Solution Brief

Silicom Ibiza 1U Universal CPE
Intel Atom® x7000 Processor Series

Silicom Brings AI Into Network Appliance at the Edge

Silicom Ibiza 1U Universal CPE, powered by the Intel Atom® x7000 processor series, delivers a robust, secure, and intelligent platform for deploying AI and cryptographic workloads at the edge.

Edge networking is a critical component in this rapidly changing networking environment. Corporations are looking for improved efficiency, latency and resource optimized applications for end-users or devices. This has encouraged corporations to explore a smaller footprint and versatile CPEs to support the evolving edge networking requirements.

As new edge networking requirements continue to rise, advanced network and security features, such as next generation firewall (NGFW), zero trust, and Artificial Intelligence (AI)-enabled network security solutions, become important in edge networking to protect its users from similarly evolving cyber threats in the corporate environment. The progression in networking and security applications have also driven convergence of the two and consolidated a CPE device that provides network connectivity and security to the devices at the edge.

These CPEs represent the next evolution of corporate and edge connectivity. The capabilities of advanced features within allow corporate to optimize edge network further, manage traffic flow better while reducing latency, and mitigate cyber threats, and hence improve performance and optimize productivity of a corporate IT environment.

Silicom Ltd., an Intel® Industry Solution Builders Network Builders member, has developed the Ibiza-1U series, a compact Intel Atom® x7000 processor-based appliances to accelerate and secure the edge networking edge. Silicom and Intel tested the performance of Ibiza 1U series on AI and cryptographic workloads using NetSec software package offered by Intel.

Silicom Ibiza 1U Universal CPE

Silicom's Ibiza network appliance stands out by uniquely integrating high-speed networking with AI acceleration and edge vision capabilities—all within a compact, power-efficient platform. By leveraging the processor-integrated Intel® UHD Graphics for real-time inference, Silicom enables a unified solution that traditionally requires multiple discrete systems, delivering a differentiated edge architecture ideal for AI-driven network security and computer vision at the edge.

Silicom Ltd. has designed a network appliance based on Intel Atom x7000 processor series. The design meets the needs of robust, secure, and intelligent platform for deploying AI-enabled network security applications with heavy cryptographic requirements. The Ibiza 1U Universal CPE design comes with a rich feature set including flexible PCIe expansion, integrated hardware security modules, and Silicom's acceleration for networking and encryption. These appliances are ideal for industries demanding high-throughput, low-latency networking that connects intelligent devices at the edge.

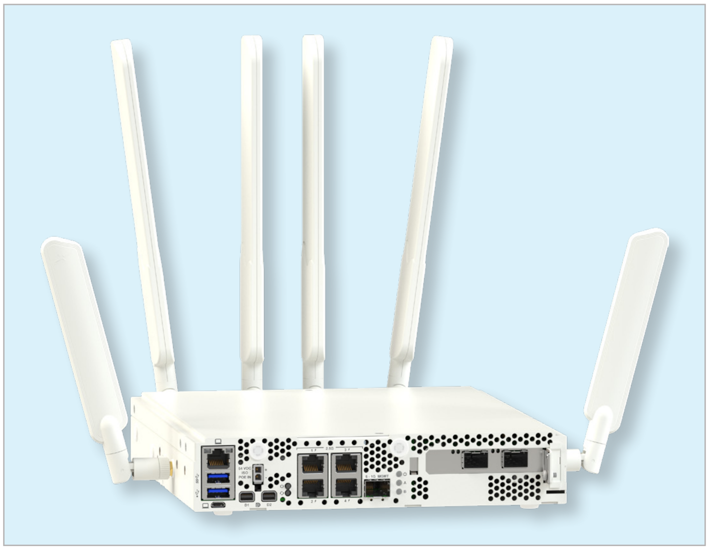

Figure 1. Ibiza 1U Universal CPE

Silicom's Ibiza 1U series supports a range of high-impact use cases including computer visualization, and increasingly, AI-enabled network security. It replaces traditional purpose-built CPE hardware with a wide array of wired and wireless LAN/ WAN options for maximum site installation flexibility while still maintaining a small footprint and optimum price points. It comes with LAN connectivity, including dual-band 802.11ax Wi-Fi 6, as well as 2.5 Gbps RJ-45 ports supporting auxiliary Wi-Fi access points at full bandwidth. PoE++ output power of up to 60W per 2.5G port can optionally be included. Additionally, Ibiza 1U series includes a 1 Gbps that can be populated as copper RJ-45 or fiber SFP to align with site-specific needs. It comes with a PCIe low profile (LP) expansion slot supporting standard add-in cards for expanded connectivity. Optionally, a single or dual 4G LTE or 5G sub-6 uplinks can be included on the Ibiza 1U series.

