What is Infrastructure?

Tenant's Instances

Provider's Physical Resources

infrastructure-as-a-service
virtual resources
cloud semantics
enhanced services
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

Inst 1

Inst 2

Inst 3

Inst 4
What is Programmed?

Switches

Servers

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/q/opi
Why OPI?
Premier and General Members

Premier

- DELL Technologies
- f5
- intel
- KEYSIGHT TECHNOLOGIES
- MARVELL™
- NVIDIA
- Red Hat
- Tencent
- ZTE

General

- DreamBig SEMICONDUCTOR
- SolidRun
- Unifabrix
OPI Overall Structure

Board of Directors

Outreach Committee

Technical Steering Committee

Provisioning & Lifecycle

API & Behavioral Model

Developer Platform

Use Case

OPI Deliverables
• Open-Source Projects
• Specifications/Standards
• Reference Platforms
• Test Suites & Cases
• POC/Prototypes
# OPI Working Scope

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<th>API</th>
<th>Device Monitoring</th>
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<td>○ Storage</td>
<td>○ Open Telemetry (OTEL)</td>
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<td>○ Zero Touch</td>
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</table>

## Developer Platform
- ○ Real devices & emulation
- ○ CI/CD pipeline

## Use Cases
- ○ Driven by End Users
- ○ Requirements
Open DPU/IPU Ecosystem

Implementation Across CPU, DPU, IPU & Switch

Common Governance

OPI APIs
Common Components & Tools

An Implementation of OPI
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
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
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

Programmable
Open vSwitch w/ P4
SPDK Using NVMe/TCP

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

Linux Foundation link to join the project
https://enrollment.lfx.linuxfoundation.org/?project=opifund
THANK YOU!