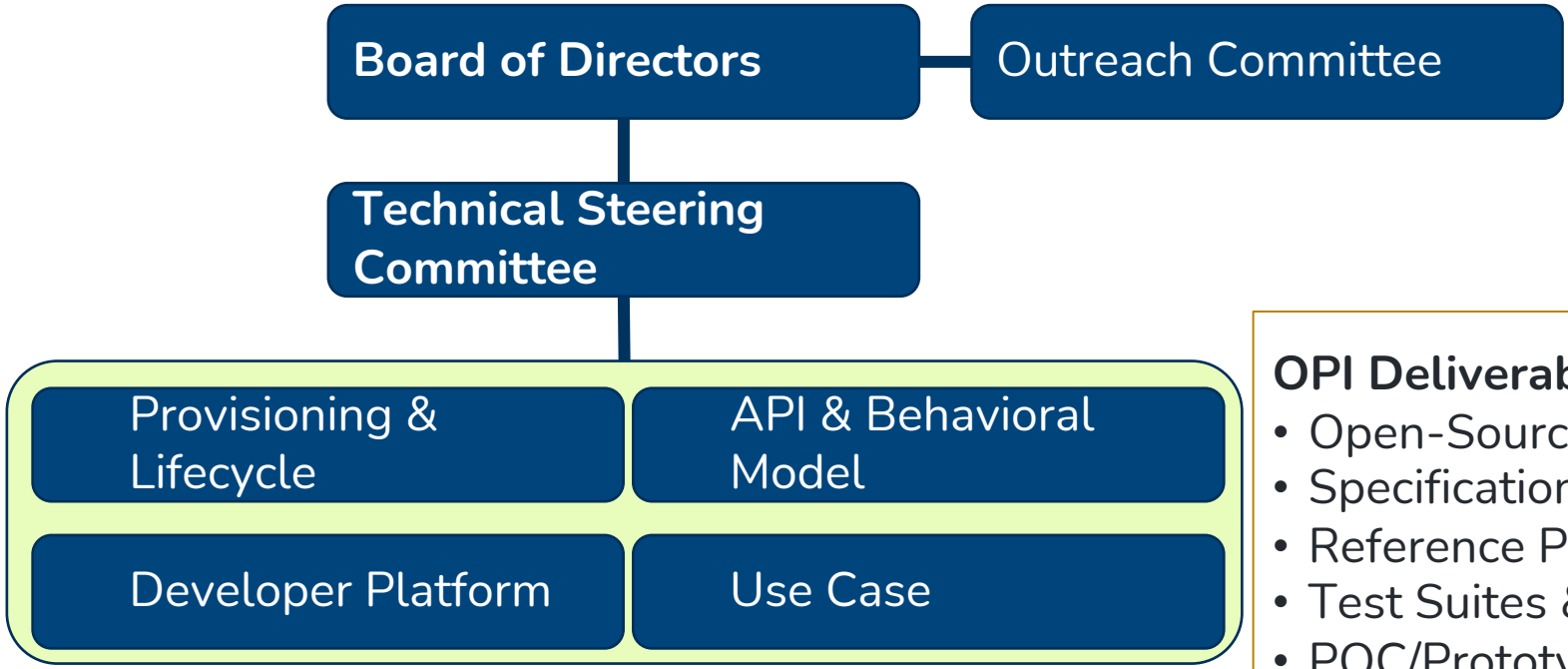


Premier and General Members

Premier

General

OPI Overall Structure



OPI Deliverables

- Open-Source Projects
- Specifications/Standards
- Reference Platforms
- Test Suites & Cases
- POC/Prototypes