Intel Atom® x7000 Processor Series

Silicom Ltd. chose the Intel Atom x7000 processor series because of its exceptional computational capabilities for a modern network environment. The processor comes with up to eight Efficient cores (E-cores) and delivers excellent performance with robust processing power in compact and low-power design. The Intel Atom x7000 processor series comes with Intel® Advanced Vector Extensions 2 (Intel® AVX2), that enhances the processor's ability to accelerate common network security task such as cryptography and AI tasks, which is critical in the consolidated edge network security applications.

The Intel Atom x7000 processor series for the edge also offers enhanced AI inferencing capability with Intel's integrated GPU (Intel UHD Graphics based on X^e architecture). The integrated graphic plays a critical role in accelerating AI inference on-device, reducing reliance on external and backend compute resources and improving response times for real-time application processing. By combining low power consumption and advance capabilities of Efficient core and integrated graphics available in Intel Atom x7000 processor series, it is well-suited for the dynamic and demanding nature of edge networking and security requirements.

Within Intel Atom x7000 processor series there are Intel Atom x7000C processors and Intel Atom x7000RE processors. Silicom has chosen both processor series to support the AI and cryptographic workloads and each series has different use conditions which are suitable for different workloads. The summary of the chosen Intel Atom x7000 processor-based boards to execute the workloads and measure performance is shown below.

		Intel Atom® x7809C Processor	Intel Atom® x7835RE Processor
TDP		25 W	12 W
CPU	Total Number of Cores	8	8
	CPU Max Turbo Frequency	3.6 GHz	3.6 GHz
GPU	Number of GPU Execution Units (EU)	N/A	32
	Graphics Max Dynamic Frequency		1.2 GHz

Cryptography Performance

Silicom tested cryptography performance on Ibiza based on Intel Atom x7809C with VPP IPsec, a software stack with Intel optimized crypto features. Crypto acceleration features available on Intel Atom x7000 processors make these platforms a good fit for edge networking solutions:

- Intel® Crypto Acceleration is a software acceleration of cryptographic workloads using Intel crypto libraries and advanced instruction sets that delivers performance which scales linearly with number of CPU cores.

- Intel Advanced Vector Extensions 2.0 (Intel AVX2) is an instruction set in Intel architecture CPUs that extends the Intel® Advanced Vector Extensions (Intel® AVX) with 256-bit integer instructions. Intel AVX2 improves CPU performance for vectorized workloads such as math, codec, image, and digital signal processing software.

- Intel® Multi-Buffer Crypto for IPsec library provides software acceleration for encrypted packet processing applications. It simplifies the implementation of multi-buffer processing for authentication and encryption algorithms.

Performance Tests

Figure 2 shows Ibiza connectivity to packet generator running Pktgen23.03.0. Each packet generator sends 1,000 flows of packets for 30 seconds in multiple iterations. As this traffic reaches the DUT, it implements IPSec encapsulation/de-encapsulation using Vector Packet Processor (VPP) open-source routing software. VPP is accelerated by Intel Multi-Buffer Crypto for IPsec, Intel crypto library for symmetric crypto acceleration, which is installed by default with VPP software.

This test was set up to measure data throughput when VPP encrypted the packets over IPsec and forwarded to the destination at layer 3. Ibiza supports 4x2.5G Intel® Ethernet Controller I226-V and has a riser card to install a dual port Ethernet network adapter like 2x10G or 2x25G Intel® Ethernet Network Adapter E810.

