OPI Event – Open D/IPU API

Need for Common Interface Framework
Multiple Vendors
Solutions and Ecosystems

• Vendors
  – NVIDIA
  – Pensando
  – Intel
  – Marvell
  – Xsight
  – Fungible
  – AMD/Xilinx
  – ...

• Cards and Silicon
  – Bluefield, Bluefield2
  – DSC-25/100, DSC-200
  – Mt Evans
  – CN9xxx
  – Octeon 10
  – FC50, FC100, FC200
  – ...

• Ecosystems
  – DOCA
  – IPDK
  – Various Marketplaces
DPU/IPU Roulette
Multiple Behaviors, Multiple Interfaces, Multiple Frameworks

- High Level Behavioral Models
  - SDXI (SNIA)
  - DASH
  - Redfish (DMTS)
  - OpenBMC
  - OpenConfig

- Low Level
  - Vendor SDKs
  - Pipeline interfaces
  - DPDK
  - SPDK
  - RegEx

- Internal Vendor System Level
  - DOCA
  - IPDK

- Operating Environment (Linux)
  - Container
  - OS Acceleration (eBPF)

- Service Specific
  - Networking
  - Storage
  - Security
  - Gateway
  - Accelerator (AI/ML)
  - Telemetry

- Lifecycle Management

- Need a community agnostic API set to provide a common behavioral interface set for the DPU/IPU multi-vendor ecosystem
Key Use Cases for D/IPU

0. **Better / Distributed Security (cross-cutting use-case)**

1. **Network Offload and Disaggregation**
   - Virtualize the ToR and offload network functions

2. **Storage Offload and Disaggregation**
   - Offload storage functions

3. **Bare Metal**
   - Utilize as a Bare Metal Controller

4. **Edge/5G**
   - Offload I/O intensive functions

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**Diagram Details:**
- **Server**: VMs, OS, DPU/IPU, vSwitch
- **Storage Services**:
  - Local Storage
  - Remote (NVMe-oF)
- **DPU/IPU**:
  - Resource Mgmt.
  - Security
  - Local IO Control
- **Device**: vSwitch, SDS, NVMe-oF
- **Networking Control**
  - NW Function Control
  - vNIC, vDPA, DPDK, vDPA, SR-IOV
- **OS**: Host OS, NW Function Control
- **Remote Storage**: SDS, Local Storage, Remote Storage

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Need for an Open API for D/IPU

- Define standard mechanisms for Service Deployment
- Support of a Multi-Vendor Open D/IPU API definition and adoption for
  - Storage Services
  - Network Services
  - Security Services
  - AI/ML
  - Telemetry
  - System and Lifecycle Management
- Reuse Existing or define new common APIs for Configuration, Management and Consumption
Top Level Framework View

DPU/IPU APIs

- Network
  - Network overlay offload
  - Virtual switch offload
  - Programmable pipeline offload
- Storage
  - NVMe offload
  - Data Encryption offload
  - Storage Offload (PowerFlex)
  - Data Compression
- Security
  - Network Security offload
  - Firewall offload
  - Security air-gap
  - Key handling
- Other Functions
  - Telemetry proc. offload
  - Control Plane offload
  - 5G offload
  - Hypervisor offload

DPU/IPU SW Infrastructure

- Common API (Networking, Storage, Security, Gateway, AI/ML, Telemetry)
- Network Container
- Storage Service Containers
- Security Service Containers
- Accelerator Containers
- Other Service Containers
- Container framework
- Vendor SAI, SDK
- Vendor SDK
- Base Linux distribution

DPU/IPU HW

- Low power CPU cores e.g. ARM
- PCIe switching w/ SRIOV
- Embedded network switch
- 2-8+ external ports
- Encryption acceleration
- Protocol acceleration e.g. TOE, NVMe-oF
- Compression acceleration
- Programmable pipeline
- Regular expression, hash
- Secure key store/generation
- Optional FPGA, GPU
- Time protocol/SyncE

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## API Scope

<table>
<thead>
<tr>
<th>System</th>
<th>Operating System (Linux)</th>
<th>Hardware (PCIe...)</th>
<th>Low Level APIs</th>
<th>Vendor Unique API &amp; SDK</th>
</tr>
</thead>
</table>
| • Systems Management & Lifecycle  
  • Monitoring, Metering, & Telemetry | • Standard Linux Libraries and packages  
  • Container and Application Hosting | • Virtual Function Mapping  
  • Offload Configuration | • Micro-Code in Data Flow Processing Cores  
  • P4 Packet Processing Pipelines  
  • Leverage commonly used APIs  
  • DPDK, SPDK, EBPF | • These are NOT common/Open APIs  
  • DOCA, ASAP2, SNAP |

<table>
<thead>
<tr>
<th>Storage</th>
<th>Networking</th>
<th>Gateway</th>
<th>Security</th>
<th>Other Groupings such as Accelerators, AI/ML, etc.</th>
</tr>
</thead>
</table>
| • Networked Storage  
  • NVMe/TCP  
  • NVMe/RoCE(RDMA)  
  • Storage Services  
  • RAID/Erasure Coding/etc  
  • Compression  
  • SDXI Offload | • SONiC  
  • OpenConfig (includes BGP, etc)  
  • SAI implementation by the DPU  
  • Policing and QoS and SLA  
  • Multi-tenant Overlay  
  • Host facing NIC Configurations  
  • OVS | • Connection Tracking  
  • Load Balancing  
  • NAT  
  • Tunnels | • Policy & Filters  
  • Crypto Offloads  
  • Secure Storage  
  • keys, secrets, attestation, ...  
  • Key Management  
  • Network security offload  
  • (TLS, IPSec)  
  • RegEx matching | |

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Open Programmable Infrastructure API Model

- Conceptual initial view of the API breakdown of services available in the D/IPU platforms
- Ability to support service chaining to provide the desired operation
Network Services API

• Utilize the OpenConfig model for network service configuration

• Aligns with many Networking OS environments for configuration and management
Storage Service Example
High Level View (One of Many)

• Considerations for Storage API
  1. Setup Network Interface
     - IP Address (IPv4/IPv6), QoS, VxLAN, etc
  2. Create NVMe Subsystem (optional)
  3. Create the Controller
     - For each PF/VF
  4. Create the Namespace for the local or remote storage
     - PCIe, RDMA, TCP
  5. Attach the Namespace to the Controller