

# Intel® Network Builders Insights Series

## Optimize Intel® Xeon Family Performance using Intel® QuickAssist Technology

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# Acronyms

Acronym	Description
DPDK*	Data Plane Development Kit
VPP*	Vector Packet Processing
IPsec	Internet Protocol Security
ISA	Instruction Set Architecture
PKE	Public-key cryptography
AI	Artificial Intelligence
SSL	Secure Sockets Layer
TLS	Transport Layer Security
CPS	Connections-per-second
QAT	Intel Quick Assist Technology
DUT	Device Under Testing
1C2T	1 core 2 threads (sibling threads used)

# Data Center Landscape and Strategy



Exponential data growth



Business risk & exposure impediments



Solution complexity increases



Security from the Cloud  
to the Edge



# Intel® QuickAssist Technology

Intel® QuickAssist Technology integrates hardware acceleration of compute intensive workloads

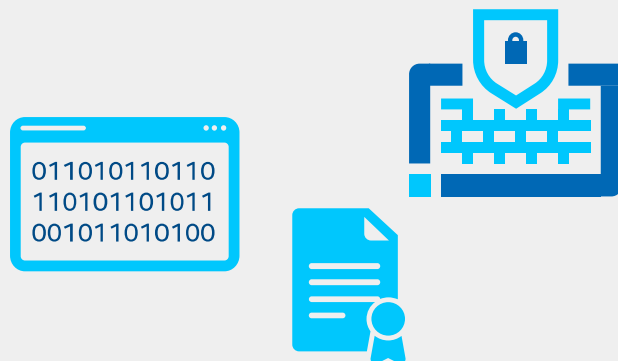
Accelerates bulk cryptography, Public Key Cryptography &

Compression/Decompression by offloading to Intel® QAT hardware

Enables significant gains in CPU efficiency, data footprint reduction, power utilization and application throughput

## Intel® QuickAssist Technology

### Cryptographic Ciphers, Hashing and Authentication



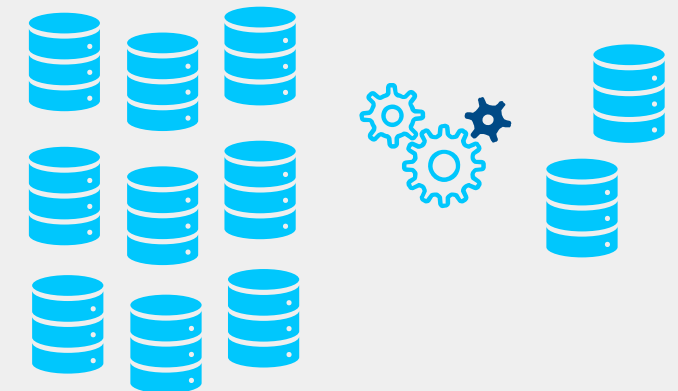
Symmetric encryption & authentication and cipher operations

### Public Key Cryptography



Asymmetric encryption, digital signatures and key exchange

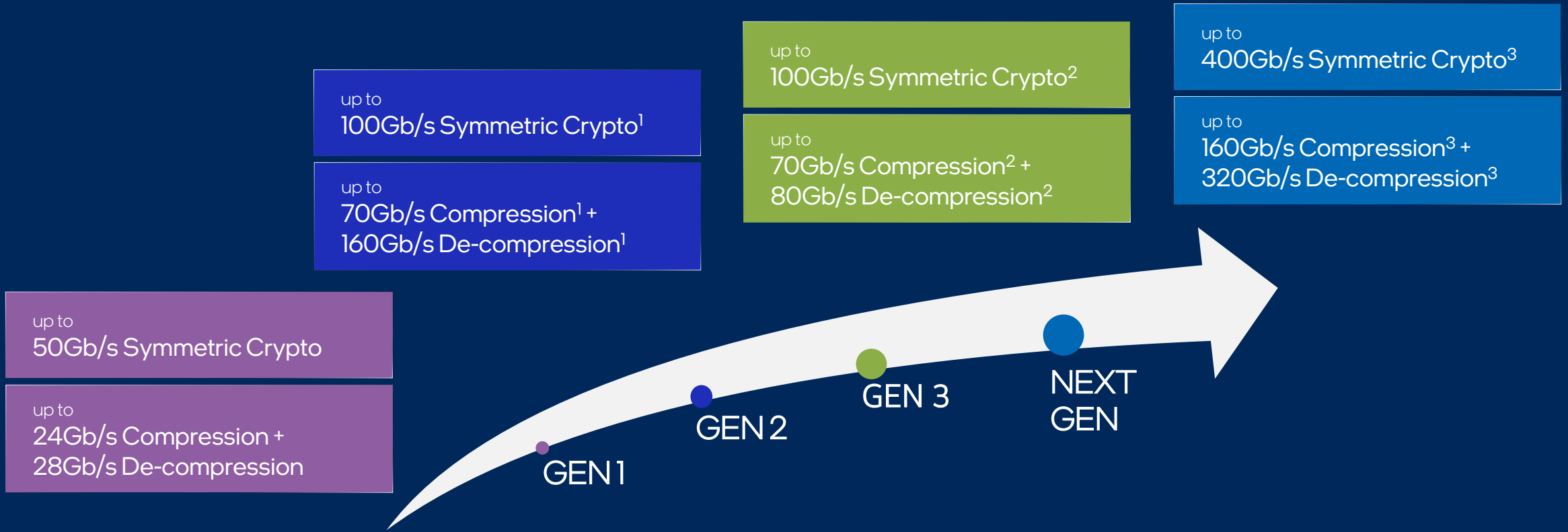
### Compression and Decompression



Lossless data compression for data in flight and at rest

# Intel® Quick Assist Technology

## Long History of Continuous Improvement

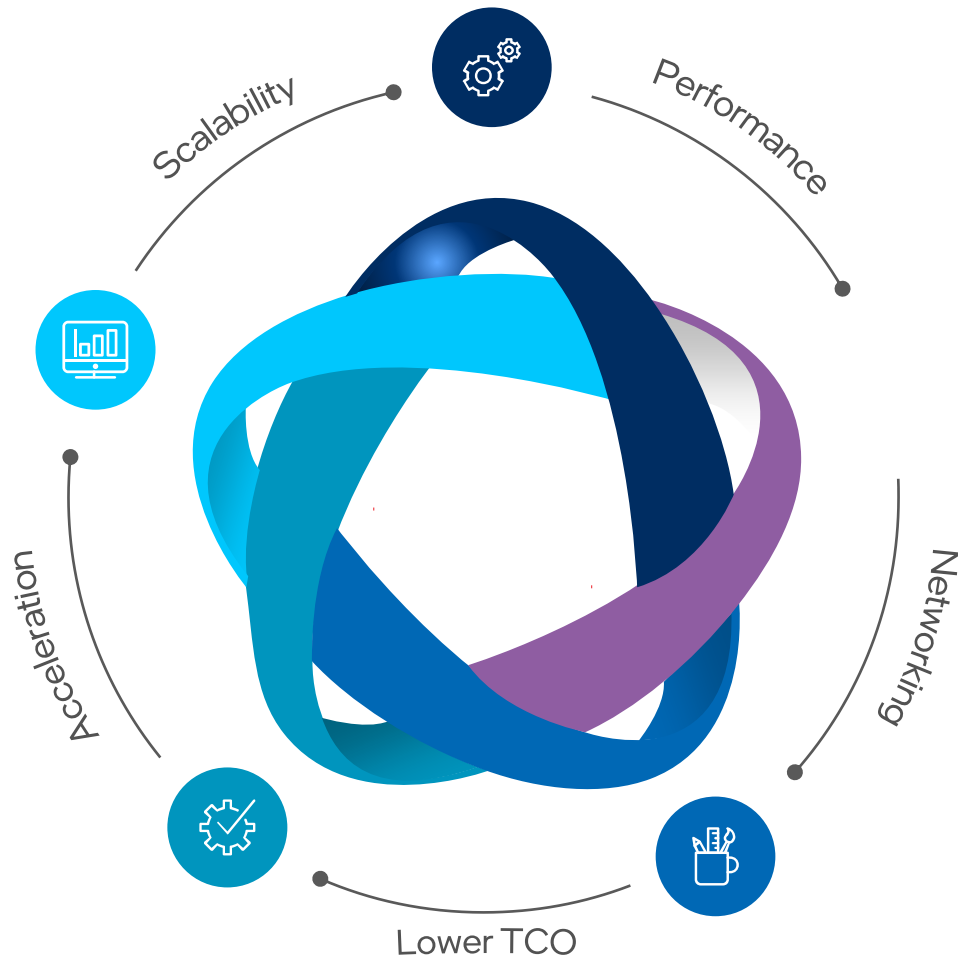


<sup>1</sup>Available on specific SKUs

<sup>2</sup>Introduced on Intel® Xeon® D-2700 Processor family

<sup>3</sup>Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

# Intel® Xeon® D 2700 Processors for Networking



## Performance Gen Over Gen

- Significant performance improvement with new Intel Architecture, resulting in greatly improved signaling and user plane performance
- Performance Improvements vs. previous generation on Data Plane Development Kit (DPDK) due to **improved Intel® AVX-512, built in accelerators**