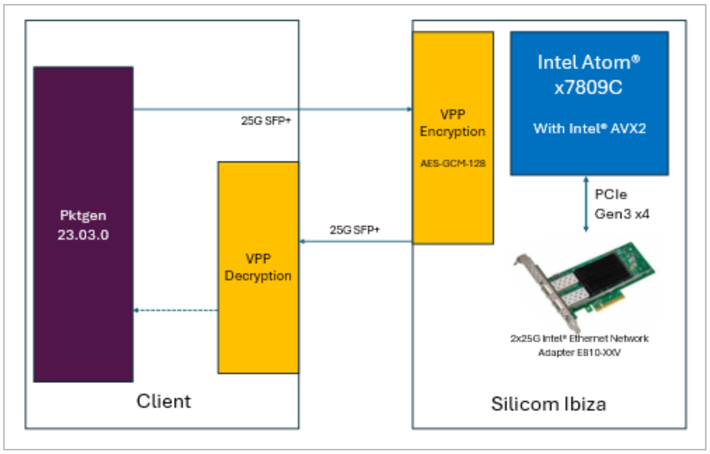

Figure 2. Silicom Ibiza VPP IPsec test configuration

IPsec tests were conducted with different packet sizes ranging from high (1518 bytes), medium (512 bytes) and small packets (64 bytes) to measure performance across the full spectrum of packet sizes (see Figures 3 and 4).

Intel Atom x7000 processors deliver maximum performance of 25Gbps for IPsec workloads.

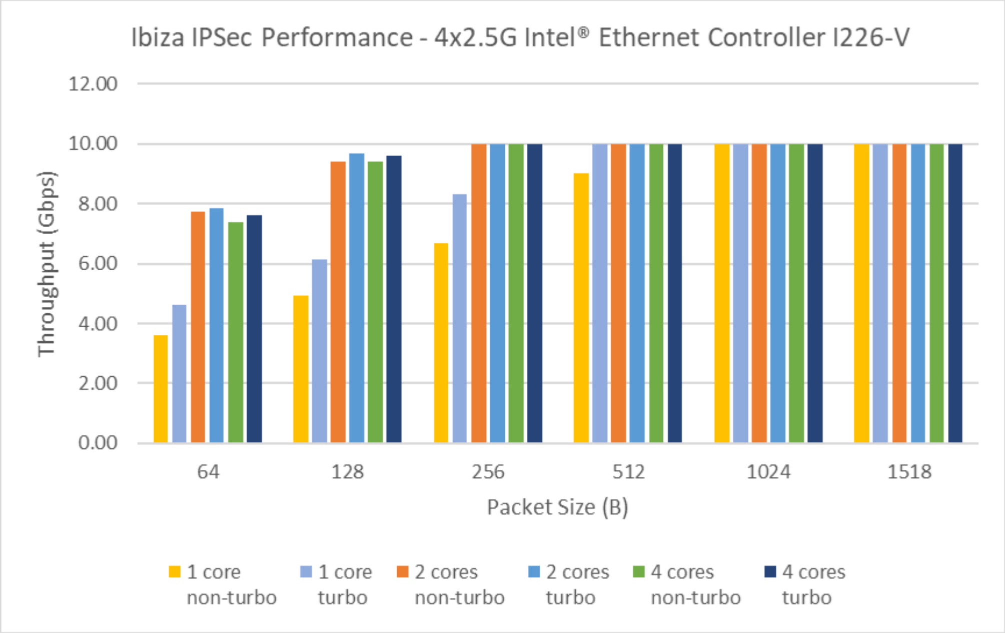

Figure 3.
Test results with an onboard Ethernet – Intel® Ethernet Controller I226-V

