Product Brief

Intel® Xeon® Processors
Intel® QuickAssist Technology (Intel® QAT)

Accelerate Data Encryption and Compression Workloads

Offload compute-intensive workloads and significantly improve application performance with Intel QuickAssist Technology (Intel QAT) on the latest Intel Xeon processors.

Intel QAT, built into 4th and 5th Gen Intel Xeon Scalable processors and Intel Xeon 6 processors, provides enterprises with increased performance, footprint reduction, and operational efficiency for today's data-driven world.

The exponential growth of data and compute-intensive workloads such as artificial intelligence (AI), analytics, high-performance storage, and cloud application services places significant demands on CPUs. Data must be protected by encryption at rest, in motion, and in process. Applications that require compressing and encrypting data in a single pass can significantly tie up processing resources and create data-flow bottlenecks, leading to increased latencies. High-performance standard compression algorithms in particular can consume significant CPU resources, utilizing up to hundreds of cores.

Intel QAT can help overcome these barriers to performance in the data center, cloud, and edge. This innovative technology, one of several Intel® Accelerator Engines, offloads computationally intensive symmetric and asymmetric cryptography and data compression/decompression operations from the CPU, relieving the CPU from these demanding tasks. This reallocation of computational resources allows the CPU to perform other tasks more efficiently, potentially enhancing overall system performance, efficiency, and power across various use cases.

Intel QAT is built into 4th and 5th Gen Intel Xeon Scalable processors and now the Intel Xeon 6 processor, which introduces a new modular x86 architecture. Intel Xeon 6 processors allow data center architects to configure and deploy infrastructures that are purpose-built for each organization's unique needs and workloads. Intel Xeon 6 processors offer the choice of two different CPU microarchitectures—Performance-cores (P-cores) and Efficient-cores (E-cores)—that provide the right amount of performance and efficiency across a wide range of workloads in the data center. Intel Xeon 6 processors with P-cores are optimized for high performance per core and excel at the widest range of workloads. E-cores are optimized for high core density and exceptional performance per watt, delivering distinct advantages for cloud-scale workloads that demand high task-parallel throughput.

Intel QAT accelerates performance across many use cases

The benefits of Intel QAT go beyond immediate performance gains. For instance, enterprises can reduce core count, leading to more streamlined processor utilization. In addition, Intel QAT on Intel Xeon 6 processors with P-cores frees CPU cycles for other tasks, helping consolidate server footprint. Intel QAT on Intel Xeon 6 processors with E-cores improves power efficiency and increases core density. With these capabilities, Intel QAT empowers businesses to realize new efficiencies and scalability, particularly for large-scale operations such as cloud environments, data centers, extensive data lakes, and various storage tiers. Users also benefit from energy efficiency savings, supporting sustainability goals.

Cloud service providers

To get more out of infrastructure and deliver more value to customers, cloud service providers (CSPs) can benefit from a reduced CPU footprint on servers with greater core efficiencies. Intel QAT on the latest Intel Xeon processors delivers data compression and encryption at scale to support content-delivery networks (CDNs), load balancers, gateways, and microservices. CSPs can serve more users while providing the necessary high-performance guard-band required to fend off distributed denial of service (DDoS) attacks that can slow down CDNs.

Intel QAT compression can provide efficiencies for storage, databases, big data, or CDNs with compression services. The value of Intel QAT compression can be observed in a standard Deflate performance benchmark, where one core can do the work of 1,026 cores for level-9 compression.[1] The efficiency of Intel QAT compression brings performance and significant power reduction to common data-rich applications.

Enterprises

Enterprises can also operate more efficiently and reduce costs when deploying hyperconverged infrastructure (HCI) and web applications thanks to higher web server capacity and performance. Intel QAT on 4th Gen Intel Xeon Scalable processors requires up to 95 percent fewer cores and delivers up to 2x higher level-1 compression throughput versus the prior generation of Intel Xeon processors.[1] In addition, compression performance on Red Hat Enterprise Linux (RHEL) is significantly improved with Intel QAT on 4th Gen Intel Xeon Scalable processors, compared to software acceleration, ranging from 9x to 139x faster compression.[2]

Improved performance allows enterprise systems to serve content quickly, connect more clients/users to content with high-performance public key cryptography, and improve the load time and responsiveness of web applications.