OPI Working Scope

Platform

- Device Discovery
- Zero Touch
- Zero Trust
- Inventory
- Lifecycle & Updates

API

- Storage
- Network
- Security
- AI/ML Interface

Device Monitoring

- Open Telemetry (OTEL)
- Metrics
- Logs
- Tracing

Developer Platform

- Real devices & emulation
- CI/CD pipeline

Use Cases

- Driven by End Users
- Requirements

Open DPU/IPU Ecosystem

OPI APIs
Common
Components & Tools

Common Governance

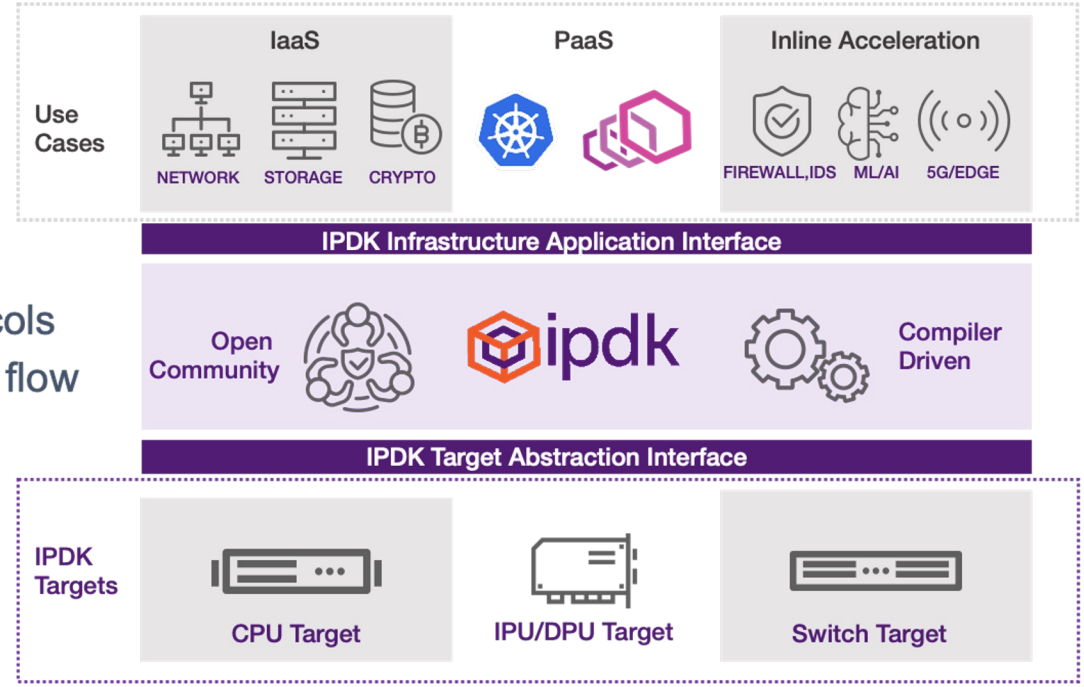
Implementation Across CPU, DPU, IPU & Switch

An Implementation of OPI

OPEN PROGRAMMABLE INFRASTRUCTURE PROJECT

Infrastructure Programmer Development Kit (IPDK)

- Open source abstraction layer
- Runs across multiple platforms
- Standards Based Accelerations
  - P4 to program the network
  - SPDK for customized storage protocols
  - DPDK or eBPF to accelerate packet flow
  - OVS, SONIC, INT with Deep Insight



P4 SPDK eBPF DPDK SONiC

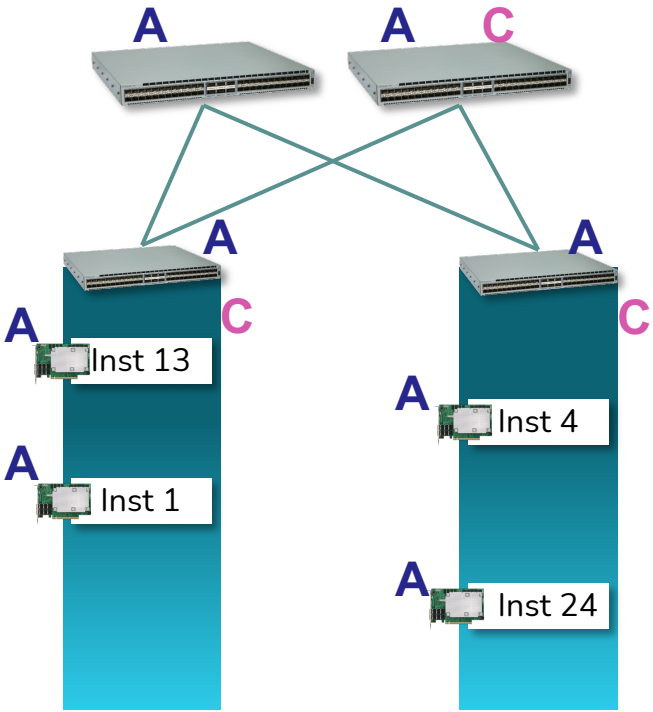
Example 1: SD-Fabric

SD-Fabric Agent (A)