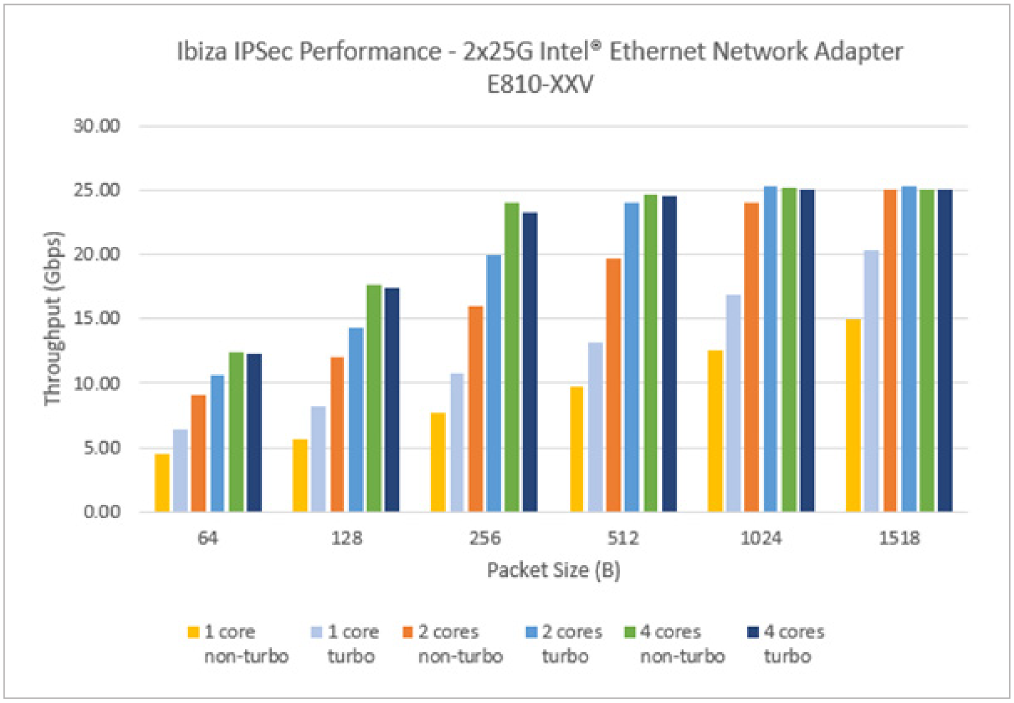

Figure 4.
Test results with Add-on Ethernet – Intel® Ethernet Network Adapter E810-XXV

AI Model Performance

Silicom tested the performance of the Ibiza with two common AI use cases in network security: Malware Portable Executable (PE) detection and Malicious Uniform Resource Locator (URL) detection. These tests were done with Intel-optimized software stack together with public AI models such as URLNet and Malconv and shown the capabilities of Ibiza 1U to enable next-generation threat detection at the edge. Combined with the appliances' ability to offload and accelerate IPSec traffic using integrated crypto engines, customers can achieve both secure communications and intelligent anomaly detection on a single, scalable platform, whether it's deploying smart cameras in retail or defending against cyber threats.

The malware detection and the URL detection models can be also offloaded to iGPU to achieve the best latency performance without requiring additional discrete GPUs. However, the ONNX INT8 model could not be fully executed on iGPU due to unsupported operations, the corresponding results were excluded from the iGPU subgraph.

By utilizing Intel optimized Intel® Extension for Tensorflow and ONNX frameworks with model precision quantization (see Figures 5 and 6), the malware detection performance with the INT8 quantization model shown dramatically less latency compared to the original precision. While the latency performance of the Malconv model improved with INT8 quantization, the accuracy of the model remains similar after quantization.

Another test (see Figures 7 and 8) was run with public AI model, URLNet for the malicious URL detection. Silicom tested the AI performance of the URLNet model with higher batch sizes of

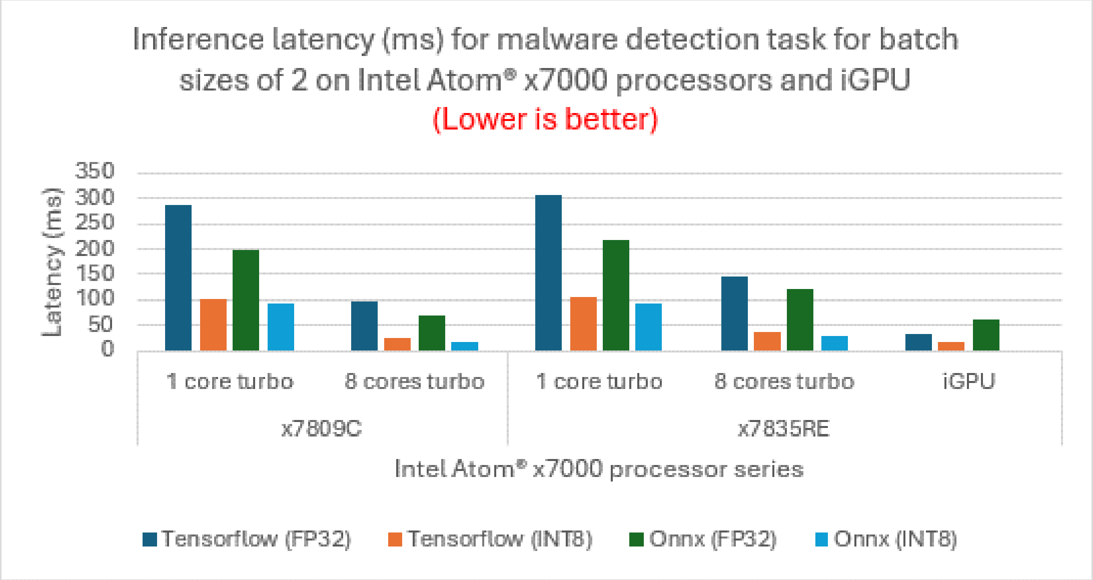

Figure 5. Inference latency (ms) for malware detection task for batch sizes of 2 on Intel Atom® x7000 processors and iGPU

