Accelerating the FD.IO/VPP Crypto Workload with the DPDK Cryptodev Framework

FAN ZHANG, PH.D
NETWORK PLATFORM GROUP, DATA CENTER GROUP
ROY.FAN.ZHANG@INTEL.COM

主办方: (intel)

参与方: 腾讯云 ZTE 美团云 Panabit 太一星晨 云杉网络

协办方: SDNLAB 视频支持方: IT大咖说

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Agenda

▶ Problem Statement

▶ DPDK Cryptodev Framework Introduction

▶ Enable DPDK Cryptodev Framework in VPP

▶ Performance

▶ Future work

▶ Conclusion

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▶ **Problem Statement**

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Think about security at every step of the process: architecture, implementation, testing, documentation, distribution and deployment

- *Dr. Nicko van Someren, CTO, Linux Foundation*

With VPP, a single core can do 40G, 100G or even higher throughput L2 forwarding
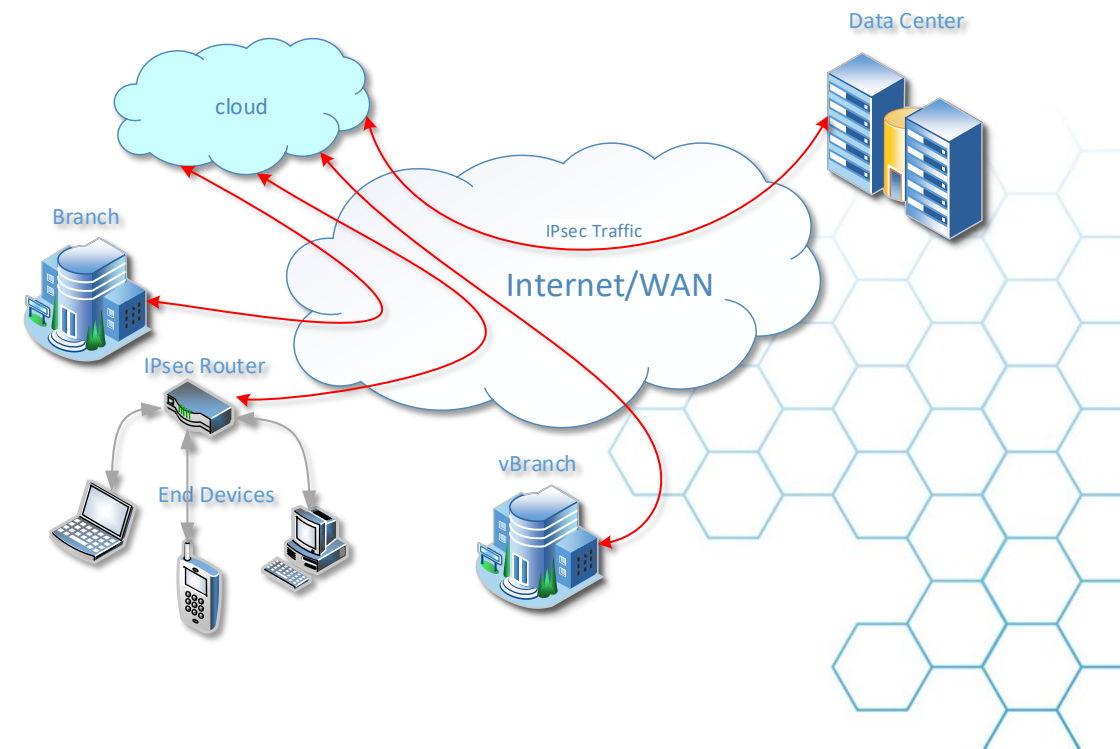
But what is the throughput after adding security protection?