Uses IPDK for:

- Common Runtime Environment
- Consistent APIs across DPU, IPU & Switch

Communicates w/ SDN Controller (C)



SD-Fabric Controller (C)

Uses IPDK for:

- Common Runtime Environment

Manages physical network

Virtualizes resources for tenant usage

Enforces security & QoS

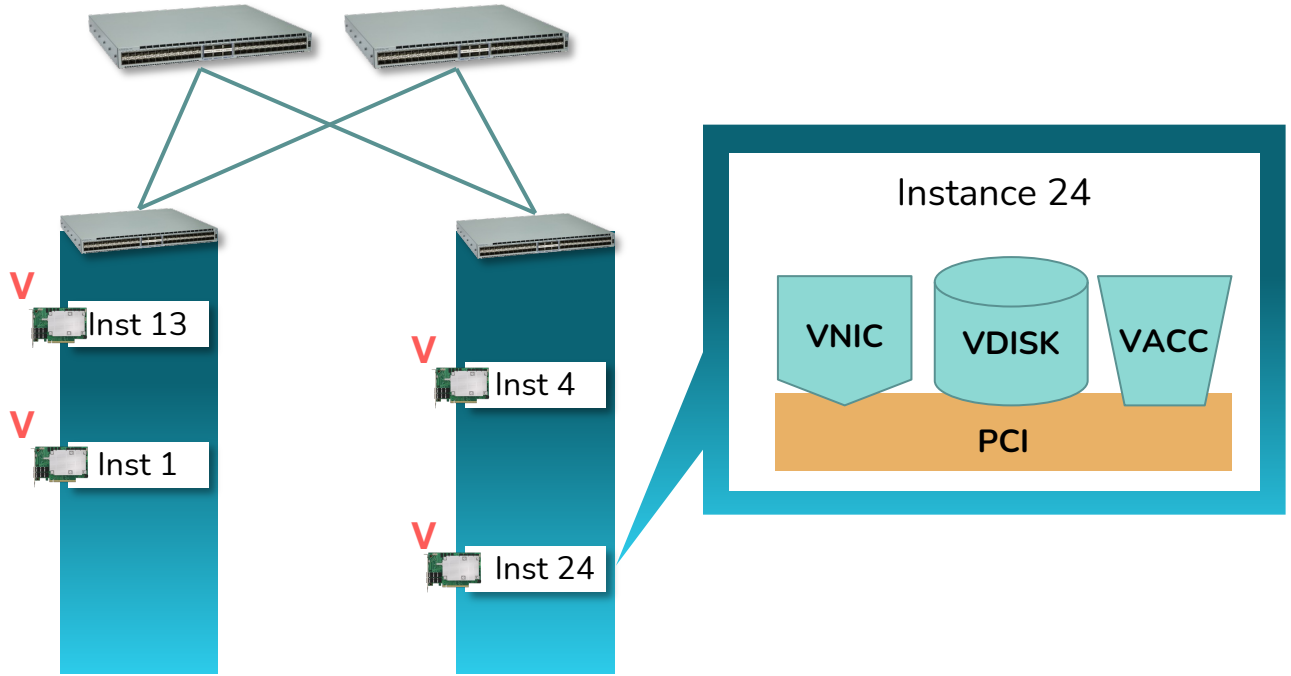
Provides network resiliency

Example 2: Virtual Devices

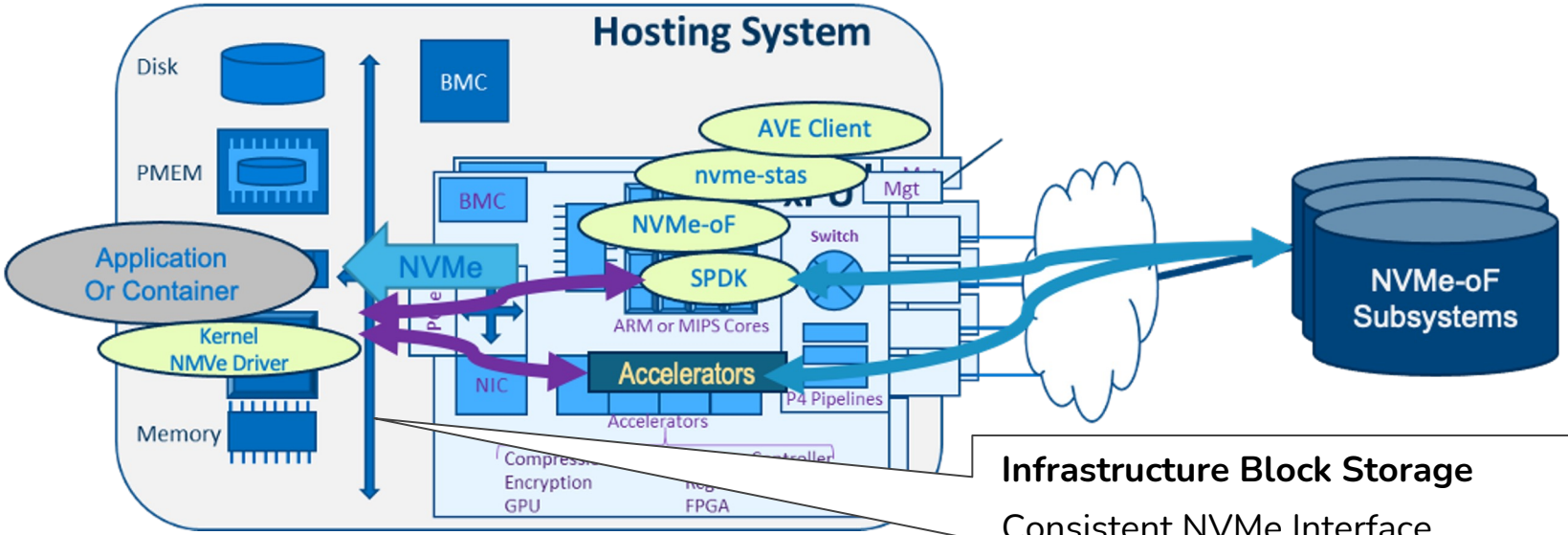
vDevice Agent (V)

Uses IPDK for:

- Common Device Models (Virtio, NVMe, ...)
- Hardware Isolation & QoS
- Integration w/ SPDK, DPDK & Open vSwitch



Example 1: NVMe over Fabric



Two Interfaces:

- Interface into the Server (NVMe)
- Interface into the Infrastructure (OPI APIs)