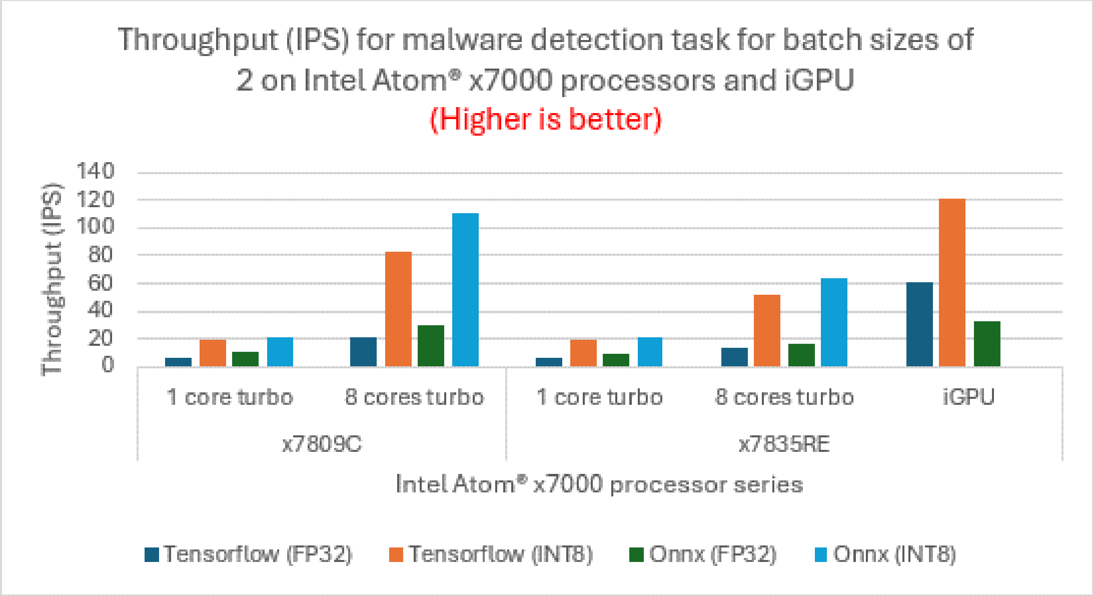

Figure 6. Throughput (IPS) for malware detection task for batch sizes of 2 on Intel Atom® x7000 processors and iGPU

256 and observed the latency and Inference Per Seconds (IPS) in a single CPU and at the socket level of the chosen Intel Atom processors. The malicious URL detection test was run using the Tensorflow, ONNX and OpenVINO frameworks on the chosen Intel Atom processor and iGPU.

Conclusion

The advancement of edge networking and security reflects the importance of flexibility, cost-effective and high-performance solutions in a corporate environment. Silicom's Ibiza 1U Universal CPE is a good choice for edge use cases delivering performance necessary for network, security and AI workloads.

The Ibiza 1U Universal CPE can benefit from Intel's latest Intel AVX2, available in Intel Atom x7000 processor series and Intel Multi-Buffer Crypto for IPSec library for different edge networking workloads. Additionally, AI models that can be offloaded to iGPU could save some CPU resources and bring the overall total cost of ownership (TCO) down, compared to board designs with discrete GPUs.

The Ibiza 1U Universal CPE meets the business needs of a robust, secure, and intelligent platform, which is ideal for industries demanding high-throughput, low-latency processing for deploying AI and cryptographic workloads at the edge.

All network security use cases discussed are available in a single package NetSec Software Package offered by Intel. Contact your representative account managers for more information.

