DPDK Summit

DPDK Cryptodev

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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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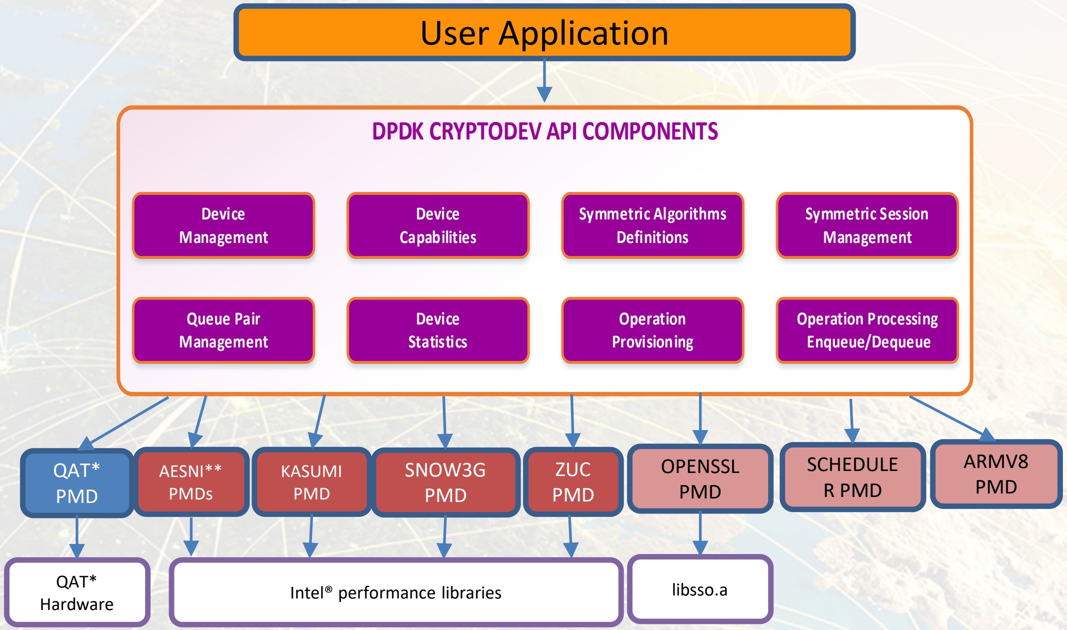
DPDK CRYPTODEV INTRODUCTION

- 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

Cryptodev PMDs

QAT	AESNI MB AESNI GCM ARMv8	SNOW 3G KASUMI ZUC	OpenSSL	Scheduler	NULL
PMD for hardware acceleration	PMDs for optimized software acceleration libraries	PMDs for optimized software acceleration libraries for wireless algorithms	PMD for non-optimized software implementation	PMD to distribute packets across multiple accelerators	PMD for test purposes

Future work includes:

- Extending the API to support asymmetric crypto.
- More advanced Scheduler capabilities.

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SUPPORTED ALGORITHMS IN CRYPTODEV

Cipher Algorithms	Hash Algorithms	AEAD Algorithms
• ***AES CBC/CTR 128/192/256 bit*** • ***Snow3G (UEA2)*** • ***KASUMI F8,*** • ***ZUC EEA3*** • **AES_CFB**	• ***MD5_HMAC**** • ***SHA1/224*/256/384*/512,*** • ***AES XCBC,*** • ***Snow3G UIA2,*** • ***KASUMI F9,*** • ***ZUC EIA3,*** • ***NULL***	• ***AES GCM 128/192**/256 bit***