Storage

Organizations can reduce total cost of ownership (TCO) and power consumption in storage architecture, all while meeting growing demands on performance. With Intel QAT, data compression and decompression tasks are completed faster when performing backup and archiving for application data or distributed storage systems and data lakes. For example, data backup on Microsoft SQL Server 2022 can be up to 3.2x faster with 4th Gen Intel Xeon Scalable processors and Intel QAT, compared to prior generations of Intel Xeon processors.[3]

Networking edge and core

Intel QAT accelerates encryption and decryption of network traffic, which can improve performance for virtual private network (VPN) security and web servers. Intel QAT on 4th Gen Intel Xeon Scalable processors allows the use of up to 47 percent fewer cores to achieve the same number of connections per second on an NGINX key handshake versus the prior generation.[4] In order to meet high service-level agreements (SLAs) while managing power consumption in the 5G control plane, Intel QAT enables the additional capacity needed from the service mesh to keep up with increasing user plane input.

Improve system resource consumption and overall efficiency

Figure 1 shows how Intel QAT on the latest Intel Xeon processors also helps improve energy efficiency. It allows users to accelerate security and data-compression workloads on existing hardware and increase power efficiency with leading performance per watt. These capabilities can lead to more efficient CPU utilization and lower electricity consumption, and they help businesses achieve their sustainability goals. Learn more about how Intel Xeon Scalable processors with Intel QAT outperform AMD EPYC processors.

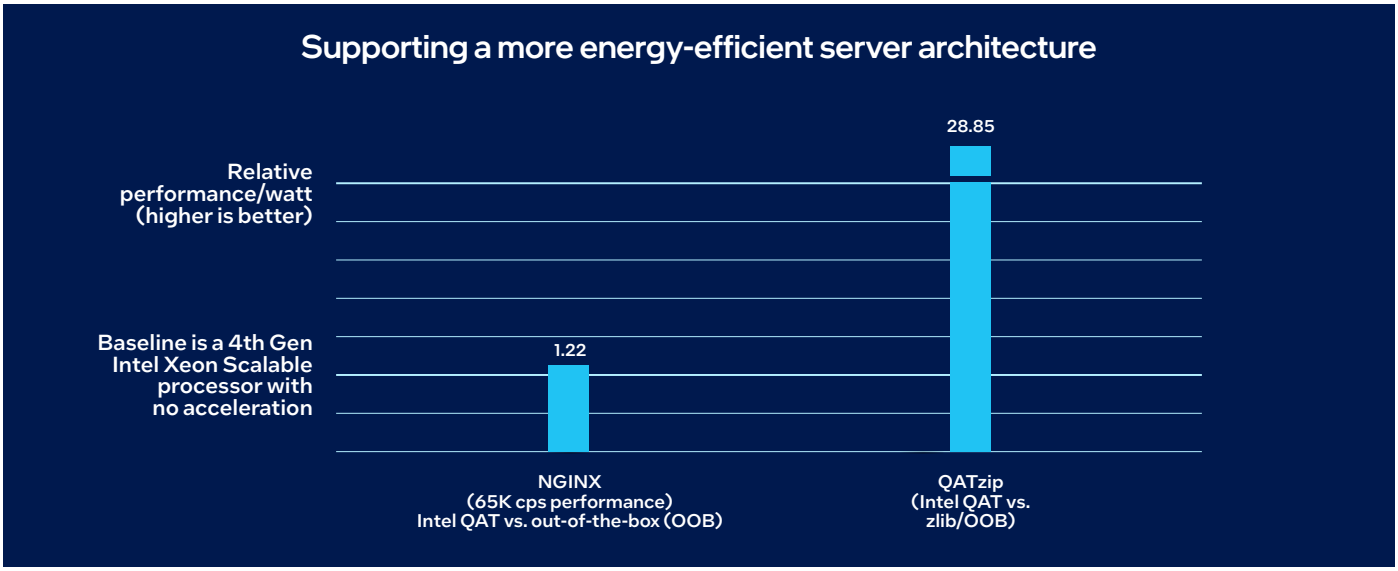

Figure 1. Intel QAT helps improve performance per watt on Intel Xeon processor platforms[5]