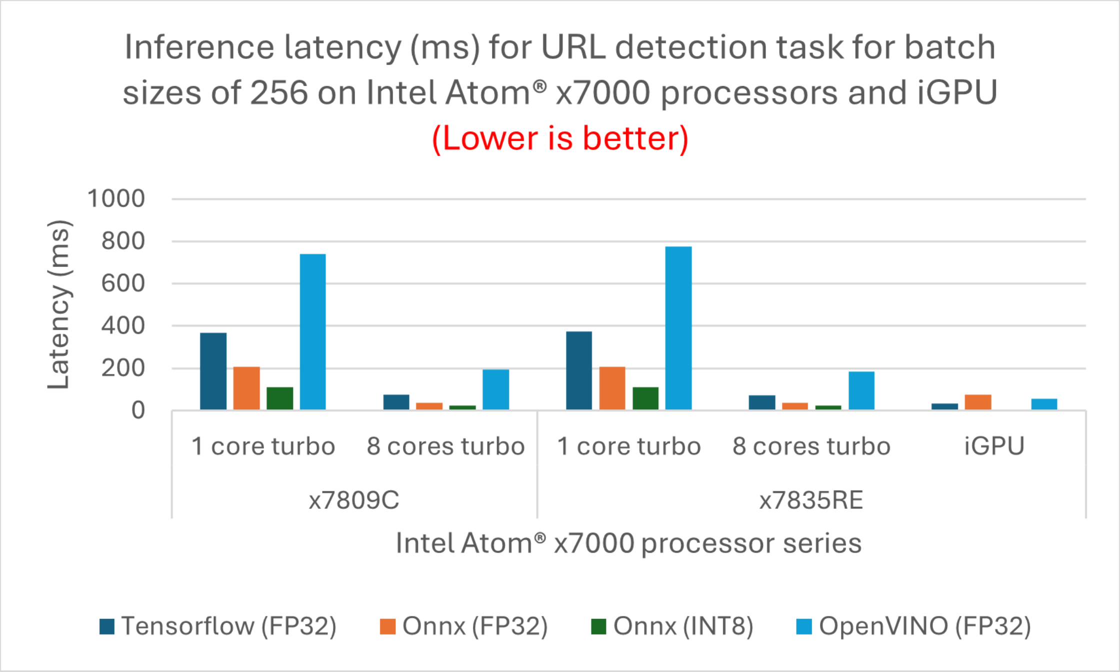

Figure 7. Inference latency (ms) for URL detection task for batch sizes of 256 on Intel Atom® x7000 processors and iGPU

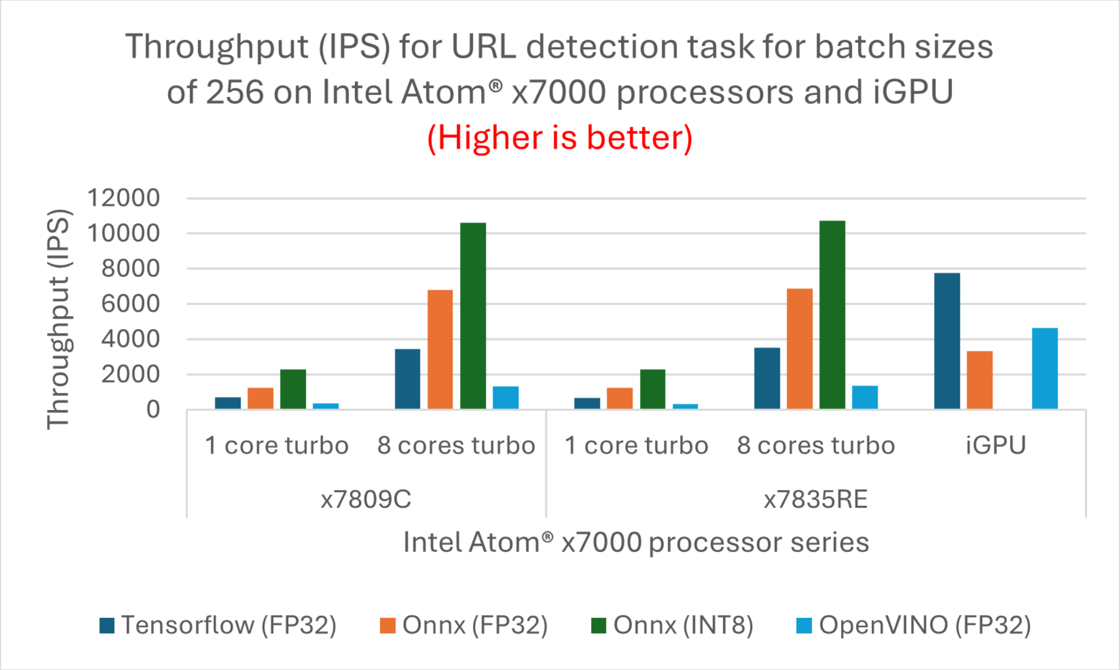

Figure 8. Throughput (IPS) for URL detection task for batch sizes of 256 on Intel Atom® x7000 processors on iGPU

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