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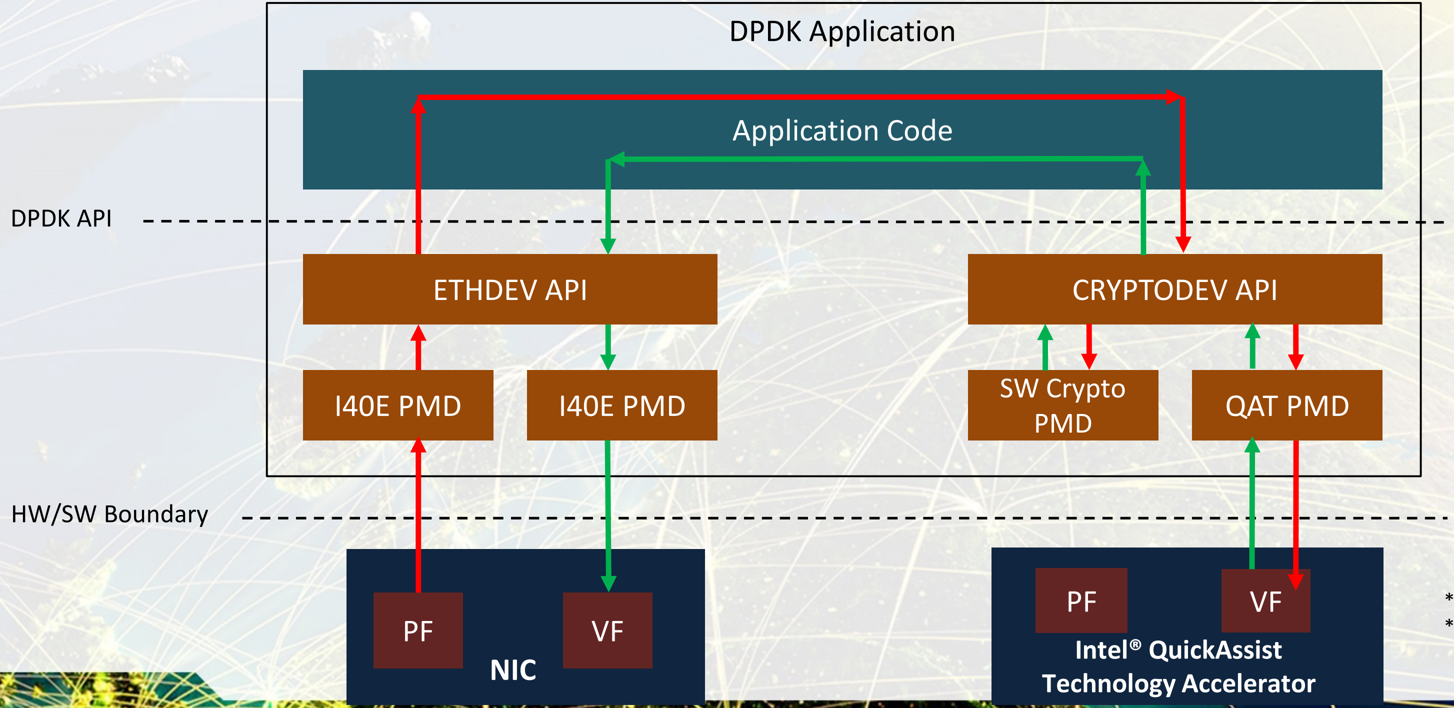
CRYPTODEV PACKET PROCESSING FLOW



Plaintext packet flow (encryption)

Encrypted packet flow (encryption)

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** AESNI-MB and AESNI-GCM PMDs

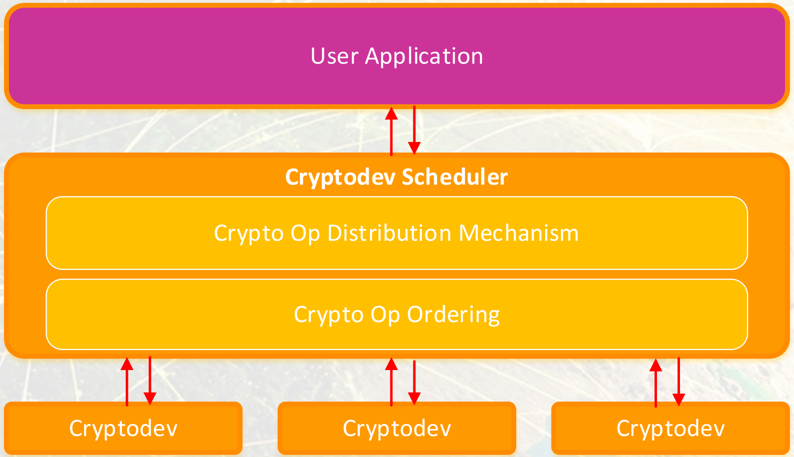
Effortless Migration (HW & SW)

