

White Paper

Lanner Communications Appliances:
Unprecedented Performance Gains
with the Intel® Atom™ Processor
C2000 Product Family

Lanner



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Abstract

There is a growing need for increased agility in cloud computing infrastructure and for the rapid delivery of services in virtualized environments. These services include the management of underlying networks to maintain the service quality defined in the service-level agreements (SLAs) between service providers and their customers.

To answer these demands, Lanner Electronics has developed a series of entry to mid-range communications appliances based on the Intel® Atom™ processor C2000 product family (formerly codenamed “Rangeley”). These appliances unify computing, networking, management, virtualization, and security capabilities in an integrated hardware architecture.

The R&D department of Lanner Electronics has conducted benchmark testing on several of our products based on the Intel Atom processor C2000 product family to provide a precise comparison on the security performance between the current and previous generations of Intel® Atom™ processors. The benchmark results have demonstrated that the Intel Atom processor C2000 product family delivers significant performance advantages and lower cost of ownership over the previous generation.

Introduction

The Intel Atom processor C2000 product family offers a range of highly energy-efficient 64-bit systems-on-a-chip (SoCs) in two-to-eight core designs offering significant I/O and acceleration integration for the communications market. Using Intel’s industry-leading 22-nanometer (nm) 3-D Tri-Gate transistor technology, these new processors deliver significantly greater performance and power efficiency than the previous generations of Intel Atom processors. Select SKUs also include Intel® QuickAssist Technology to provide hardware acceleration services for more efficient cryptographic performance.

Test results from Lanner Electronics confirm Intel’s measurements for RSA crypto throughput. Our results show the RSA-2048 bit crypto runs 33 times faster on an Intel Atom processor C2000 with Intel QuickAssist Technology than the same configuration equipped with the previous generation processor. The benchmark test we used shows an 18 times faster performance from the Intel QuickAssist Technology alone on this popular RSA-2048 bit crypto.

The Lanner product line based on the Intel Atom processor C2000 product family include the FW-7551, FW-7571, and FW-7573. Each appliance has been developed and tested to scale readily with customization options in the number of Ethernet ports and LAN bypass pairs, as well as storage capacity. In addition, the Intel Atom processor C2000 product family’s built-in crypto acceleration and server-grade Ethernet connectivity helps ensure reliability, resilience, and robust security for high-quality next-generation networking and communications.

Intel Innovations Deliver Improved Performance and Efficiency

Designed for the network and communications market segment, the Intel Atom processor C2000 product family's new and innovative design addresses the need for building efficient entry-level to mid-range routers, switches and security appliances. Based on the Silvermont microarchitecture, these processors use this microarchitecture's improvements to deliver up to six times the energy efficiency and up to seven times the performance of the previous processor generation.

Intel achieves these improvements through a combination of enhanced power management capabilities and a new multi-core and system fabric architecture. The enhanced power management includes power-saving techniques such as intelligent burst technology, per-core power gating and frequency control, new C-states with L2 cache retention, lower power C-states, and lower entry/exit latencies. In addition, the Silvermont microarchitecture includes other improvements ranging from better branch predictions to redesigned execution units and bigger caches (shared 1MB L2 cache and 16-way per dual-core configuration).

Lanner Solutions with the Intel Atom Processor C2000 Product Family

Designed with these feature-rich next generation processors, Lanner network appliances provide high performance and workload consolidation with excellent hardware acceleration for crypto functions. These appliances address the need for hosting applications in datacenters and serving as lightweight computing and communication equipment in core or edge networks. By offering products built on general-purpose SoCs, we are able to deliver hardware solutions designed for scalability with built-in accelerators that help customers take advantage of next-generation network

paradigms and communication services such as software-defined networks and unified communication. Furthermore, our off-the-shelf Ethernet modules with their range of ports and connection speeds allow application developers to scale to meet workload demands and handle larger spikes in traffic, as well as help them provide solutions for consolidating data center networks onto a single Ethernet fabric.