## Networking up to 2x100GbE connectivity

- Up to **8 port Ethernet** with up to **100Gbps packet processing** capabilities
- Ensure **line rate** requirement is supported while adding more value via additional services and features

## Lower TCO Perf/\$ & Perf/W

- **Increased I/O bandwidth**, with **PCIe 4.0** (16 GT/s) with up to 32 lanes
- **Increase bandwidth** over previous generation

## Acceleration up to 100Gbps Crypto

- **Improved Intel® QAT** – better acceleration vs. previous generation
- **New ISA AES instructions** for AI workload acceleration
- Higher throughput with **inline crypto (IPSec)**

## Scalability up to 20 Cores

- Single standard architecture : for **Scalable NFV product portfolio**
- **Reduced total platform investment** with application, control, and data plane workload consolidation

Features, SKUs, frequencies are preliminary and are subject to change

# Accelerate Intel® Xeon® Family Performance

## Key Enabling Software Projects

### Storage



Intel® QAT Gen 3  
API Performance

### 5G & Network Security



DPDK, VPP  
IPSec  
Wireguard\*

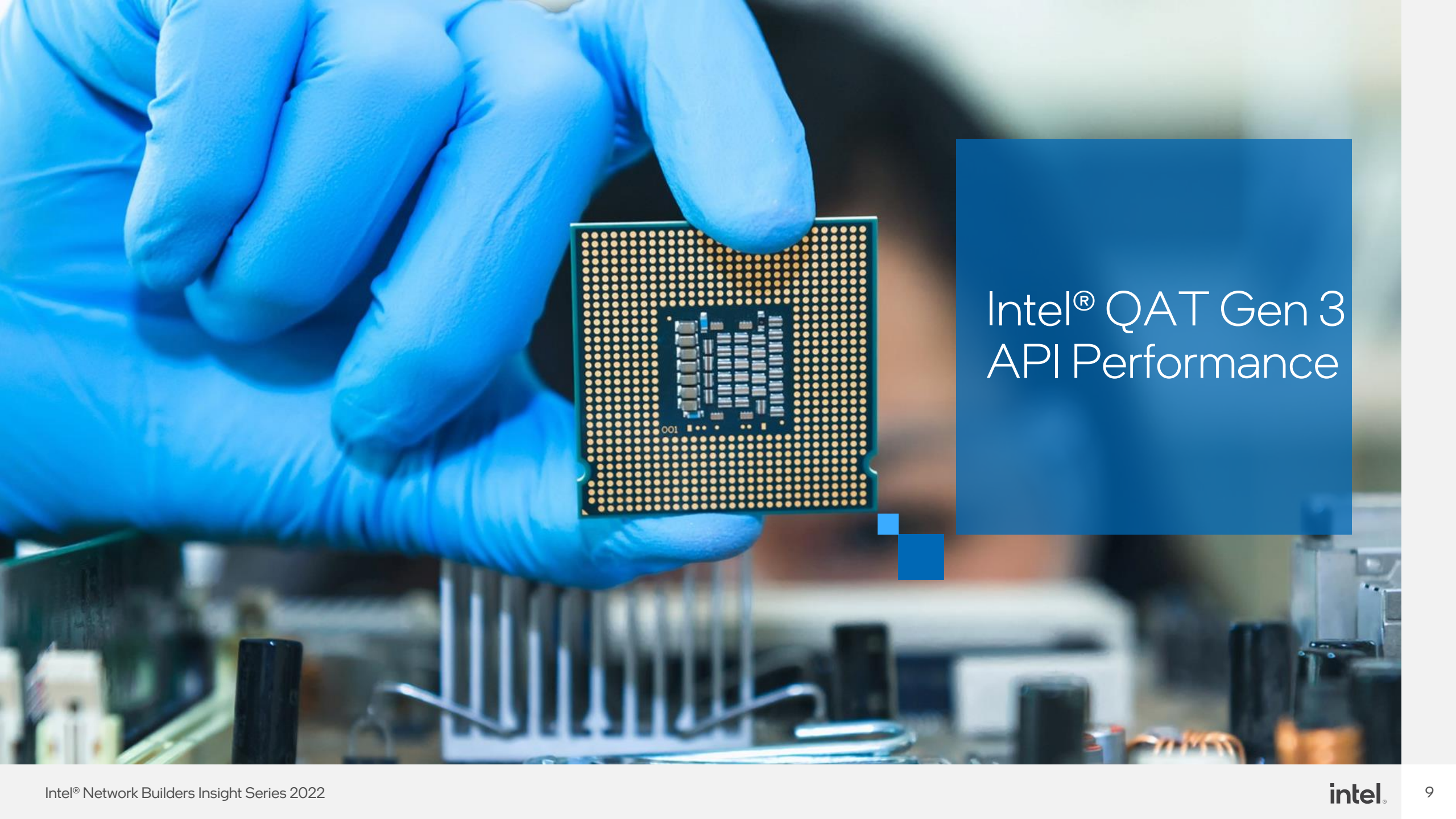
### Cloud/Enterprise



TLS Security  
CDN  
NGINX\*

\*Other names and brands may be claimed as the property of others

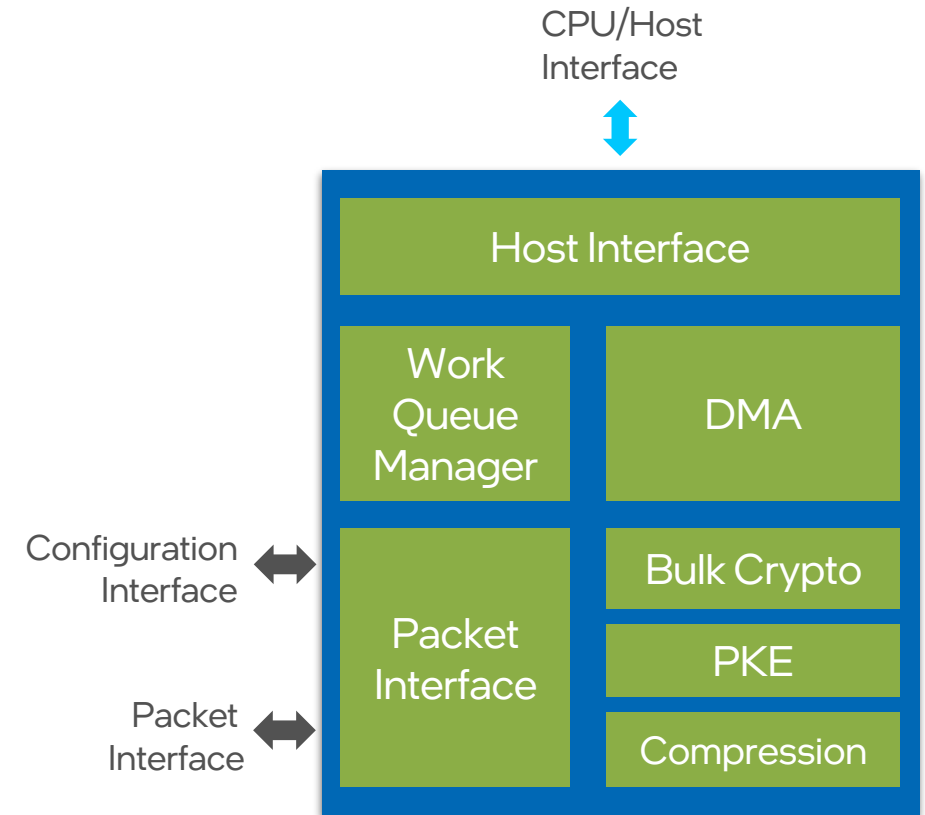




# Intel® QAT Gen 3 API Performance

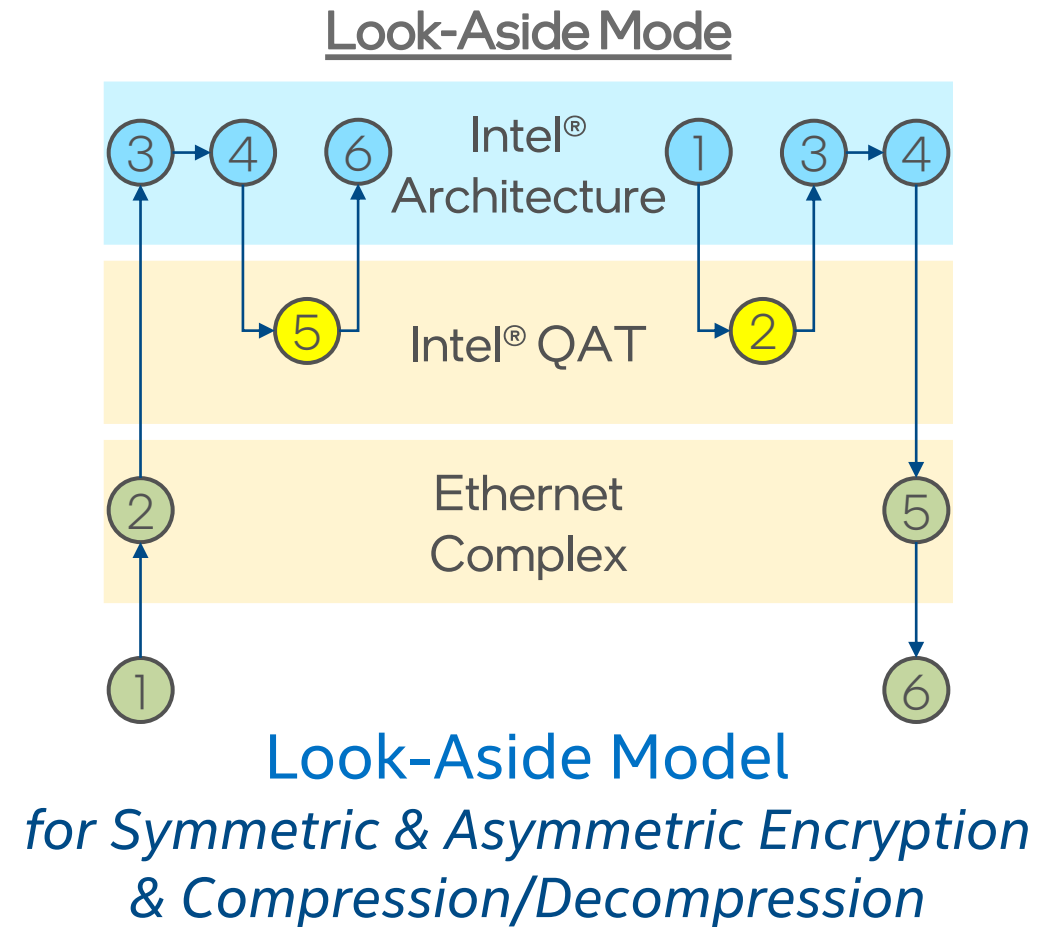
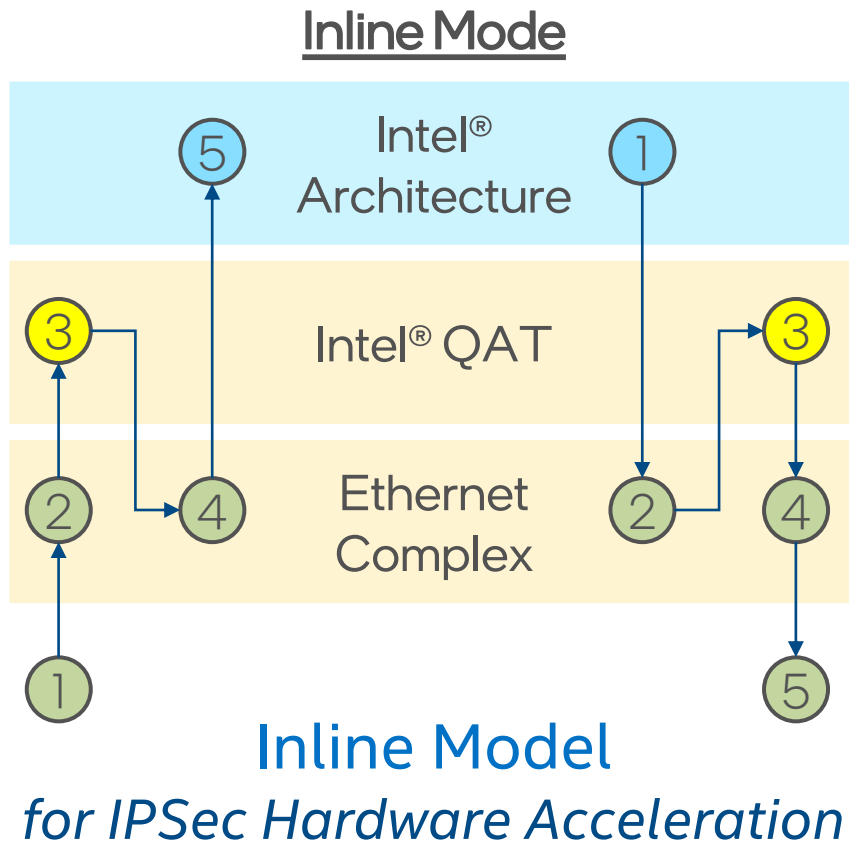
# Intel® QuickAssist Technology (Intel® QAT) Gen 3

- **Security & compression acceleration functions**
  - Cryptographic Ciphers & Hashes
  - Public Key Cryptography Engine
  - Compression/Decompression
- **Advanced Power Management, Virtualization**
- **Scalability**
  - Crypto, PKE and compression engines are independently scalable
- **Connectivity**
  - CPU/Host for configuration & look-aside processing
- **Supports simultaneous look-aside processing**



