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- Test and System Configurations: Estimates are based on internal Intel analysis using at least Data Plane Development Kit ipsec sample application on Intel(R) Xeon(R) CPU E5-2658 v4@ 2.30GHz with atleast using Intel(R) Communications Chipset(s) 8955 with Intel(R) QuickAssist Technology.
Agenda

• DPDK CRYPTODEV INTRODUCTION
• FEATURES
  • SUPPORTED ALGORITHMS
  • CRYPTODEV PACKET PROCESSING FLOW
  • EFFORTLESS MIGRATION
  • SCHEDULER PMD
• VPP + DPDK CRYPTODEV FRAMEWORK
• PERFORMANCE
• FUTURE WORKS
• SUMMARY
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- **DPDK CRYPTODEV INTRODUCTION**
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Crypto framework for processing symmetric crypto workloads in DPDK.

DPDK Cryptodev consists of:
- Crypto Poll Mode Drivers for hardware accelerated lookaside (Intel® QuickAssist Technology) and software based crypto primitives
- A standard API supports all PMDs

Allowing effortless migration of work between hardware and software, even between physical to virtual environments

* QAT = Intel(R) QuickAssist Technology
** AESNI-MB and AESNI-GCM PMDs
Future work includes:

- Extending the API to support asymmetric crypto.
- More advanced Scheduler capabilities.
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### Supported Algorithms in Cryptodev

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

#### 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

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** AESNI-MB and AESNI-GCM PMDs
CRYPTODEV PACKET PROCESSING FLOW

DPDK Application

Application Code

ETHDEV API

I40E PMD

I40E PMD

CRYPTODEV API

SW Crypto PMD

QAT PMD

DPDK API

HW/SW Boundary

Plaintext packet flow (encryption)

Encrypted packet flow (encryption)

* QAT = Intel(R) QuickAssist Technology
** AESNI-MB and AESNI-GCM PMDs
Effortless Migration (HW & SW)

- ./l2fwd-crypto -l 11 -n 4 --socket-mem 0,2048 -w 88:01.0 -w 88:01.1 -w 84:00.0 -p 0x1 --chain CIPHER_HASH --cipher_op ENCRYPT --cipher_algo AES_CBC --cipher_key 00:01:02:03:04:05:06:07:08:09:0a:0b:0c:0d:0e:0f --auth_op GENERATE --auth_algo SHA1_HMAC --auth_key 10:11:12:13:14:15:16:17:18:19:1a:1b:1c:1d:1e:1f:20:21:22:23

- ./l2fwd-crypto -l 11 -n 4 --socket-mem 0,2048 -w 88:01.0 -w 88:01.1 --vdev "crypto_aesni_mb" -p 0x1 --chain CIPHER_HASH --cipher_op ENCRYPT --cipher_algo AES_CBC --cipher_key 00:01:02:03:04:05:06:07:08:09:0a:0b:0c:0d:0e:0f --auth_op GENERATE --auth_algo SHA1_HMAC --auth_key 10:11:12:13:14:15:16:17:18:19:1a:1b:1c:1d:1e:1f:20:21:22:23

Same application can be used on both SW PMD and QAT PMD, simply address the device in the EAL commandline option.
Scheduler PMD

- Distributing crypto ops to multiple crypto PMDs (slaves)
- Supports multiple distribution modes:
  - Round-robin mode to balance workload across multiple slaves. (DPDK 17.02)
  - Packet Size based mode (DPDK 17.05 RC1)
  - More modes are planned for future releases
- Provides API to manage slaves, set modes, and enable/disable ordering
- Provided API for user to use his own crafted mode
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• FUTURE WORK
• SUMMARY
FD.io/VPP

► Open-source Linux Foundation Project.

► Highly performant data plane platform.

► VPP is a packet processing engine using DPDK as the network I/O.

► Run-to-completion mode of VPP
FD.io/VPP + DPDK CRYPTODEV FRAMEWORK


- It has DPDK EthDev integrated, but didn't have DPDK Cryptodev enabled.