The following table briefly highlights the Lanner network appliances powered by these new processors. The processor family scales from two to eight cores with a maximum clock speed of 2.4 GHz. All of these processors include Intel® Virtualization Technology (Intel®VT-x2) and Intel QuickAssist Technology crypto functions. The onboard Ethernet ports are also equipped with Lanner's proprietary LAN bypass technology to support uninterrupted network operations.

	FW-7551	FW-7571	FW-7573
<i>Form factor</i>	<i>Desktop</i>	<i>1U Rack-mount</i>	<i>1U Rack-mount</i>
<i>Processor</i>	<i>Intel® Atom™ C2358 2-Core SoC</i>	<i>Intel® Atom™ C2518 4-core SoC</i>	<i>Intel® Atom™ C2718 8-core SoC</i>
<i>Networking and Bypass</i>	<i>2 x Intel® i210-AT, 1 x Marvell 88E1543 (2 pairs G2 bypass)</i>	<i>2 x Intel® i210-AT, 1 x Marvell 88E1543 (3 pairs G3 bypass)</i>	<i>2 x Intel® i210-AT, 1 x Marvell 88E1543 (3 pairs G3 bypass)</i>

For detailed specifications, visit the Lanner website at www.lannerinc.com

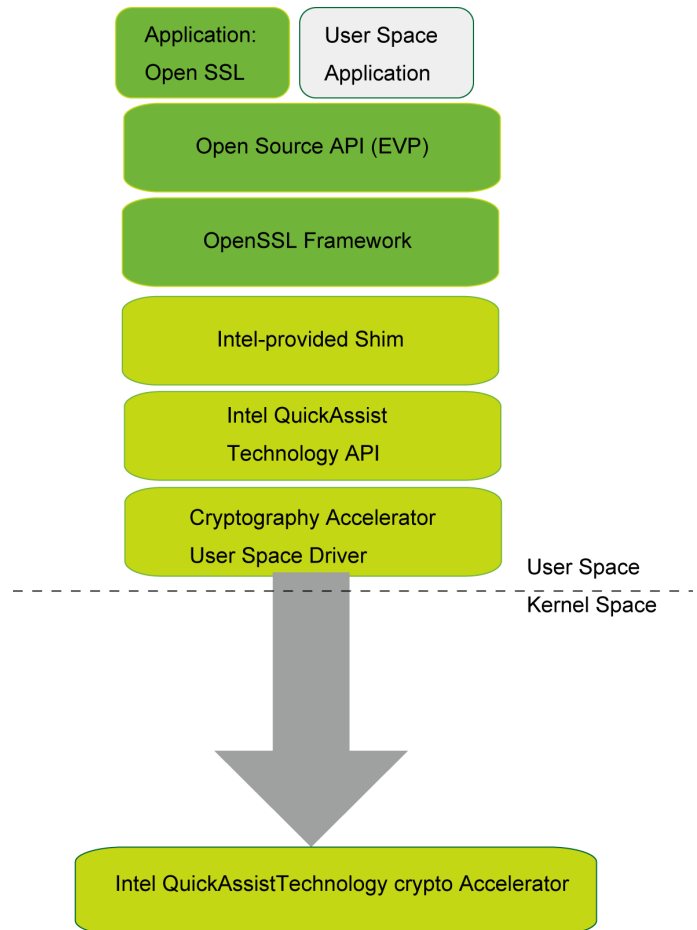
Benchmark Configuration and Environment

We used the Algorithm Speed Measurement tool to measure the speed of the crypto algorithm. In order to support the Intel QuickAssist Technology engine, parameters such as `asynch`, `batch` and `num_ctx` are added to the speed commands.

The first and second scenarios compare the RSA encryption performance of the Intel Atom processor C2000 product family with and without Intel QuickAssist Technology against the previous generation processor. The report from executing the Speed command produced the number of signing and verifying operations per second and the results are plotted and interpreted in the following sections.