Intel® QAT Gen 3 supports inline & look-aside security processing

# Intel® QAT: Inline vs Look-Aside Acceleration



# Intel® QuickAssist Technology (Intel® QAT) Gen 3

## Look-aside Encryption

### Usage Model

- Network security (IPSec, SSL/TLS), hashing for data-deduplication, encrypted storage)

### Symmetric (Bulk) Cryptography

- Ciphers (AES, 3DES/DES, RC4, KASUMI, Snow 3G)
- Message digest/hash (MD5, SHA1, SHA2x, **SHA3**) with HMAC and & AES-XCBC, AES-CBC-MAC, AES-GMAC, AES-CMAC
- Algorithm chaining (one cipher and one hash in a single operation)
- Authenticated encryption (AES-GCM, AES-CCM, **ChachaPoly**)
- AES-XTS
- **SM3&SM4**

### Inline IPSec with Ethernet Controller

Support for IPSec protocol inline with the Ethernet controller

### Wireless Specific

- KASUMI, Snow 3G and ZUC

### Asymmetric (Public Key) Cryptography

- Modular exponentiation for Diffie-Hellman (DH)
- RSA key generation, encryption/decryption and digital signature generation/verification
- DSA parameter generation and digital signature generation/verification
- Elliptic Curve Cryptography: ECDSA, ECDHE

### Virtualization

- SR-IOV Support 48VFs

### Performance at API level

#### Cipher or Hash Only

AES XTS, CBC, GCM, CCP, SM4 >100Gb/s

SHA256, SHA3, >100Gb/s

#### Public Key Encryption

RSA Decrypt 2K >80k Ops/s

#### Algorithm Chaining

AES XTS, CBC, GCM, CCP, SM4 >100 Gb/s

#### Wireless Ciphers

ZUC/Snow 3G/KASUMI F8 >50Gb/s

Notes: Bulk Crypto uses AES-CBC-HMAC 256/SHA3 or AES GCM; KASUMI-F8 (encryption) at 320B packets; PFS = Perfect Forward Secrecy

Performance varies by use, configuration and other factors. Learn more at <http://www.intel.com/PerformanceIndex>.  
Look-aside Encryption with Intel QuickAssist Technology: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, QAT sample code application, Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041, test by Intel on 2/14/2022.