Let's take IPSec as an example

- ▶ > 20 years old but is still extremely popular

- ▶ Playing the role of security guardian in many network applications

- ▶ Requires lots of computations including crypto

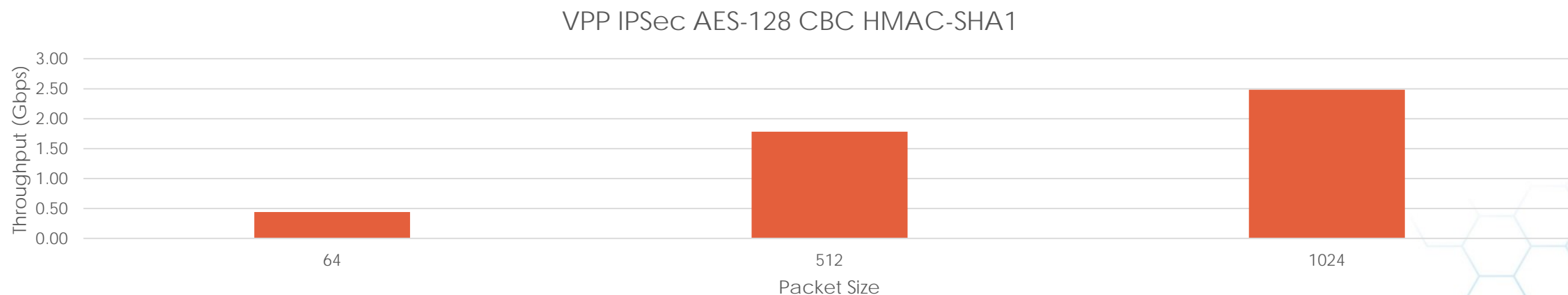- ▶ When traffic rate is high, efficient crypto implementation becomes necessary

FD.io / VPP IPSec

▶ Supports IPv4/IPv6 IPSec ESP, tunnel/transport mode, and SA management

▶ DPDK EthDev integrated

▶ For crypto it uses OpenSSL by default

▶ Performance?
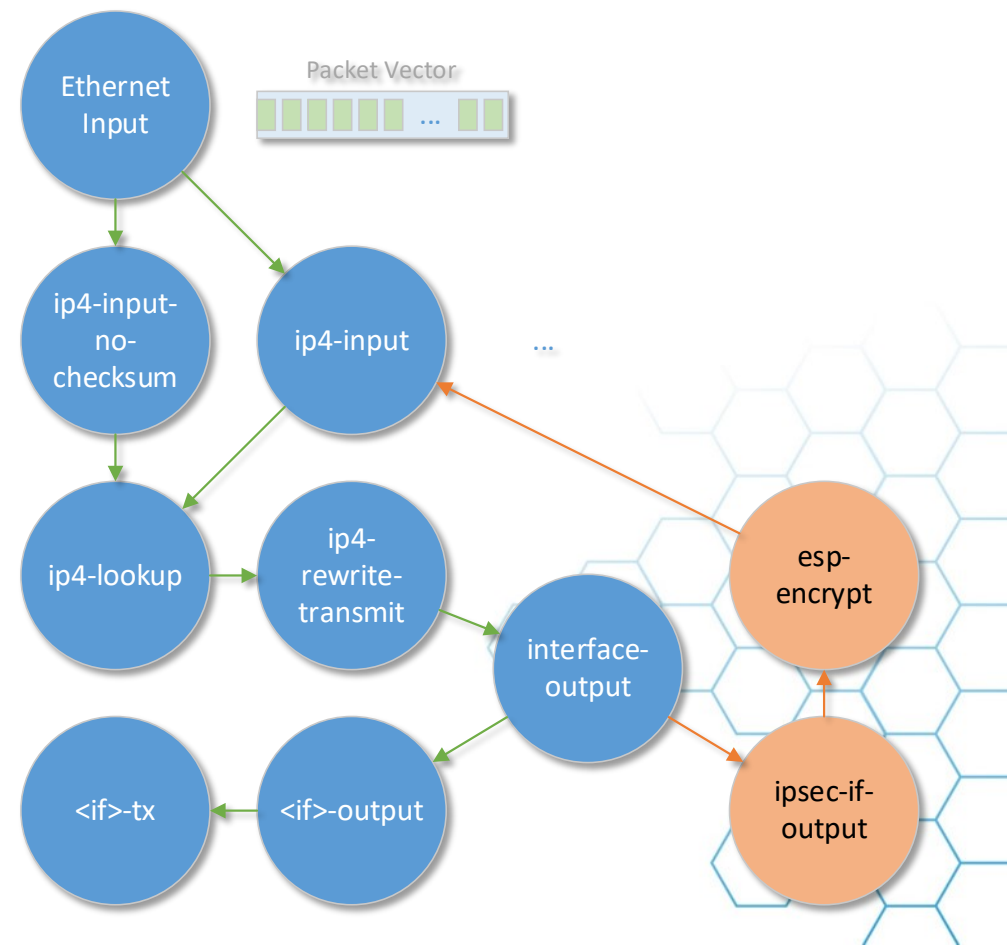
FD.io/VPP IPSec with OpenSSL as Crypto Performance§