- We integrated DPDK Cryptodev Framework into VPP, to accelerate VPP IPsec with Intel® Performance Library and/or Intel® QuickAssist Technology.
ENABLE DPDK CRYPTODEV IN VPP IPSEC

► Replace VPP esp-encrypt and esp-decrypt nodes with dpdk-esp-encrypt and dpdk-esp-decrypt

► Added 3 nodes:
  ► dpdk-crypto-input: polling input node, dequeuing from crypto PMDs
  ► dpdk-esp-encrypt-post and dpdk-esp-decrypt-post: encapsulate to valid packet vectors from dequeued packets
VPP CONFIGURATION FOR DPDK CRYPTODEV

- Environmental option: `vpp_use_dpdk_cryptodev=yes`

- No special IPsec configuration is required

- Allocate crypto resources on best effort approach: hardware first, then software. If there is not enough crypto resource for every worker, drop all packets.

- User only needs to provide Cryptodevs in startup.conf file.
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Performance§ from DPDK IPSec sample application

AES-128CBC-HMAC-SHA1

Packet Size (Bytes)

Performance (Gbps)

64 128 256 512 768 1024 1280 1420

AESNI QAT

§ Mileage may vary Disclaimer: Tests document performance of components on a particular test, in specific systems. Differences in hardware, software, or configuration will affect actual performance. Consult other sources of information to evaluate performance as you consider your purchase. For more complete information about performance and benchmark results, visit www.intel.com/benchmarks

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PLANNED FEATURES IN FUTURE RELEASES

Performance
- QAT* PMD optimizations
- SW PMD optimizations
  Refactoring & Clean up

Algorithm support
- QAT* PMD
  - DES
  - ZUC
  - AES-CFB64/ECB
- SW PMD
  - DES
  - AES-CFB64/ECB

Scheduler
- Packet-size based scheduling mode
- Multi-core scheduling mode

VPP IPsec integration
- Performance Optimization
- Enable DPDK cryptodev in VPP IKEv2
- Enable DPDK Cryptodev scheduler PMD

*QAT = Intel(R) QuickAssist Technology
Summary

- Cryptodev currently provides support for symmetric algorithms.

- Provides both Software(SW) and Hardware (Intel® QuickAssist Technology) implementations.

- Healthy pipeline of features planned for future release.

- HW provides provides major boost in performance over SW implementation.
QUESTIONS?

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BACKUP
VPP IPsec with DPDK Cryptodev: How it works

- Assign available Cryptodev resources to each worker
VPP IPsec with DPDK Cryptodev: How it works

- Assign available Cryptodev resources to each worker
- When adding an SA, create sessions for each worker/crypto resource based on the specified algorithms and store them along with queue pair info with same index of SA.
VPP IPsec with DPDK Cryptodev: How it works

- Assign available Cryptodev resources to every worker.
- When adding an SA, create sessions for each worker/crypto resource based on the specified algorithms and store them along with queue pair info with same index of SA.
- For each packet, retrieve SA, and hence get session for this worker.
VPP IPsec with DPDK Cryptodev: How it works

- Create crypto op for each packet, attach key, pass data and digest pointer, etc.
- Attach session to each crypto op
- Enqueue the burst of crypto ops to the destination crypto device / queue
VPP IPsec with DPDK Cryptodev: How it works

- Dequeue the burst of processed crypto ops from the same device/queue in dpdk-crypto-input node.

- The asynchronous enqueue/dequeue action helps amortize the cost of crypto operations over multiple packets and also greatly maximize the performance when offloading to hardware lookaside.
VPP IPsec with DPDK Cryptodev: How it works

- Dequeue the burst of processed crypto ops from the same device/queue in dpdk-crypto-input node
- Encapsulate the crypto ops to a valid IPsec packet vector in dpdk-encrypt/decrypt-post node, and pass to next graph node.
THANK YOU