OPEN SOURCE NETWORKING DAYS

Accelerate Cloud Native with FD.io

Naoyuki Mori, Ping Yu, Kinsella Ray, Hongjun Ni
Intel

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Agenda

• FD.io*: Cloud native acceleration framework
• Acceleration of Envoy with FD.io* TCP and QAT
• Acceleration of Load Balancing with FD.io* LB
• Summary

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Orchestration & Controller

Data Plane Services
Dataplane Management Agent
Packet Processing

Network IO

Operating Systems

Data-plane Management
Honeycomb
Networking-VPP
Contiv-VPP

Packet Processing
NSH_SFC
PMA Tools
Sandbox
DMM
P4VPP
GoVPP
VPP

Analytics
pnda

Testing/Support
CSIT
Trex

OSV Packaging
debo_dpk
rpm_dpdk

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**FD.io** VPP Overview

### Universal data plane
- Layer 2 – 4 Network Stack
- CP, TM, Overlays and more ...
- Linux (and FreeBSD) support
- Kernel Interfaces (Netmap, FastTap)
- Container and Virtualization support
- Appliance, Infrastructure, VNF & CNF

### Extensible Modular Design
**Architecture**
- Pluggable, easy to understand & extend.
- Mature graph node architecture.

**Plugins**
- Full control to reorganize the pipeline.
- Fast, plugins are equal citizens

### Fast, Scalable and Deterministic
- L2XC - 16+ Mpps per core
- 0 packet drops, ~15µs latency
- Continuous & extensive latency testing.

### Developer friendly
- Runtime counters for everything. (throughput, ipc, errors etc)
- Full pipeline tracing facilities.
- Multi-language API bindings.
- VPP command line introspection.

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FD.io VPP – The “Magic” of Vectors
Compute Optimized SW Network Platform

1. Packet processing is decomposed into a directed graph of nodes …

2. … packets move through graph nodes in vector …

3. … graph nodes are optimized to fit inside the instruction cache …

4. … packets are pre-fetched into the data cache.

Microprocessor

Instruction Cache

Data Cache

Vector on Vector for amplified performance (?)

Makes use of modern Intel® Xeon® Processor micro-architectures.
Instruction cache & data cache always hot ➔ Minimized memory latency and usage.

* Each graph node implements a “micro-NF”, a “micro-NetworkFunction” processing packets.

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Network Function Virtualization to Cloud

Applications are changing... from

Development Process
- Waterfall
- Agile

Application Architecture
- Monolithic
- N-Tier

Deployment & Packaging
- Physical Servers
- Virtual Servers

Application Infrastructure
- Datacenter
- Cloud

DevOps

Microservices

Containers

Serverless / FaaS

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FD.io Cloud Native

Strategic Engagements

- Cloud Native Computing Foundation
  - Infrastructure Lab
- Envoy - TCP/TLS Integration

Commercial Product

- Cisco Container Platform
- More...

Cloud Native Technologies

- kubernetes
  - Production-Grade Container Orchestration
- Contiv-VPP
  - Performance-Centric Container Networking
- LIGATO
  - Cloud-native NF Orchestration
  - Cloud-native NF Agent platform
- FD.io
  - Containerized Fast Data Input/Output

Enabling Production-Grade Native Cloud Network Services at Scale

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FD.io Cloud Architecture: Contiv

- Can deliver complete container networking solution entirely from userspace.
- Replace all eth/kernel interfaces with memif/userspace interfaces.
- Apps can add VCL library for Higher Performance (bypass Kernel host stack and use VPP TCP stack)
- Legacy apps can still use the kernel host stack in the same architecture
FD.io Cloud Architecture: Ligato

- Kubernetes does not provide a way to stitch micro-services together today
- Ligato allows you to wire the data plane together into a service topology
- All services (apps and network functions) run in the same L2 domain
- Network functions can now become part of the service topology

K8s Master

SFC Controller

Contiv-VPP Netmaster

Contiv-VPP Etcdf

Ligato Etcdf

IPv4/IPv6/SRv6 Network

High Performance Apps

Legacy Apps

Cloud-Native VNFs

Kubelet

Agent

Pod

Envoy Sidecar

VPP TCP Stack

Kernel Host stack

tapv2/vet

memif

CNI CRI

SFC Controller

Define Services

Define Topology

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FD.io Cloud Architecture: TCP Acceleration

VCL Library, directs the TCP bit stream to FD.io VPP.
TCP Streams are aggregated in FD.io VPP.