Implement Intel QAT for key workloads

To help IT admins and developers enable Intel QAT in their solutions, this section provides numerous resources and tools to help them get started and make Intel QAT implementation and adoption easier:

- Intel QAT Getting Started Guide: Instructions to obtain, build, install, and exercise Intel QAT software for the Hardware Version 2.0 package.
- Intel QAT driver for Linux: Download the driver for the Hardware Version 2.0 package.
- Technical documentation and drivers: Drivers, applications, and technical documentation for Intel QAT enablement.
- Intel® Developer Zone: Official source for developing on Intel hardware.
- Intel® Developer Cloud: Resources for developers to learn, prototype, test, and run workloads on a cluster of the latest Intel hardware.

Database workloads

Improve productivity and uptime for SQL Server 2022 Enterprise edition and MySQL, with up to 3.2x faster backup time for both database applications.[3]

SQL Server: Get up to 1.93x speedup and up to 1.64x higher performance per watt for HammerDB on SQL Server 2022 servers with backup compression running on 5th Gen Intel Xeon Platinum 8592+ processors with integrated Intel QAT, compared to 4th Generation AMD EPYC 9554 processors using default compression.[6]

To enable Intel QAT for SQL Server backup:

- Install the latest version of SQL Server 2022 Enterprise edition.
- Install the latest Intel QAT driver.
- Enable hardware offload configuration with sp_configure.
- Enable hardware offload for the Intel QAT accelerator.

Implementation and adoption resources:

- Intel QAT for SQL Server: How to configure an integrated acceleration and offloading solution with Intel QAT for SQL Server
- Tuning guide, SQL Server OLAP: MySQL tuning guide for online analytical processing (OLAP)
- Tuning guide, SQL Server OLTP: MySQL tuning guide for online transactional processing (OLTP)
- Intel QAT for SQL Server 2022: White paper emphasizing performance gains and configuration details for SQL Server 2022 utilizing Intel QAT

MySQL: Implementation and adoption resources are listed below.

- Intel QAT for MySQL: Intel® Optimization Hub recipe for MySQL making use of Intel QAT
- Container: Container details for Intel-optimized MySQL
- Coding resources:
    - GitHub code for MySQL
    - GitHub code for HammerDB on MySQL

Networking workloads

IPSec: Lower TCO when using IPSec, with the need for up to 33 percent fewer server cores with Intel QAT on 4th Gen Intel Xeon Scalable processors, compared to the prior generation.[7]

Implementation and adoption resources:

- Intel QAT for network functions virtualization (NFV) workloads: How Intel QAT accelerates network function workloads
- Intel QAT for IPSec: Intel Optimization Hub recipe for IPSec using Intel QAT
- Container: Container details for Intel QAT crypto base
- Coding resources: GitHub code for IPSec

WireGuard: Increase capacity to handle more network traffic—up to 5.9x higher speeds when offloading large packet size traffic to Intel QAT.[8]

Implementation and adoption resources:

- Intel QAT for WireGuard processing: Accelerate WireGuard processing technology guide
- Intel QAT for NFV workloads: How Intel QAT accelerates network function workloads

NGINX: Get up to 2.17x higher NGINX TLS handshake performance per core with the 5th Gen Intel Xeon Platinum 8592+ processor with integrated Intel QAT, compared to out-of-the-box (OOB) software.[4] Get up to 1.85x higher NGINX TLS handshake performance per core with the 5th Gen Intel Xeon Platinum 8592+ processor with integrated Intel QAT, compared to the OOB 4th Gen AMD EPYC 9554 processor.[9]

Implementation and adoption resources:

- Intel QAT for NGINX: Intel QAT for NGINX tech paper
- Intel QAT software for NGINX: Intel Optimization Hub recipe for NGINX with Intel QAT software
- Intel QAT for NGINX: Intel Optimization Hub recipe for NGINX with the Intel QAT accelerator
- NGINX cloud performance benchmarks: 12 key NGINX benchmarks
- Container: Container details for Intel-optimized NGINX
- Coding resources: GitHub code for NGINX