Intel QuickAssist Technology Implementation

As illustrated in the graph, the Open Source Application, OpenSSL, and its associated high level API, the EVP, run in the user space. The communication between the EVP and the Intel QuickAssist Technology API was made possible by an Intel-provided shim through an OpenSSL engine implementation. The engine will call a user space driver that interacts with the hardware.



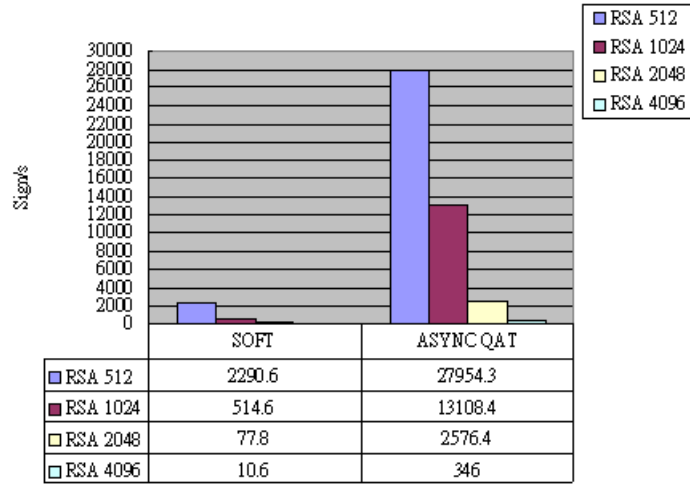
Scenario I:

In the first experiment, we compared the security performance for both processors. The Intel® Atom™ processor D525 is the previous generation of Intel Atom processor based on 45nm architecture, whereas the Intel® Atom™ processor C2358 is based on Intel's 22nm process technology. In addition to the difference in process technology, the Intel Atom processor D525 is a two-chip solution whereas the Rangeley is an SoC. The Intel Atom processor D525 uses a two-chip partition to integrate graphics and memory into the processor, thereby reducing the package area and power consumption.

Lanner Model Name (Device under Test)	FW-7540	FW-7551
CPU and Chipset	Intel D525 (dual core 1MB Cache, 1.8 GHz) and ICH8M	Intel Atom C2358 (2 core SoC) (1MB Cache, 1.7 GHz)
Memory	DDR3 1066 GHz 1 GB	
Network Controllers	Intel 82583V Gigabit Ethernet	
OS	Fedora Core 17 64 Bit	
Intel Atom C2000 Processor Product Family Software Package and the Libcrypto OpenSSL Patch	525874_QAT1.5.L.1.3.0_90.tar.gz + 477629_libcrypto_QuickAssist_Patch_L.0.4.3_010.zip	
Application	OpenSSL on RSA encryption	

The Speed command with support of the Intel QuickAssist Technology engine outputs the number of signing operations per second with respect to encryption bit-length. The Intel Atom processor C2358 significantly outperforms the Intel Atom processor D525 in RSA crypto across all encryption bit lengths. The RSA operations were performed purely in software on the FW-7540 system without the Intel QuickAssist accelerator. The ASYNC performance result of the FW-7551 reflects the use of Intel QuickAssist Technology (abbreviated as "QAT") acceleration through the asynchronous process in the engine on the Intel Atom processor C2358.

Intel Atom Processor D525 vs. Intel Atom C2358 Processor



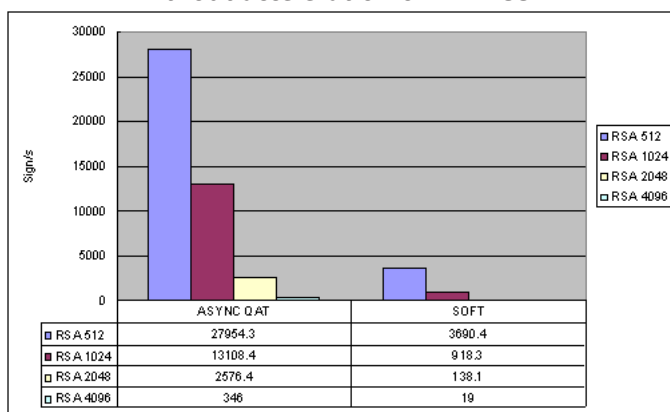
Scenario II:

In the second experiment, we compared the security performance for RSA crypto with and without the Intel QuickAssist acceleration on the Rangeley processor. The number of signing operations per second with respect to encryption bit-length is recorded and plotted in the graph shown below.