VPP IPSec AES-128 CBC HMAC-SHA1

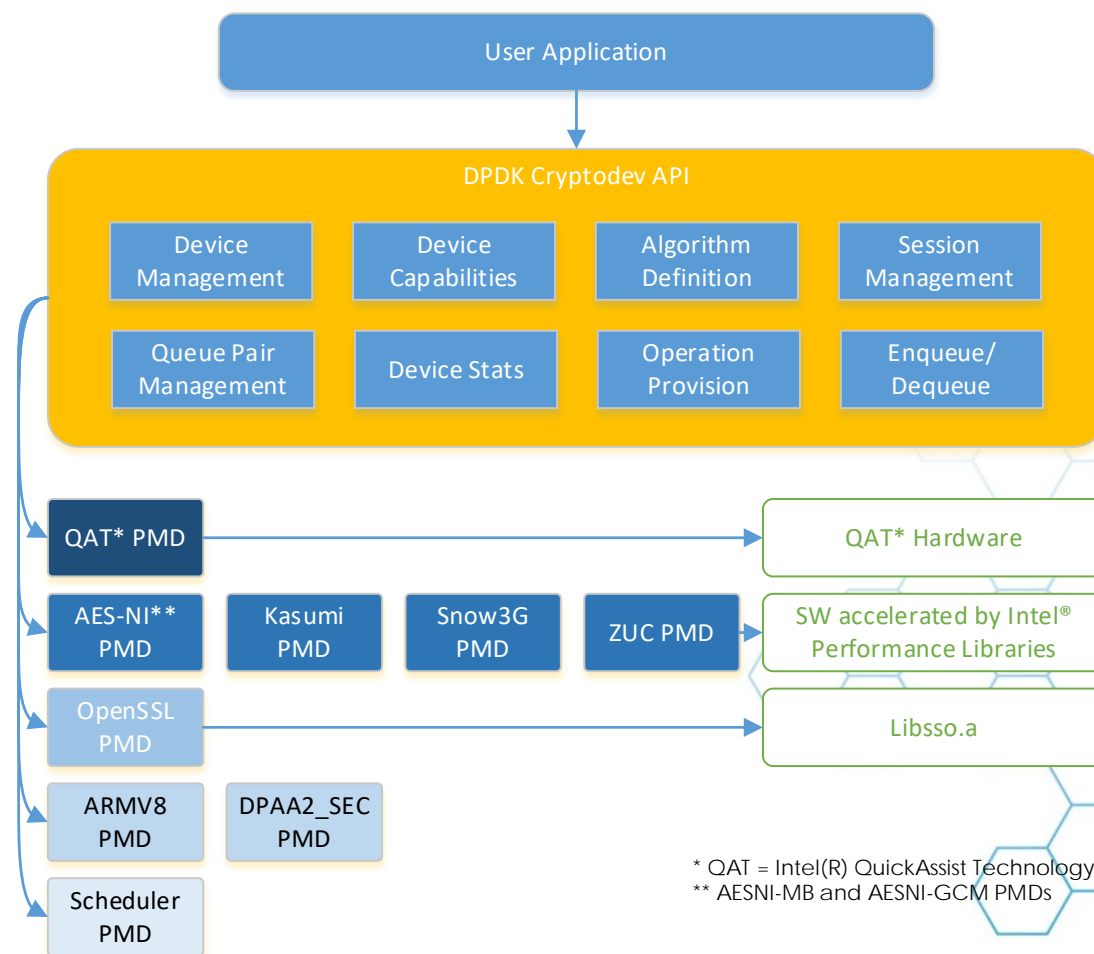▶ Does Securing the Network Application have to degrade performance?