- ./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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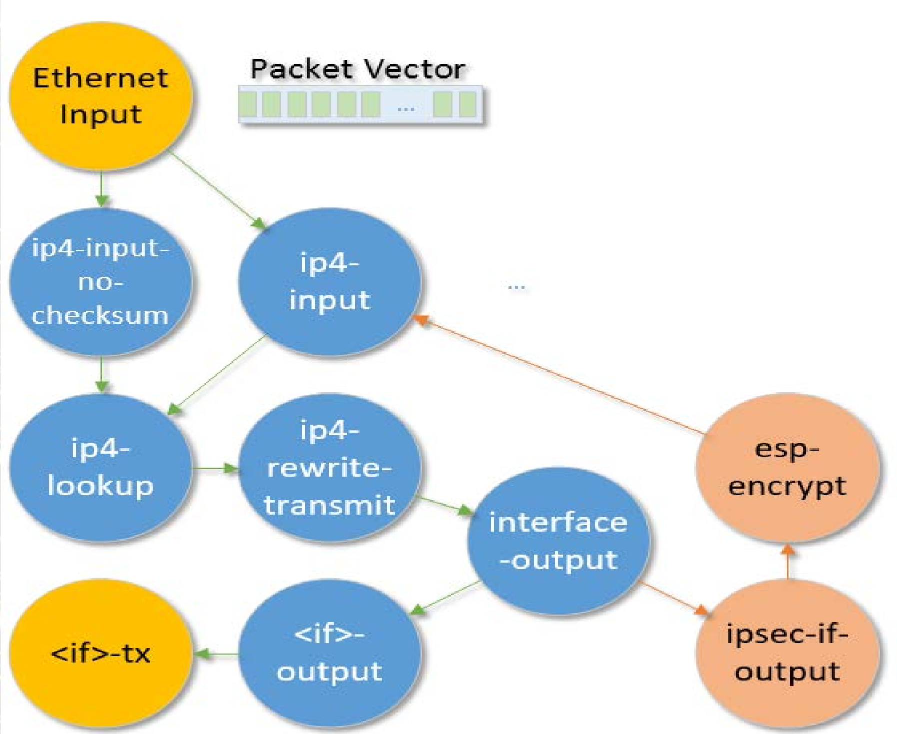
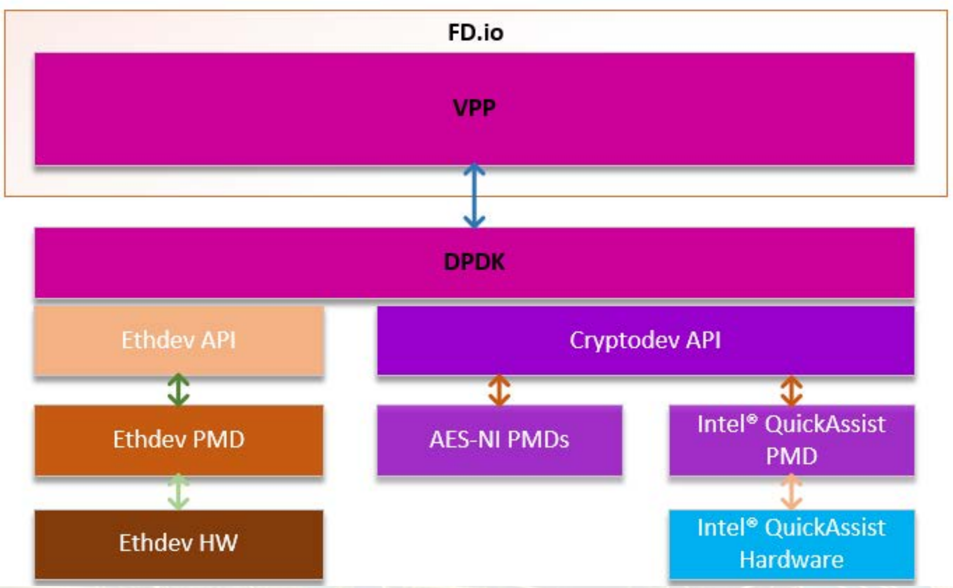
FD.io/VPP