VPP TCP Host Stack

VPP Hoststack is a high performance L4 implementation in SW.

- Best-in class TCP/UDP Performance in Software; applying ‘DPDK’ SW optimization techniques.
- Features:
  - TCP in client & server (active/passive) modes.
  - Common TCP options; MSS, timestamp, wnd scaling, s/ack.
  - Common TCP features; ddos protection, delayed ack, congestion.
  - Support for Cut-Through, Namespaces, Session Tables and TLS.
  - Also support for other Layer 4 protocols such as UDP, SCTP.

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• Industry is moving toward a highly distributed microservices architecture.
• Network should be transparent to applications
• Services are decoupled from each other and communicate with a common service language
• Data plane is composed of a set of intelligent proxies (Envoy) deployed as sidecars. These proxies mediate and control all network communication between microservices, a general-purpose policy and telemetry hub.
• The control plane manages and configures the proxies to route traffic.
Re-architect Envoy network stack with Intel ingredient

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Transparent TLS

- TLS engine between App session and transport layer.
- TLS is transparent to application just like one of session protocol such as TCP, UDP or SCTP.
- TLS application registers key and certification via API and requests TLS as session transport. Besides that, every goes like TCP.
Building a Scalable Crypto Engine

- Vector Packet Processing makes TLS transparent to the application
- QAT Accelerates the Crypto Algorithm
  - Quick Assist Technology
  - QAT Intel hardware acceleration engine to offload crypto
- Asynchronous enabling to maximize HW performance

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### Network Functions with FD.io VPP *

#### Discrete Appliances, VNFs & CNFs

<table>
<thead>
<tr>
<th>Data Plane</th>
<th>Control Plane</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2 Switch</td>
<td>Netconf/Yang</td>
</tr>
<tr>
<td>VLAN / Q-in-Q</td>
<td>BGP</td>
</tr>
<tr>
<td>L3 Router</td>
<td>TR-069</td>
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<tr>
<td>NAT</td>
<td>IKEv2</td>
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<tr>
<td>ACL (mac, ip, port)</td>
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<tr>
<td>IPSEC</td>
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#### Broadband Network Gateway

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<td>Classification</td>
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<td>hQoS</td>
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<tr>
<td>ACL</td>
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<td>TM (Policing, Metering)</td>
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#### Cloud Load Balancer

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<td>Bonding</td>
<td>OpenStack LBaaS</td>
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<tr>
<td>VLAN / Q-in-Q</td>
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<tr>
<td>NAT</td>
<td>K8s Kube-Proxy</td>
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<tr>
<td>ACL (backlist)</td>
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<tr>
<td>TM (Policing, Metering)</td>
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<tr>
<td>L4 Load Balancer</td>
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#### Intrusion Prevention System

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• Router, Load Balancer and Service Proxy are supported on VPP.

• On Router, will enable ECMP feature.

• VPP Load Balancer distributes traffic and encapsulates packets via GRE tunnel.

• On K8s node, it removes GRE tunnel and goes through Service Proxy to distribute traffic to chosen pod.

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• RSS enables traffic associated with one connection to a given thread.
• Load balancing and connection track redirects traffic to a chosen pod.

Check out Yahoo! JAPAN* VPP LB use case session!

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Summary

• FD.io* is robust and commercially deployed networking stack for cloud native acceleration
• Intel IA platform is devoted to contribute and accelerate FD.io*