# Intel® QuickAssist Technology (Intel® QAT) Gen 3 Look-aside Verified Compression

## Usage Model

- Big data Acceleration, WAN acceleration, storage/database compression, http compression
- File System
- Databases
- VM-2-VM Live migration

## Compression and Decompression Using the Following Algorithms:

- DEFLATE: LZ77 compression followed by Huffman coding, with a gzip or zlib header

## Other Features

- Support for multiple history sizes with deflate
- Engine can be configured to performance either compression or decompression
- Support for stateful (de)compression
- Chaining(1) of Compression & Crypto for data integrity (SHAx, MD5) and data encryption with AES XTS, CBC
- Compress & Verify

	<i>Performance</i>
Compression	>70 Gb/s
Decompression	>80 Gb/s
Compression + Decompression	>80 Gb/s

Notes: Dynamic Deflate Level 1 using 128KB buffer size with Compress and Verify; Compression Ratio equivalent to zlib level 1; Best case compression ratio with Gen 2 is zlib level 4, Gen 3 is zlib level 6; Measured using Calgary Corpi

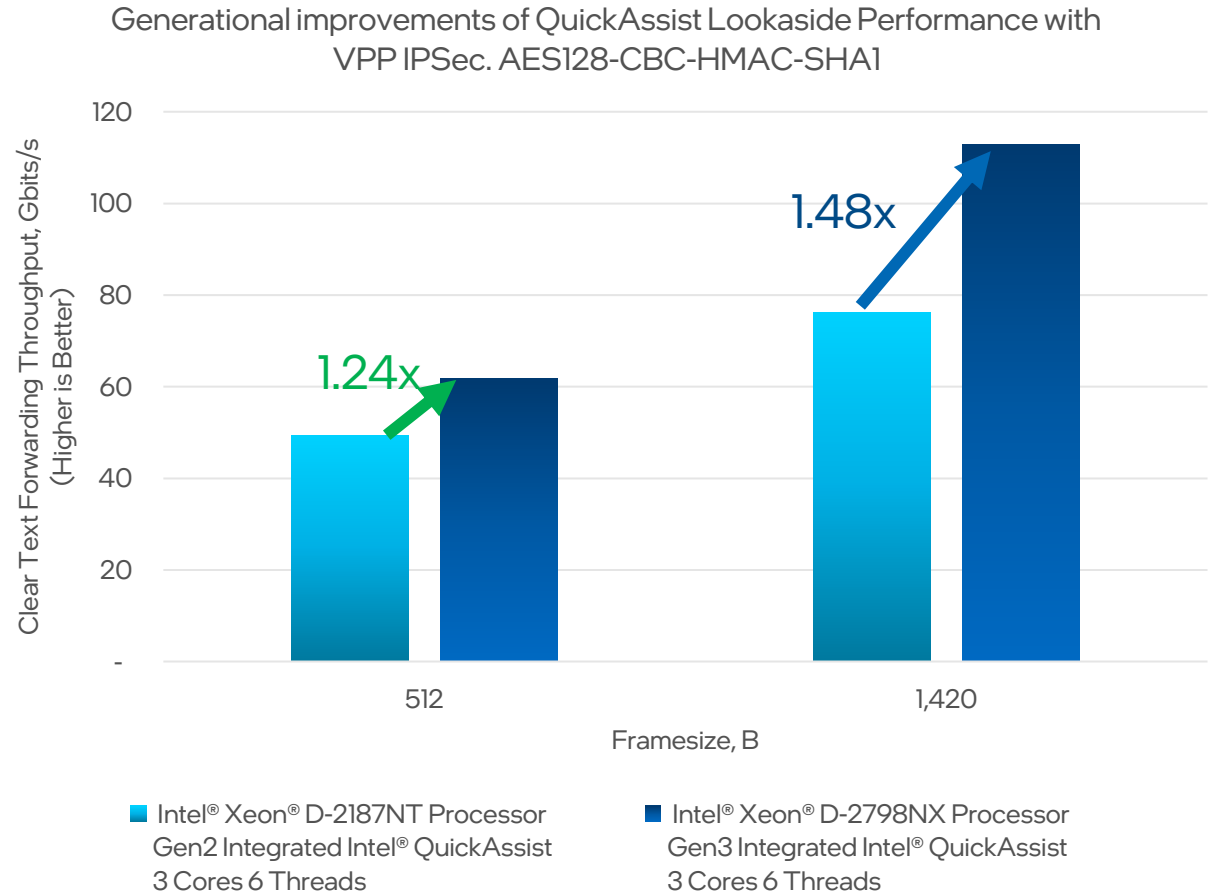
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Look-aside Compression with Intel QuickAssist Technology: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, QAT sample code application, Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041,, test by Intel on 2/14/2022.



# VPN Performance

# Gen-to-Gen Intel® QAT IPsec Look-aside Performance

- New generation of Intel® QuickAssist Technology brings new level of performance.
- Intel® QAT Gen 3 can achieve up to 1.48x higher throughput with 1420B packet size and up to 1.24x with 512B packet size.



Performance varies by use, configuration and other factors. Learn more at [www.intel.com/PerformanceIndex](http://www.intel.com/PerformanceIndex)

Intel® Xeon® D-2187NT Processor Integrated QAT: 1-node, 1x Intel Xeon D-2187NX CPU on Intel reference platform (Yuba City) with 128 GB (4 slots/ 32 GB/ 3200[2666]) total DDR4 memory, ucode 0x2006c0a, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2, VPP v v22.02-rc0-359-gf03e67691 configured as IPsec gateway, Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041, test by Intel on 2/22/2021.

Intel® Xeon® D-2798NX Processor Integrated QAT : 1-node, 1x Intel® Xeon D-2798NX CPU on Intel® reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000132, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2, VPP v v22.02-rc0-359-gf03e67691 configured as IPsec gateway, Gcc 9.3.0, Intel-aesni-mb v1.1, test by Intel® on 12/20/2021.

# Integrated Intel® Ethernet Technology

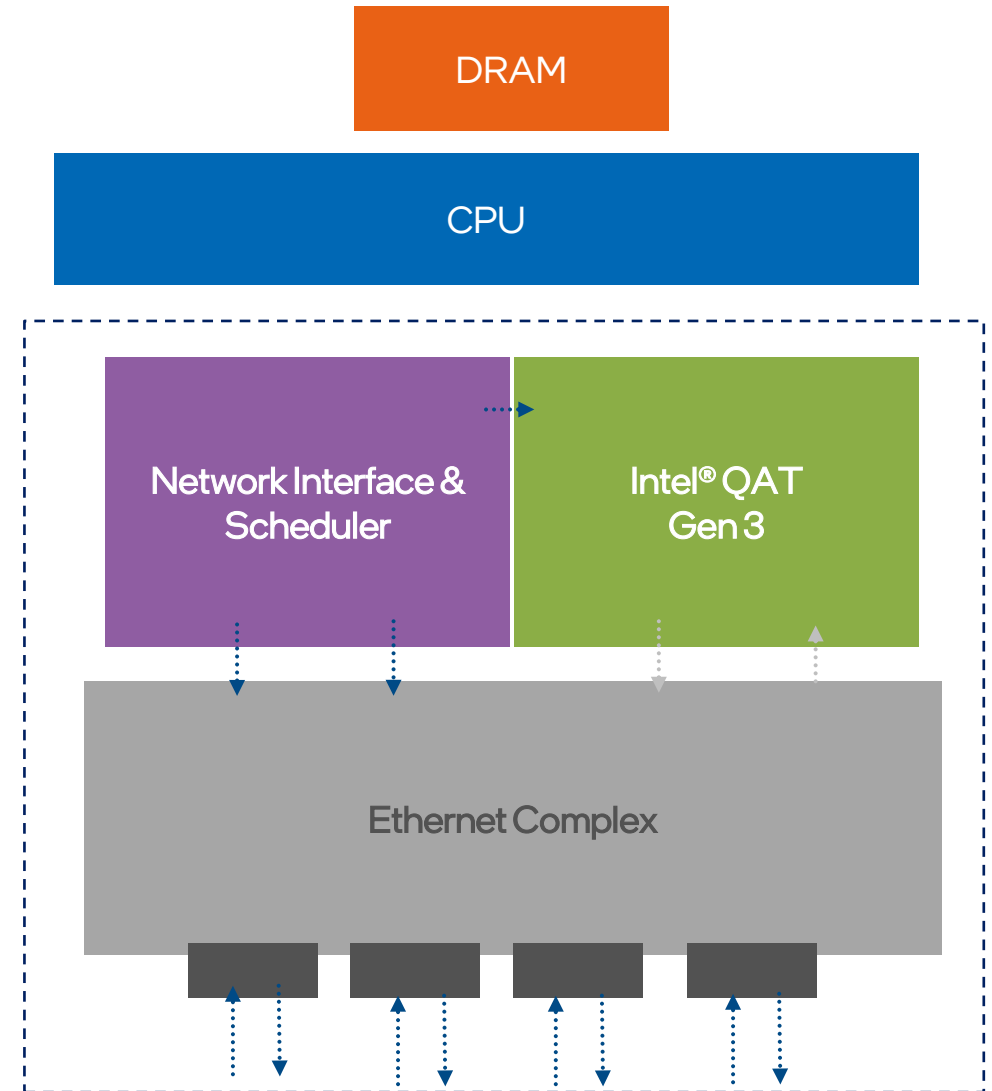
Latency and coherency optimizations

## Intel® Ethernet Controller

- 100 Gb/s programmable parsing/classification/modification
- Integrated ACL processing
- Feature rich RSS/Flow Director
- Advanced Scheduling Module: multiple layer hierarchical scheduler with dynamic updates, dual rate shaping, Strict Priority, WFQ or combination scheduling