- 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



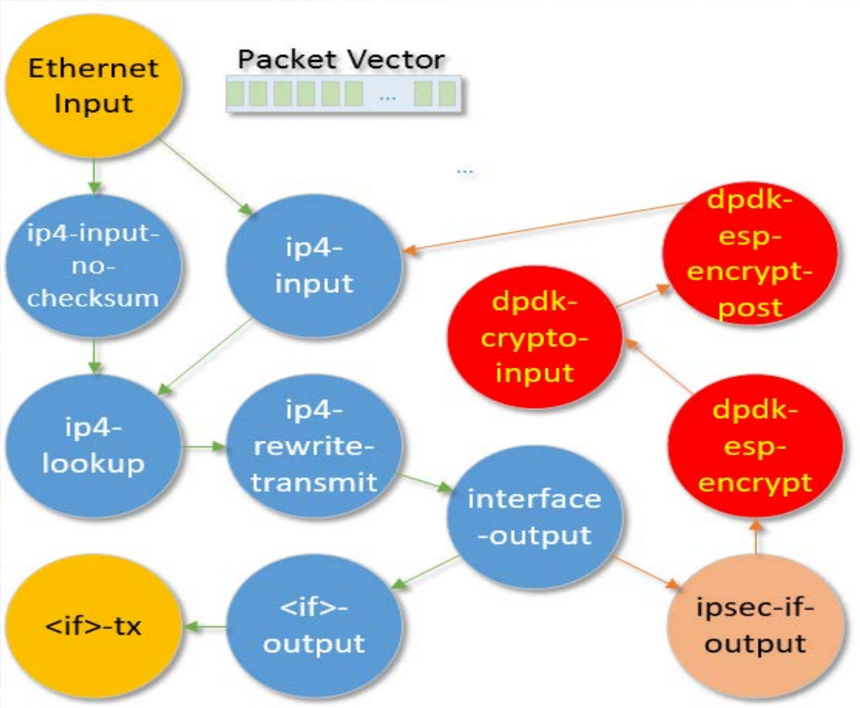
FD.io/VPP + DPDK CRYPTODEV FRAMEWORK

- FD.io/VPP supports IPv4/IPv6 IPsec ESP, tunnel/transport mode, and SA management.
- 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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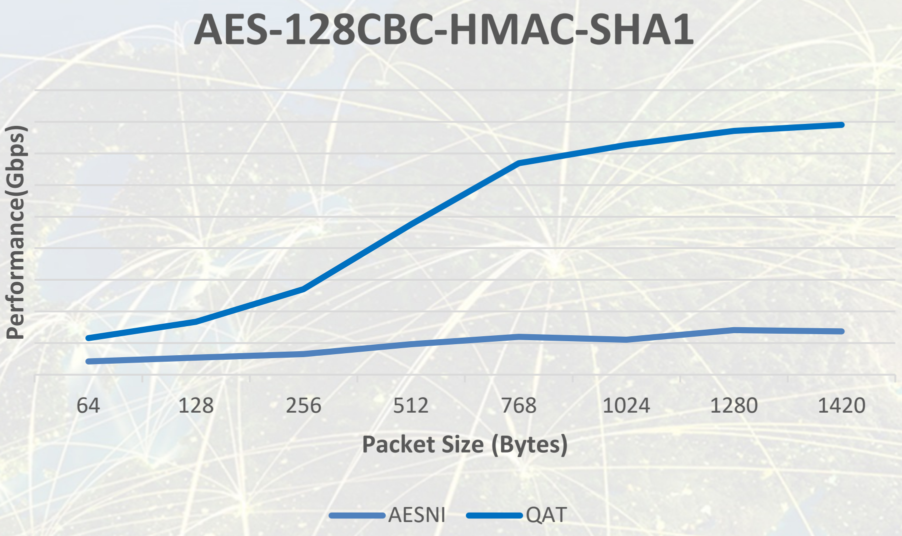
Performance§ from DPDK IPSec sample application



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§ 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

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.