Infrastructure Block Storage

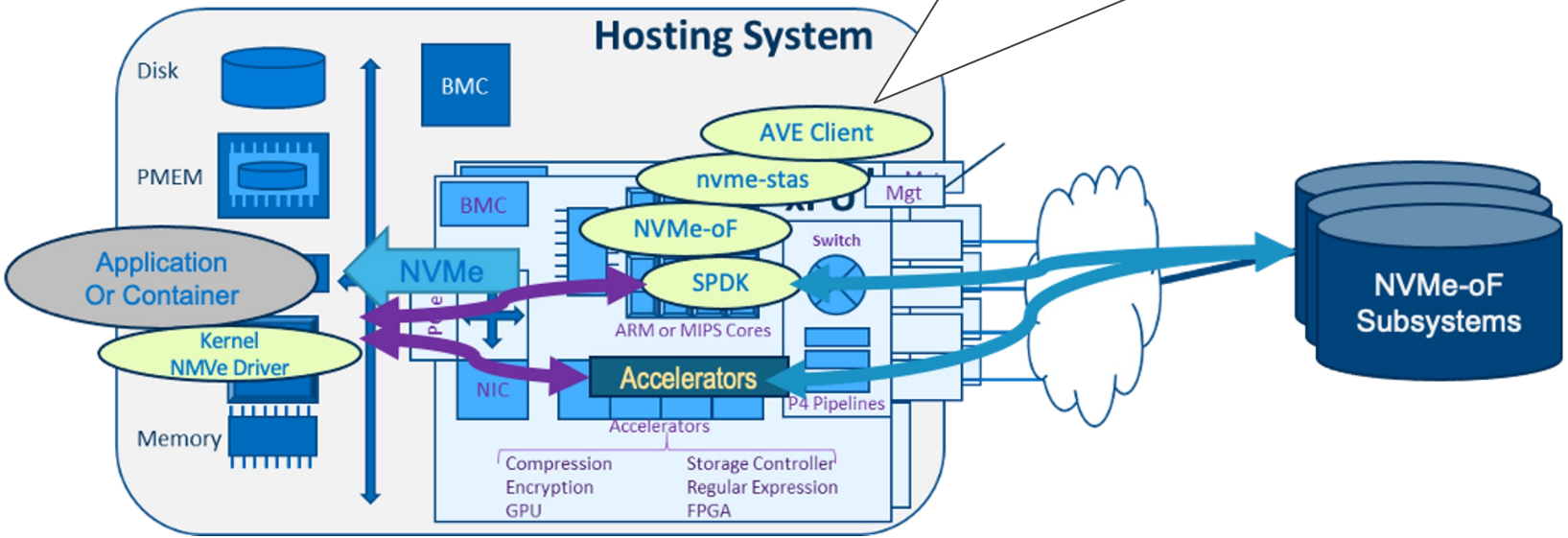
Consistent NVMe Interface

- Hardware-based Isolation, Encryption & Security
- Resilient & Always Available I/O

Virtual NVMe Disks Use Case

Common OPI API's allow:

- **Common** configuration
- **Choice** in device (DPU/IPU)
- **Consistent** and transparent host interface



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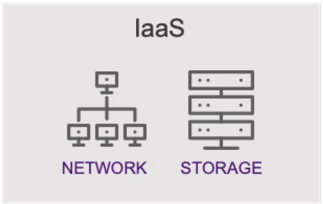
IPDK Release: July 2022 (22.07)