## Flexible Packet Processor and Switch

- Only available in Intel® Xeon® D-2700NX processors
- Switch features including port to port, MAC learning, flexible parsing/classification, policing, ACLs, VM to VM
- Interfaces with Intel® QuickAssist Technology Gen 3 for providing Inline IPSec offload

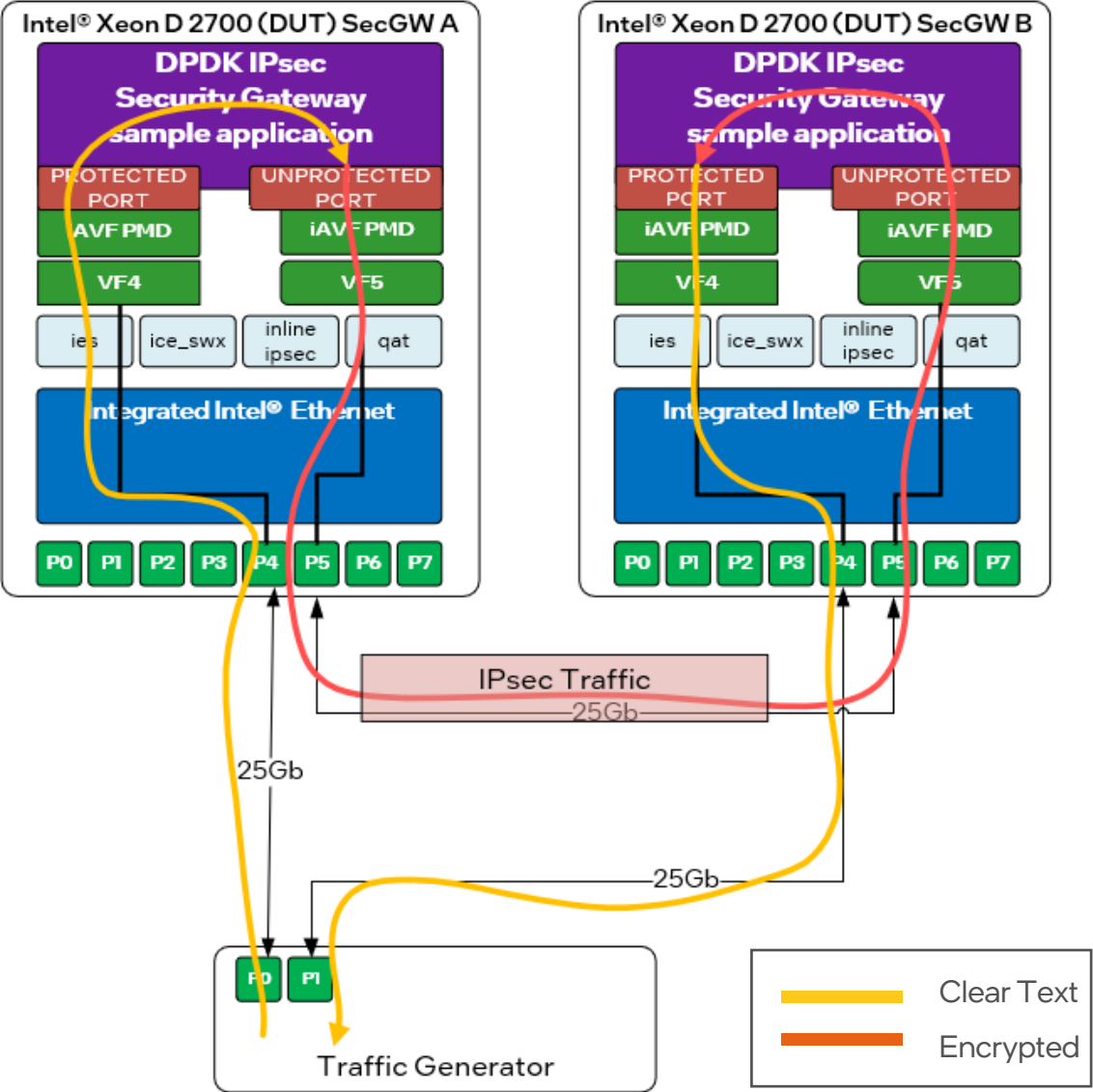




# Intel® Integrated Ethernet Inline IPsec Capabilities

Usage Model	Network Security; IPsec Offload
Performance	Up to 100 Gbps aggregate @ 1KB
Number of Offloaded IPsec Security Associations	8K-16K (software managed)
Max Packet Size	9KB
IPsec Modes / Protocols	Tunnel, Transport, ESP
Virtualization	SADB management per SR-IOV VF
Concurrent NIC Offloads	IPsec, TSO, Checksums

Type	Cipher Suite - Algorithm
AEAD	AES{128 192 256}-GCM, ChaCha20-Poly1305, AES128-CCM
Confidentiality	NULL, AES{128 192 256}-CBC, AES{128 192 256}-CTR, 3DES-CBC
Authentication	HMAC-SHA1, HMAC-SHA{256,384,512}, HMAC-MD5, AES-GMAC, AES-XCBC-MAC, AES-CMAC, NULL

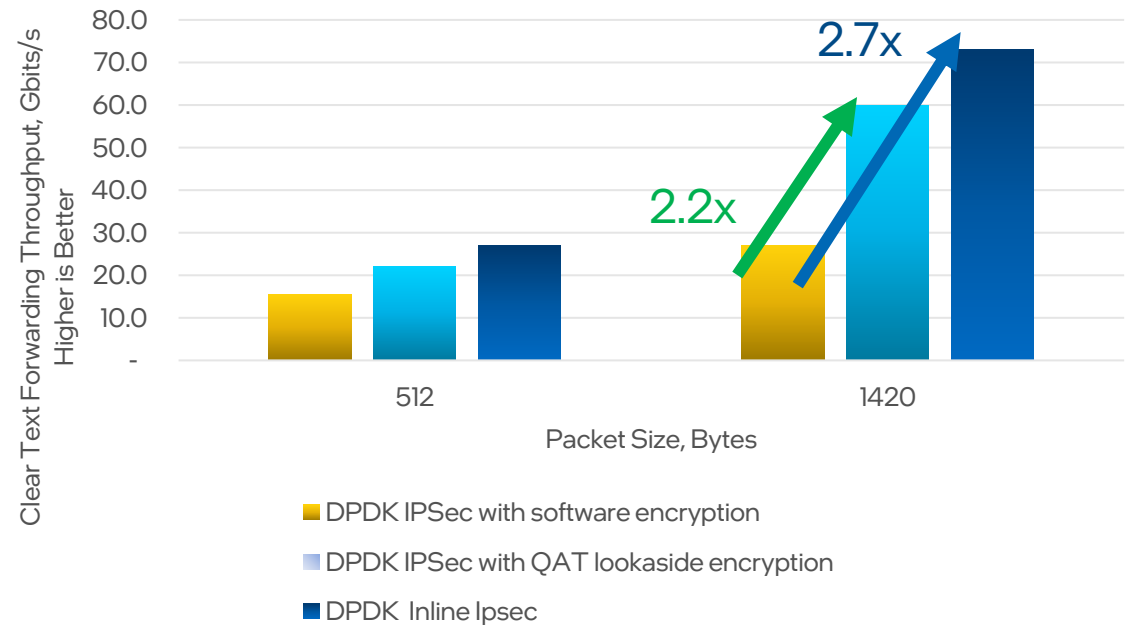


\*Other names and brands may be claimed as the property of others

# IPSec Performance with Intel® QAT Gen 3 Inline and Look-aside modes

- Offload IPSec protocol to Integrated Intel® Ethernet with Network Acceleration Complex
  - up to 2.7x with AES256 GCM with 1420B packet size
- Or offload cryptographic operations to Intel® QAT in look-aside mode:
  - up to 2.2x with AES256 GCM with 1420B packet size

DPDK IPSec AES 256 GCM Performance \*  
on the Intel® Xeon® D-2798NX Processor  
Algorithm: AES GCM256  
Cores: 1C2T @2.1GHz  
IPSec Tunnels: 5000 (10000 SAs)



Performance varies by use, configuration and other factors. Learn more at [www.intel.com/PerformanceIndex](http://www.intel.com/PerformanceIndex)

Configuration: Inline IPSec with QuickAssist Technology Software: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 4x25G Integrated Intel® Ethernet, DPDK IPSec-secgw (inline mode), Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041 (inline mode), ice\_swx 1.7.0\_rc88, ies-driver-bmsm-5.1.0.15, inline dev branch, v20.11.1-nac\_bmsm\_beta-rc5, 9b9d657eee755a93c0ed7e7f930632727533fd6b, test by Intel on 1/25/2022.