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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

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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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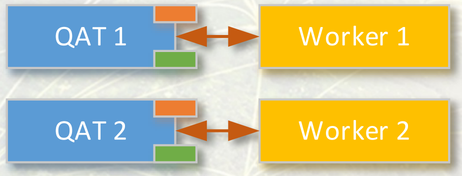
BACKUP

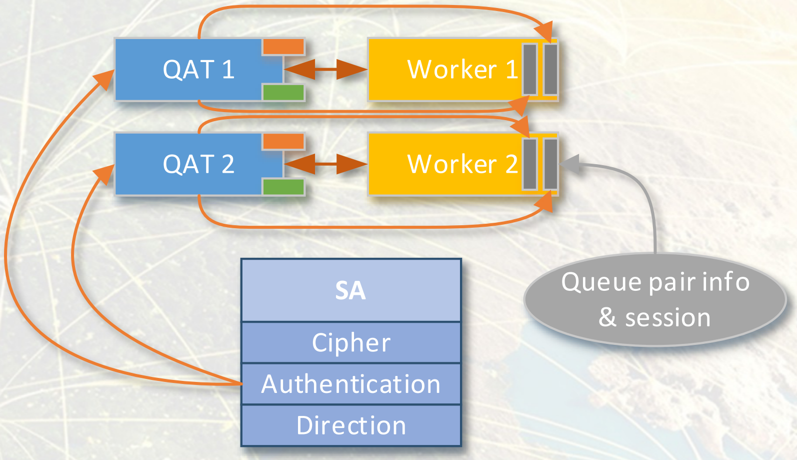
VPP IPsec with DPDK Cryptodev: How it works

- Assign available Cryptodev resources to each worker



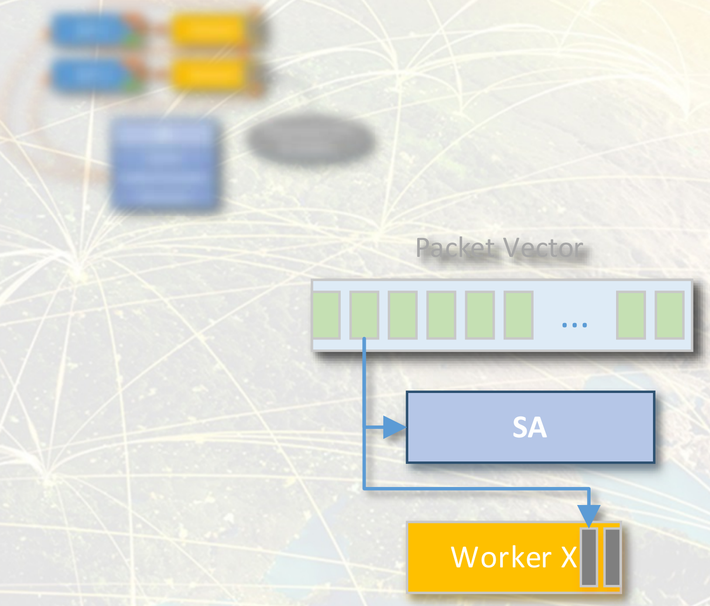
VPP IPsec with DPDK Cryptodev: How it works

- 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.



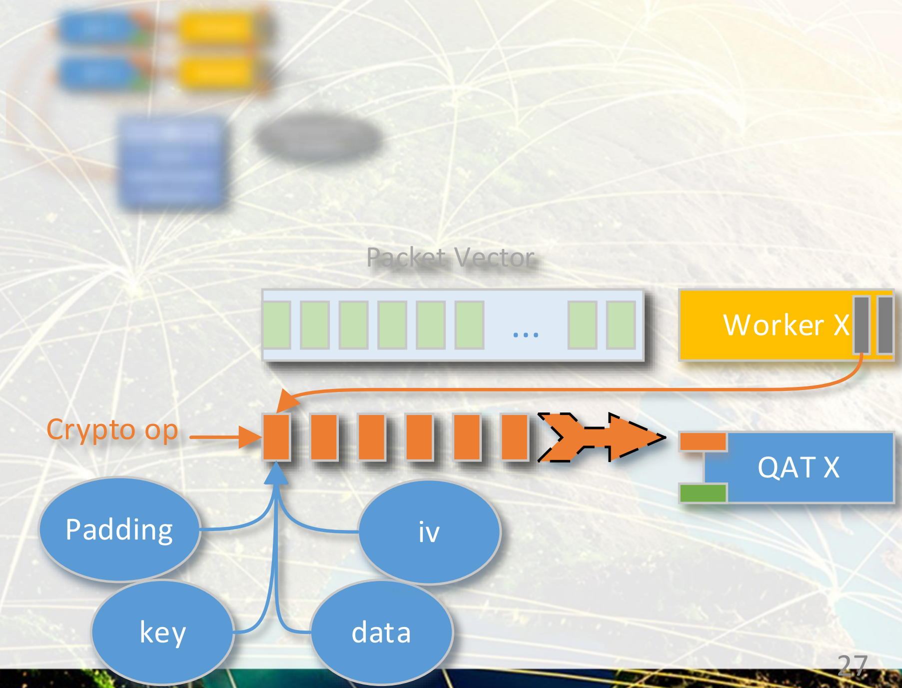
VPP IPsec with DPDK Cryptodev: How it works

- 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.



