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
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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

- 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
Supported Algorithms In Cryptodev

<table>
<thead>
<tr>
<th>Cipher Algorithms</th>
<th>Hash Algorithms</th>
<th>AEAD Algorithms</th>
</tr>
</thead>
</table>
| • AES CBC/CTR 128/192/256 bit  
• Snow3G (UEA2)  
• KASUMI F8,  
• ZUC EEA3  
• AES_CFB  
• NULL | • MD5_HMAC*  
• SHA1/224*/256/384*/512  
• AES XCBC,  
• Snow3G UIA2,  
• KASUMI F9,  
• ZUC EIA3,  
• NULL | • 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](#)

```plaintext
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

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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
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Arkadiusz Kusztal (arkadiusz.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!!