▶ **Not Really**

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DPDK Cryptodev Framework

- Crypto framework for processing symmetric crypto workloads in DPDK.
- DPDK Cryptodev consists of:
  - SW and HW Crypto PMDs
  - A standard API supports all PMDs
  - Multi-queues for multi-thread sharing
- Effortless migration (SW-HW, PHY-VIRT)
- Asynchronous enqueue/dequeue

User Application

DPDK Cryptodev API

| Device Management | Device Capabilities | Algorithm Definition | Session Management |
| Queue Pair Management | Device Stats | Operation Provision | Enqueue/ Dequeue |

QAT* PMD → QAT* Hardware

AES-NI** PMD | Kasumi PMD | Snow3G PMD | ZUC PMD → SW accelerated by Intel® Performance Libraries

OpenSSL PMD → Libsso.a

ARMV8 PMD | DPAA2_SEC PMD

Scheduler PMD

* QAT = Intel(R) QuickAssist Technology
** AESNI-MB and AESNI-GCM PMDs

Supported Algorithms In Cryptodev

Cipher Algorithms

- AES CBC/CTR 128/192/256 bit
- Snow3G (UEA2)
- KASUMI F8,
- ZUC EEA3
- AES_CFB
- NULL

Hash Algorithms

- MD5_HMAC*
- SHA1/224*/256/384*/512,
- AES XCBC,
- Snow3G UIA2,
- KASUMI F9,
- ZUC EIA3,
- NULL

AEAD Algorithms

- AES GCM 128/192**/256 bit

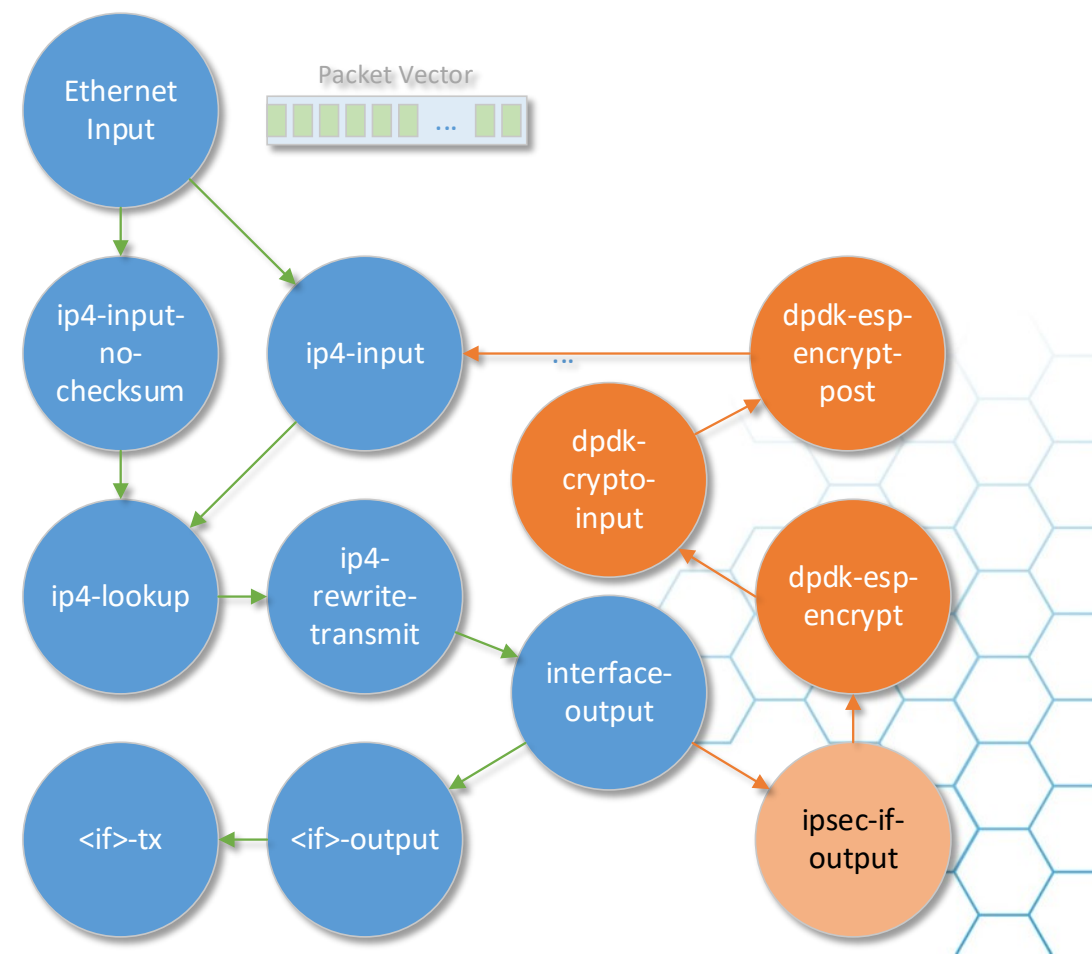* QAT = Intel(R) QuickAssist Technology
** AESNI-MB and AESNI-GCM PMDs

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Enable DPDK Cryptodev in VPP IPSec

- ▶ Replaced 2 nodes:
  - ▶ esp-encrypt ➔ dpdk-esp-encrypt
  - ▶ esp-decrypt ➔ dpdk-esp-decrypt
- ▶ Added 3 nodes:
  - ▶ dpdk-crypto-input
  - ▶ dpdk-esp-encrypt-post
  - ▶ dpdk-esp-decrypt-post

VPP Configuration for DPDK Cryptodev

- Environmental option:
  - For software PMD:

    vpp_use_dpdk_cryptodev_sw=yes

- User only needs to provide Cryptodevs in startup.conf file

- Allocate crypto resources on best effort approach

- No special IPSec configuration is required

- More information can be found here

Sample Configuration:

```
dpdk {
    …
    #HW PMDs
    enable-cryptodev
    dev 0000:85:01.0
    dev 0000:85:01.1
    #SW PMDs
    vdev cryptodev_aesni_mb_pmd0,socket_id=1
    vdev cryptodev_aesni_mb_pmd1,socket_id=1
}
```
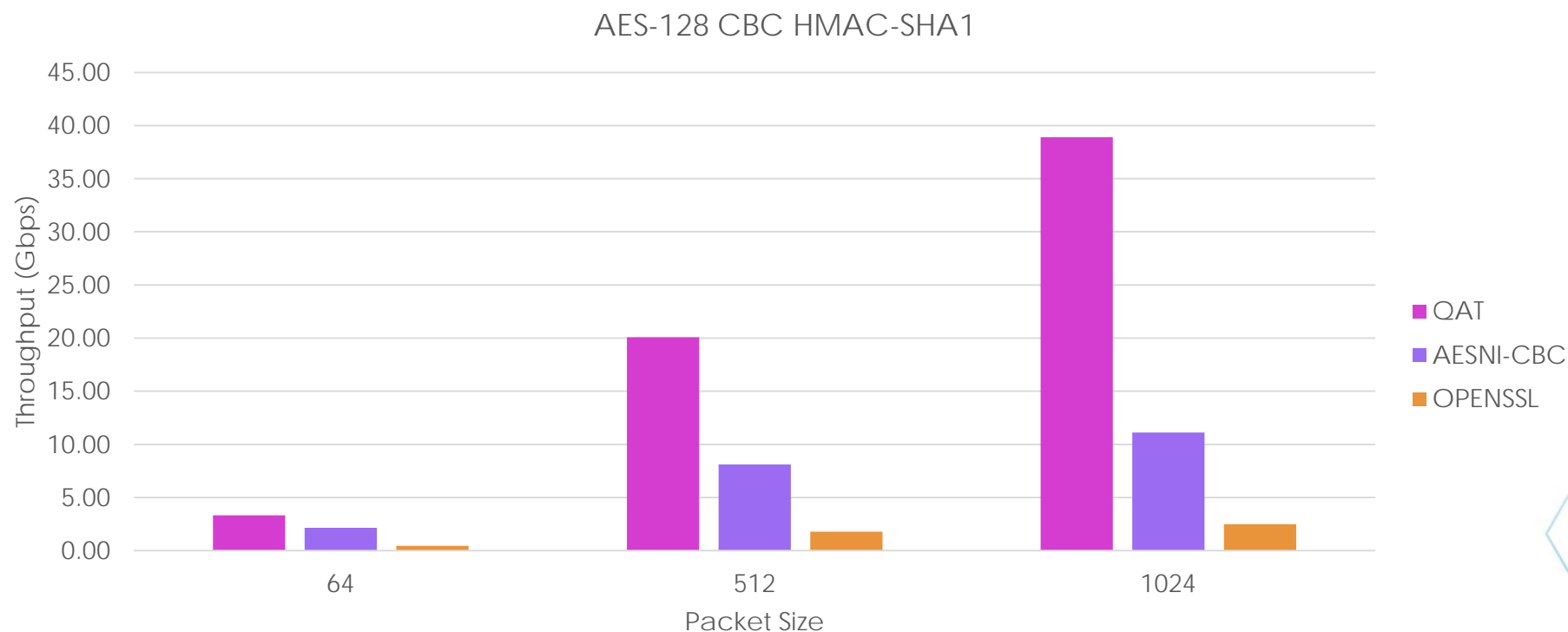
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Performance§ from VPP IPSec

AES-128 CBC HMAC-SHA1

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Future Work

▶ DPDK Cryptodev Optimization

▶ Enable DPDK Cryptodev Framework in VPP IKEv2.

▶ VPP IPSec Performance Tuning

▶ Enable DPDK Cryptodev Scheduler PMD to increase crypto workload processing capability per-worker thread

▶ Virtio-Crypto Enabling

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Summary

▶ Achieved VPP IPSec Performance boost by enabling DPDK Cryptodev Framework

▶ QAT hardware accelerated VPP IPSec has more performance boost than the software alternative

▶ Seamlessly integrated into VPP, easy to enable and configure, no extra IPSec configuration is required

▶ Migration between Software and Hardware, Physical and Virtual, is effortless

Acknowledgement

Arkadiuszx kusztal (arkadiuszx.kusztal@intel.com)
Declan Doherty (declan.doherty@intel.com)
Fiona Trahe (fiona.trahe@intel.com)
Jain Deepak (deepak.k.jain@intel.com)
John Griffin (john.griffin@intel.com)
Kirill Rybalchenko (kirill.rybalchenko@intel.com)
Pablo D. L. Guarch (pablo.de.lara.guarch@intel.com)
Radu Nicolau (radu.nicolau@intel.com)
Sergio G. M (sergio.gonzalez.monroy@intel.com)

Q&A

Thanks!!