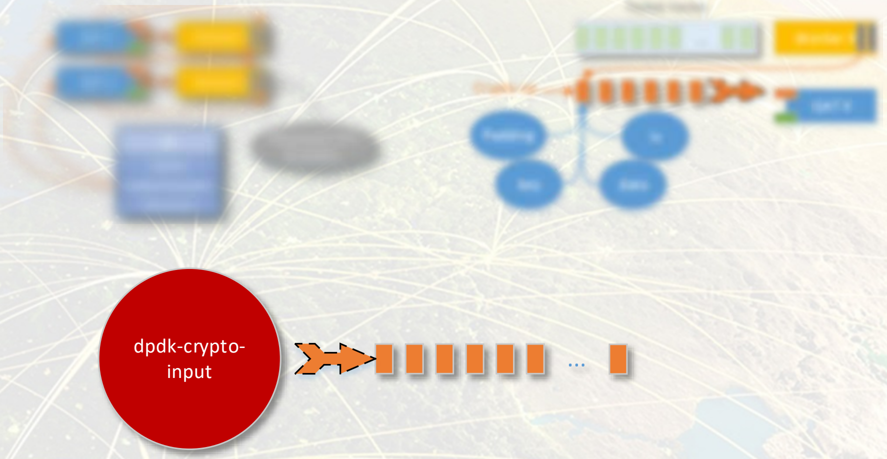
VPP IPsec with DPDK Cryptodev: How it works

- 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

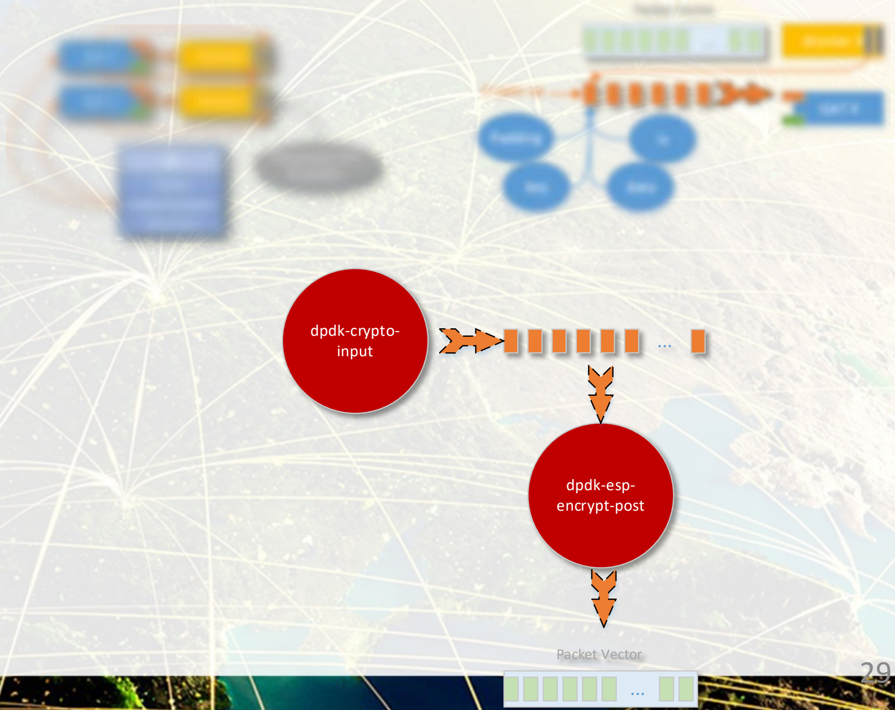
- Dequeue the burst of processed crypto ops from the same device/queue in dpdk-crypto-input node



- 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