Virtual Networking & Storage

Create devices, insert into VMs, containers and/or bare metal hosts

Target Agnostic

Software target on ipdk.io

22.07 Hardware Platforms:

- Intel Tofino Switch
- Intel IPU C500X
- Intel IPU ES2100

P4 SPDK

Programmable

Open vSwitch w/ P4

SPDK Using NVMe/TCP

ipdk Infrastructure Programmer Development Kit

https://github.com/ipdk-io/ipdk/releases

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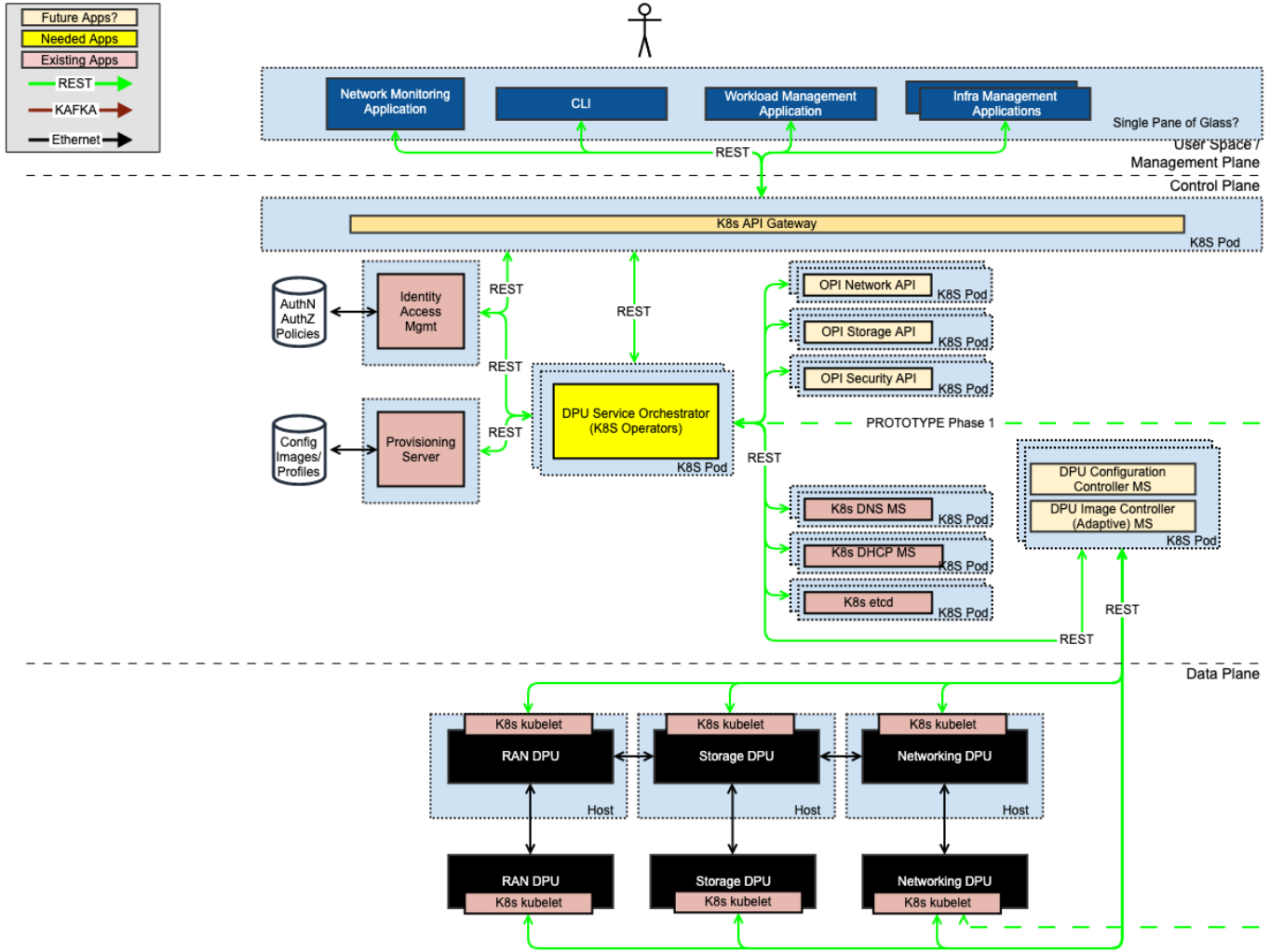
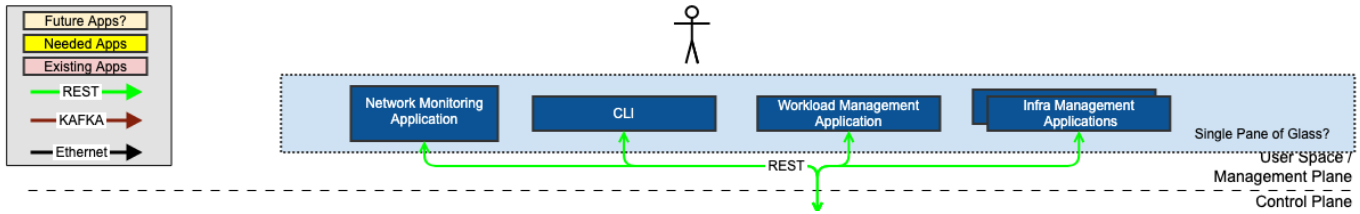
Example 4: Service Provisioning



Service Provisioning

- tl;dr it's complicated!
- Need standardization so that different platforms can run different services
- OPI is a unique opportunity to drive standardization across DPU & IPU



Call To Action

Applications can start to enable device features
Devices can join the ecosystem as targets
Developers can bring use cases & requirements

This effort is for developers to make it an order of magnitude easier to deploy in the cloud and at the edge with better performance, higher scale and hardware-based security.

Call to Action

Anyone can participate and contribute to the OPI Project

1. **To Participate,** check out the OPI Mailing List, and the OPI Slack channels.
   a. Join the subgroup lists and channels in which you would like to participate.
   b. Join the project meetings via the invites found here.
2. **Contribute** by following the steps here on GitHub.
3. **Become a Member** and support the OPI Project at the Linux Foundation link.
   a. Open Programmable Infrastructure would not exist without the support of the member organizations.

opiproject.org - Project website
Join our slack - link on the website

https://github.com/opiproject

ipdk.io - website

https://github.com/ipdk-io

Linux Foundation link to join the project

https://enrollment.lfx.linuxfoundation.org/?project=opifund

THANK YOU!