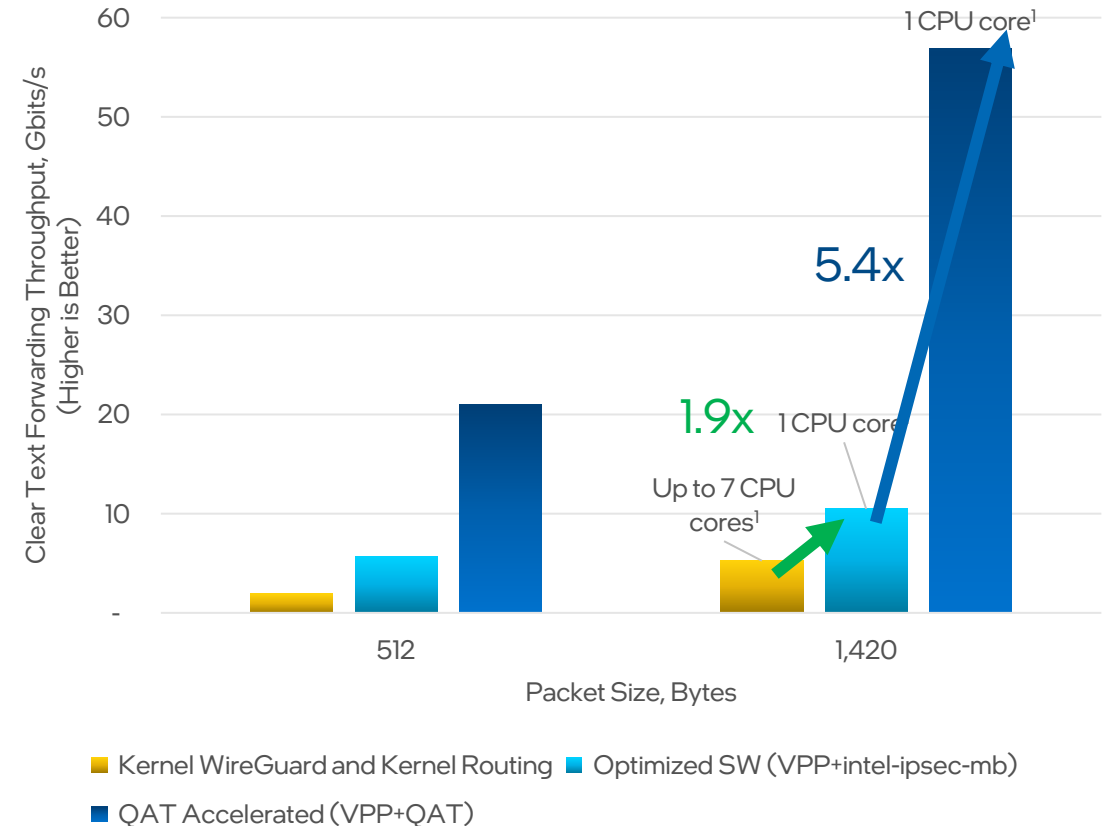
Look-aside Encryption with el QuickAssist Technology: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 4x25G Integrated Intel® Ethernet, DPDK IPSec-secgw, Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041, DPDK-21.11, test by Intel on 1/25/2022.

Encryption with vAES instructions: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 4x25G Integrated Intel® Ethernet, DPDK IPSec-secgw, Gcc 9.3.0, DPDK-21.11, intel-ipsec-mb v1.1. test by Intel on 1/25/2022.

# Optimizing WireGuard\* Performance

- Intel® QuickAssist Technology Gen 3 now supports ChaCha1305-poly20 algorithm exclusively used in WireGuard VPN protocol
- Optimizations to WireGuard plugin in VPP allow us to use vAES instructions or offload crypto operations to QAT
- **Optimizations in VPP provide a boost to performance over kernel WireGuard implementation and improved CPU utilization**
- **VPP with Intel® QAT is up to 5.4x better than same VPP stack with software crypto**

Intel® Xeon® D-2798NX Processor  
WireGuard Performance  
WireGuard Tunnels: 1



Performance varies by use, configuration and other factors. Learn more at [www.Intel.com/PerformanceIndex](http://www.Intel.com/PerformanceIndex)

QAT Accelerated (VPP+QAT): 1-node, 1x Intel® Xeon® D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000132, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2 (Chapman Beach), VPP v v22.02-rc0-359-gf03e67691 configured as WireGuard gateway, Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041, test by Intel on 12/20/2021.

Optimized SW (VPP+intel-ipsec-mb): 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000132, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2 (Chapman Beach), VPP v v22.02-rc0-359-gf03e67691 configured as WireGuard gateway, Gcc 9.3.0, Intel-aesni-mb v1.1, test by Intel on 12/20/2021.

Baseline: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000132, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2 (Chapman Beach), Kernel Wireguard package 1.0.20200513-1~20.04.2, Gcc 9.3.0, test by Intel on 12/20/2021.

<sup>1</sup> As measured by http application in Linux

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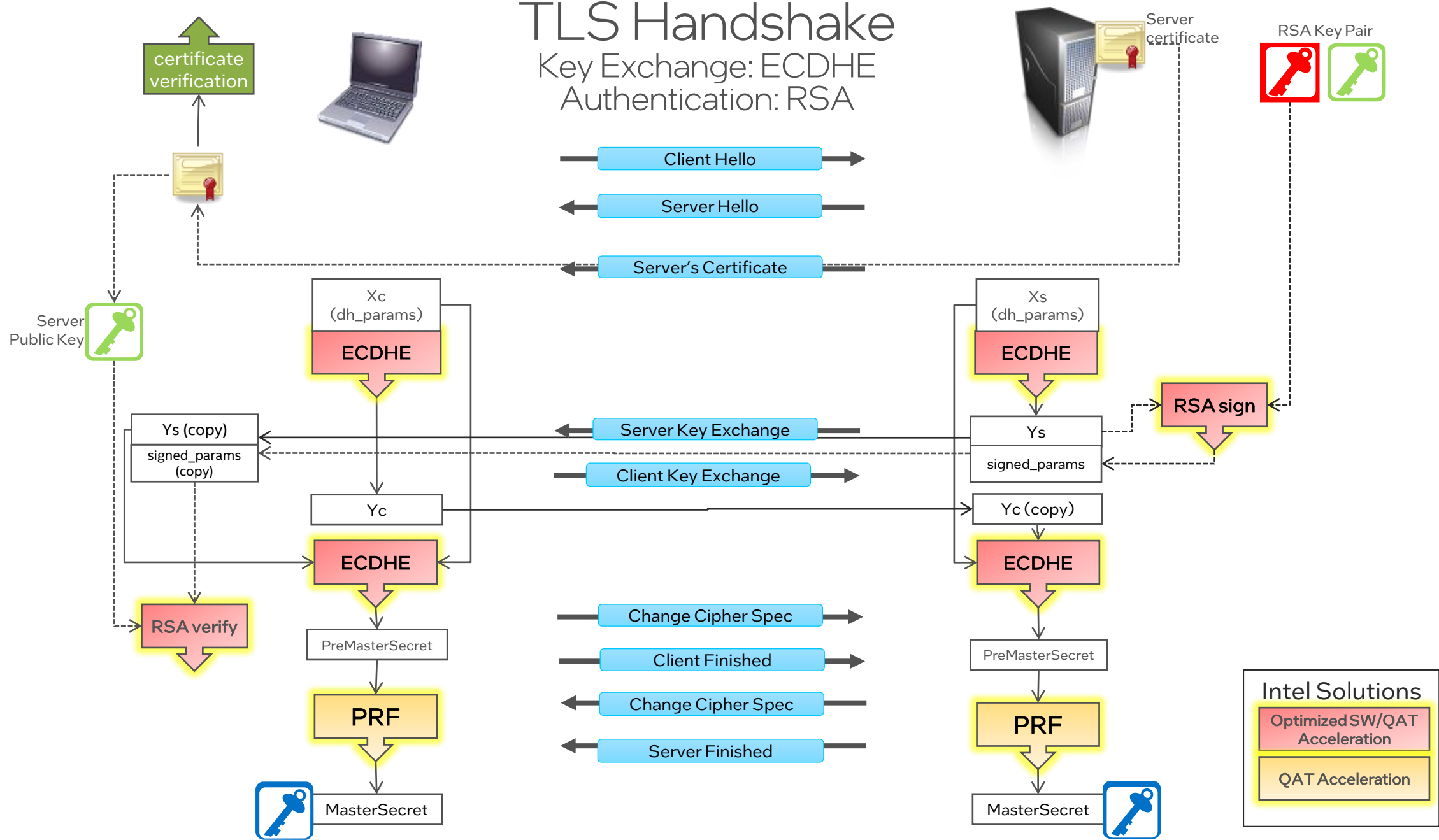