Envoy: Lower TCO, get better user experiences, and improve operational efficiency. Get up to 2.5x higher throughput (requests per second), up to 74 percent lower P99 latency, and up to 12 percent lower CPU utilization with Intel QAT on 4th Gen Intel Xeon Scalable processors, compared to a solution with no acceleration.[10]

Implementation and adoption resources:

- Intel QAT for Envoy TLS acceleration: Envoy Transport Layer Security (TLS) acceleration with Intel QAT solution brief
- Intel QAT for Envoy TLS acceleration: Configuration for Envoy TLS with Intel QAT
- Crypto Accelerations for Istio and Envoy: Crypto accelerators in Istio and Envoy with Intel Xeon processors user guide
- Istio and Envoy Optimizations: Crypto accelerators in Istio and Envoy with Intel Xeon processors solution brief
- Container: Container details for Envoy proxy
- Coding resources: GitHub code for Envoy proxy

Data services workloads

QATzip: Improve OLTP and increase capacity for more transactions. Use up to 96 percent fewer cores and achieve up to 1.37x higher level-1 compression throughput with 4th Gen Intel Xeon Scalable processors with Intel QAT using QATzip.[1]

Resources:

- Intel QAT for QATzip: Technical paper on compression efficiencies in the cloud with Intel QAT and QATzip
- Coding resources: GitHub code for QATzip

Zstd: Lower costs and power consumption. Get an up to 3.9x average performance-per-watt efficiency improvement for targeted workloads.[11]

Resources:

- Programming resources: Zstd on GitHub
- Coding resources: QAT-ZSTD-Plugin

Achieve performance gains and improve TCO with Intel QAT

Intel QAT helps reduce system resource consumption and TCO by accelerating security and data-compression workloads on existing hardware and increasing power efficiency with leading performance per watt.

Learn more at intel.com/quickassist or get started today with these additional Intel QAT resources:

- Intel QAT outcomes
- Intel QAT documentation and drivers
- Intel Developer Zone
- Intel Developer Cloud

Learn more about 4th Gen Intel Xeon Scalable processors, 5th Gen Intel Xeon processors, Intel Xeon 6 processors, and Intel Accelerator Engines.

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[1] Calculated from results of internal performance testing of 1 core/1 thread conducted in April 2022. Hardware = 90.3 Gb/s. Software = 0.088 Gb/s. 4th Gen Intel Xeon Scalable processor (pre-launch SKU), 56 cores, 1.8 GHz/2.7 GHz. QATzip micro v1.0.7. ISA-L VL1-3 vectorized instructions. lzbench micro v1.8.1. LVL9 compression. Buffer size: 64 KB. Intel QAT driver: QAT20.L.2201.0.0-00042.

[2] Red Hat. "Red Hat Enterprise Linux achieves significant performance gains with Intel's 4th Generation Xeon Scalable Processors." April 2023. redhat.com/en/blog/red-hat-enterprise-linux-achieves-significant-performance-gains-intels-4th-generation-xeon-scalable-processors.

[3] See [D7] at intel.com/processorclaims: 4th Gen Intel Xeon Scalable processors. Results may vary.

[4] See [N15] at intel.com/processorclaims: 4th Gen Intel Xeon Scalable processors. Results may vary.

[5] See [E1] at intel.com/processorclaims: 4th Gen Intel Xeon Scalable processors. Results may vary.

[6] See [D204] at intel.com/processorclaims: 5th Gen Intel Xeon processors. Results may vary.

[7] See [N17] at intel.com/processorclaims: 4th Gen Intel Xeon Scalable processors. Results may vary.

[8] Intel. "Intel® QAT - Accelerate WireGuard* Processing with 4th Gen Intel® Xeon® Scalable Processor." January 2023. https://networkbuilders.intel.com/docs/networkbuilders/intel-qat-accelerate-wireguard-processing-with-4th-gen-intel-xeon-scalable-processor-technology-guide-1673248114.pdf.

[9] See [N202] at intel.com/processorclaims: 5th Gen Intel Xeon processors. Results may vary.

[10] See [W5] at intel.com/processorclaims: 4th Gen Intel Xeon Scalable processors. Results may vary.

[11] See [E2] at intel.com/processorclaims: 4th Gen Intel Xeon Scalable processors. Results may vary.

Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See configuration disclosure for additional details.

No product or component can be absolutely secure.

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