# NGINX\* TLS 1.3 Handshake Benchmark

\*Other names and brands may be claimed as the property of others

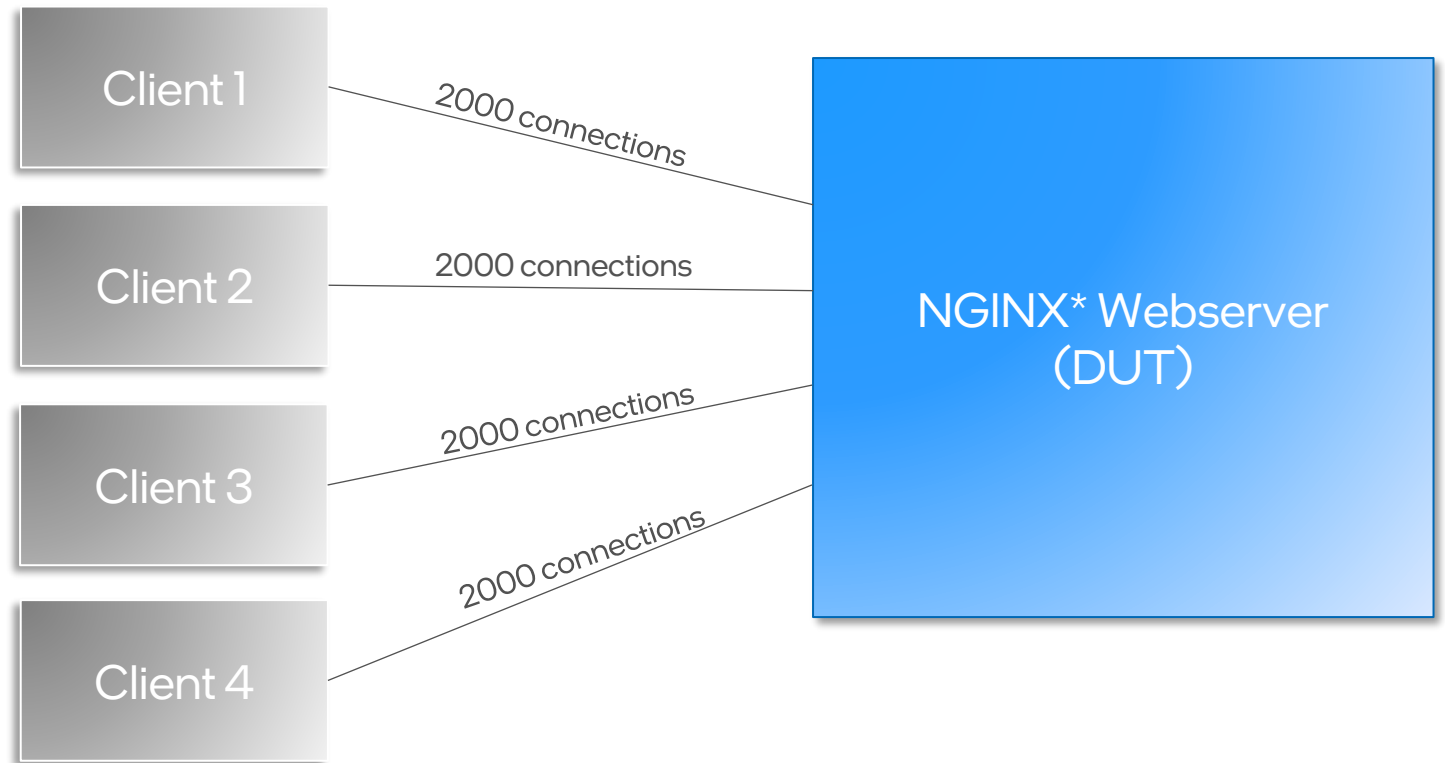
# TLS Handshake

Key Exchange: ECDHE  
Authentication: RSA



# NGINX\* Connections Per Second

- For each client, 2000 outstanding connection requests are created with OpenSSL\* s\_time. The requests run both continuously and simultaneously for 400 seconds
- Multiple client machines are used to ensure that there are no limitations from the Client side
- Each client process establishes a secure connection, exits gracefully and sends a new request to establish a secure connection
- At the end of the 400 second run, the Connections per Second from each process is summed up
- Connection-Per-Second tests does not request any file

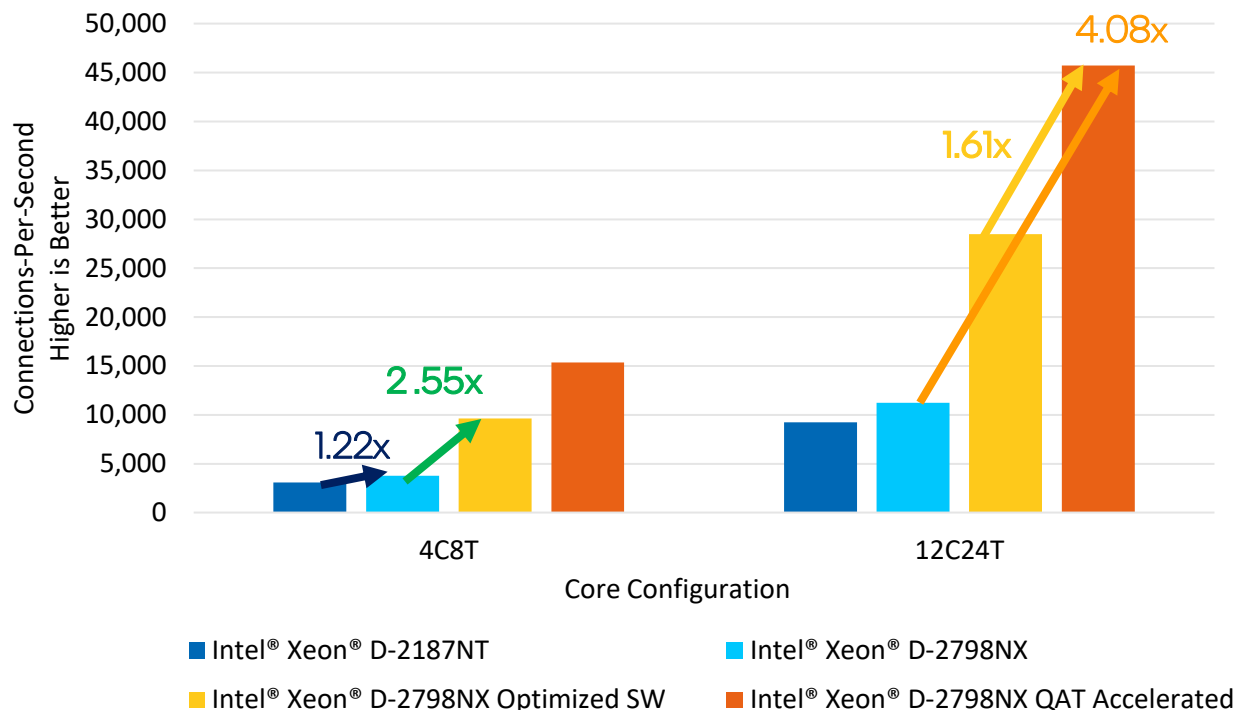


\*Other names and brands may be claimed as the property of others

# NGINX\* Secure TLS 1.3 Webserver Handshakes Only (CPS)

- Intel® Xeon® D-2187NT to Intel® Xeon® D-2798NX baseline performance without new instructions
  - Up to 1.22x Gen-to-Gen performance gain for ECDHE\_X25519\_RSA2K
- New crypto ISAs for optimized software on Intel® Xeon® D-2798NX
  - Up to 2.55x performance gain for ECDHE\_X25519\_RSA2K with optimized software
- Intel® QAT Acceleration of crypto functions on Intel® Xeon® D-2798NX
  - Up to 4.08x performance gain for ECDHE\_X25519\_RSA2K with Intel® QAT Acceleration

NGINX\* TLS 1.3 Webserver  
Intel® Xeon® D-2187NT vs Intel® Xeon® D-2798NX  
Cipher: TLS\_AES\_128\_GCM\_SHA256, Curve: X25519, Key: RSA2K  
Handshakes Only



Performance varies by use, configuration and other factors. Learn more at [www.Intel.com/PerformanceIndex](http://www.Intel.com/PerformanceIndex)

<sup>1</sup> Intel® Xeon® D-2187NT : 1-node, 1x Intel Xeon D-2187NT CPU @2.0Ghz on Intel reference platform (Yuba City) with 64 GB (4 slots/ 16GB/ 2666) total DDR4 memory, ucode 0x2006c0a, HT ON, Turbo OFF, Ubuntu 20.04 LTS (Focal Fossa), 5.4.0-67-generic, Async NGINX v0.4.7, OpenSSL 1.1.1l, 1x Intel 240G SSD, test by Intel on 2/10/2022.

<sup>2</sup> Intel® Xeon® D-2798NX : 1-node, 1x Intel Xeon D-2798NX CPU @2.1Ghz on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 2933) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04 LTS (Focal Fossa), 5.4.0-67-generic, NGINX v0.4.7, OpenSSL 1.1.1l, 1x Intel 240G SSD, test by Intel on 2/28/2022.

<sup>3</sup> Intel® Xeon® D-2798NX Optimized SW: 1-node, 1x Intel Xeon D-2798NX CPU @2.1Ghz on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 2933) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04 LTS (Focal Fossa), 5.4.0-67-generic, NGINX v0.4.7, OpenSSL 1.1.1l, QAT Engine v0.6.10, Intel IPsec MB v1.1, IPP-Crypto ipccp\_2021.4, 1x Intel 240G SSD, test by Intel on 2/28/2022.

<sup>4</sup> Intel® Xeon® D-2798NX QAT Accelerated : 1-node, 1x Intel Xeon D-2798NX CPU @2.1Ghz on Intel reference platform (Moro City) with 64 GB (4 slots/ 16GB/ 2933) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04 LTS (Focal Fossa), 5.4.0-67-generic, NGINX v0.4.7, OpenSSL 1.1.1l, QAT18.L.1.4.0-00008, 1x Intel 240G SSD, test by Intel on 2/28/2022.

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# Questions?

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April 6<sup>th</sup> @ 8am PDT

Intel® Network Builders Insights Series  
The Next Generation Intel® Xeon® D SoC and  
Platform Built For The Edge

- Xiaojun (Shawn) Li, Sales Director, Next Wave OEM & eODM
- Pompey Nagra, Product Marketing Engineer
- Craig Carter, Product Marketing Engineer
- Gopal Mundada, Senior Principal Engineer



The Intel logo is centered on a solid blue background. It features the word "intel" in a white, lowercase, sans-serif font. A small blue square is positioned above the letter 'i'. To the right of the word "intel" is a registered trademark symbol (®).

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# System Configuration

<p>DPDK IPsec</p>	<p>Up to 2.64x higher performance (frame size: 512B), 3.58x higher performance (frame size: 1420) on Intel Xeon 2798-NX processor with inline IPsec compared to software encryption for DPDK IPsec application.</p> <p>Up to 1.67x higher performance (frame size: 512B), 2.6x higher performance (frame size: 1420) on Intel Xeon 2798-NX processor with QAT lookaside encryption compared to software encryption for DPDK IPsec application.</p>	<p>New1: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 1x 1x100G Internal Port, DPDK IPsec-secgw (inline mode), Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041 (inline mode), ice_swx 1.7.0_rc88, ies-driver-bmsm-5.1.0.15, inline dev branch, v20.11.1-nac_bmsm_beta-rc5, 9b9d657eee755a93c0ed7e7f930632727533fd6b, test by Intel on 1/25/2022.</p> <p>New2: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 1x 1x100G Internal Port, DPDK IPsec-secgw, Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041, DPDK-21.11, test by Intel on 1/25/2022.</p> <p>Baseline: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 1x 1x100G Internal Port, DPDK IPsec-secgw, Gcc 9.3.0, Intel-aesni-mb, DPDK-21.11, test by Intel on 1/25/2022.</p>
<p>NGINX</p>	<p>Up to 4.08x higher performance on Intel Xeon 2798-NX processor with QAT hardware offload compared to non-optimized baseline for NGINX Secure TLS 1.3 Web-Server application.</p> <p>Up to 2.55x higher performance on Intel Xeon 2798-NX processor with software encryption optimizations compared to non-optimized baseline for NGINX Secure TLS 1.3 Web-Server application.</p>	<p>New1: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 2933) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04 LTS (Focal Fossa), 5.4.0-67-generic, 1x Intel 240G SSD, 2x 100G E810-CQDA2 (Chapman Beach) + 1x100G internal Port, Async NGINX v0.4.7, Gcc 9.3.0, OpenSSL 1.1.1l, QAT Engine v0.6.10, QAT18.L.1.4.0-00008, test by Intel on 2/28/2022.</p> <p>New2: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 2933) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04 LTS (Focal Fossa), 5.4.0-67-generic, 1x Intel 240G SSD, 2x 100G E810-CQDA2 (Chapman Beach) + 1x100G internal Port, Async NGINX v0.4.7, Gcc 9.3.0, OpenSSL 1.1.1l, QAT Engine v0.6.10, Intel Ipsec MB v1.1, IPP-Crypto ipccp_2021.4, test by Intel on 2/28/2022.</p> <p>Baseline: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 2933) total DDR4 memory, ucode 0x1000150, HT ON, Turbo OFF, Ubuntu 20.04 LTS (Focal Fossa), 5.4.0-67-generic, 1x Intel 240G SSD, 2x 100G E810-CQDA2 (Chapman Beach) + 1x100G internal Port, Async NGINX v0.4.7, Gcc 9.3.0, OpenSSL 1.1.1l, test by Intel on 2/28/2022.</p>
<p>VPP Wireguard</p>	<p>Up to 2.47x higher performance (frame size: 512B), 1.74x higher performance (frame size: 1420) on Intel Xeon 2798-NX processor with QAT hardware offload compared to kernel implementation for VPP Wireguard application.</p> <p>Up to 3.72x higher performance (frame size: 512B), 5.43x higher performance (frame size: 1420) on Intel Xeon 2798-NX processor with QAT look-aside encryption compared to software encryption for DPDK IPsec application.</p>	<p>New1: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000132, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2 (Chapman Beach), v22.02-rc0-359-gf03e67691 dpdk-21.11-wireguard, Gcc 9.3.0, QAT driver QAT18.L.1.2.0-00041, test by Intel on 12/20/2021.</p> <p>New2: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000132, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2 (Chapman Beach), v22.02-rc0-359-gf03e67691 dpdk-21.11-wireguard, Gcc 9.3.0, Intel-aesni-mb v1.1, test by Intel on 12/20/2021.</p> <p>Baseline: 1-node, 1x Intel Xeon D-2798NX CPU on Intel reference platform (Moro City) with 64 GB (4 slots/16GB/ 3200[2933]) total DDR4 memory, ucode 0x1000132, HT ON, Turbo OFF, Ubuntu 20.04.3 LTS (Focal Fossa), 5.4.0-67-generic, 1x SanDisk SD8SBAT2 240GB, 2x 100G E810-CQDA2 (Chapman Beach), Kernel Wireguard package 1.0.20200513-1~20.04.2, Gcc 9.3.0, test by Intel on 12/20/2021.</p>