Lanner Model Name (Device under Test)	FW-7551	FW-7551
CPU	Intel Atom C2358 (2 core SoC) (1MB Cache, 1.7 GHz)	
Memory	DDR3 1066 GHz 1 GB	
Network Controllers	Intel i210-AT Gigabit Ethernet	
OS	Fedora Core 17 64 Bit	
Intel Atom C2000 Processor Product Family Software Package and the Libcrypto OpenSSL Patch	None	525874_QAT1.5.L.1.3.0_90.tar.gz + 477629_libcrypto_QuickAssist_Patch_L.0.4.3_010.zip
Application	OpenSSL on RSA encryption	

The chart compares RSA encryption with and without Intel QuickAssist Technology on the Lanner's entry-level FW-7551 appliance. The test result shows an 1800% performance gain with Intel QuickAssist Technology on the popular RSA-2048 bit algorithm. In addition, considering the result from scenario I makes clear the Intel Atom processor C2000 product family advantages over the Intel Atom processor D525 in RSA crypto with and without Intel QuickAssist Technology. The chart also reveals a dramatic performance decline with an increase in encryption bit length. This decline demonstrates the greater operation complexity as bit length progressively doubles.

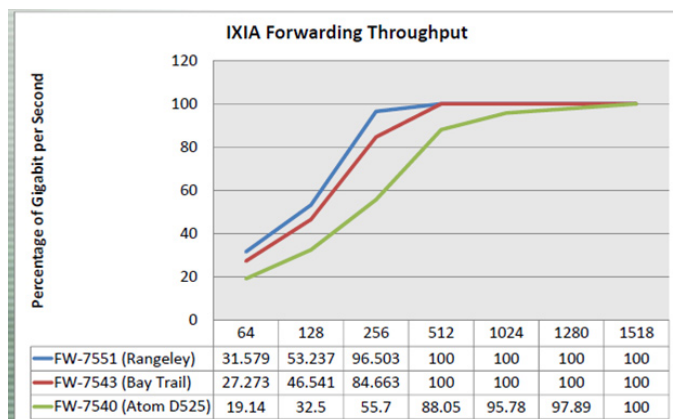
Crypto with acceleration vs. without acceleration on FW-7551



Scenario III:

We used a Smartbit 6000B network performance analysis test system to measure IPV4 throughput on different generations of Lanner network appliances based on different product families of Intel Atom processors. The processors were carefully chosen so that the CPU frequency and cache were limited to 1.8 GHz and 1MB respectively. The Smartbit SmartMetrics (10/100/1000Base-T Ethernet (LAN-3300A)) module generates clear IPV4 packets at maximum rate and transmits them to one of the Ethernet ports of the device under test. The performance numbers shown reflect the aggregate bi-directional IPV4 forwarding rate of the device under test.

Lanner Model Name (Device under Test)	FW-7540	FW-7573	FW-7551
CPU and chipset	Intel Atom Processor D525 (dual core) (1MB Cache, 1.80 GHz) and ICH8M	Intel Celeron Processor J1900 (dual core) (1MB Cache, 1.8GHz) and H61	Intel Atom Processor C2358 (dual core SoC) (1MB Cache, 1.7 GHz)
Memory	DDR3 1066 GHz 1 GB		
Network Controllers	Intel 82583V Gigabit Ethernet	Intel i211 Gigabit Ethernet	Intel i210-AT Gigabit Ethernet
OS	Fedora Core 17 64bit		



According to the recorded data, the Intel Atom processor C2358 provides the highest throughput at all packet sizes. It reaches line rate (100% throughput) at the packet size of 512 bytes—same as the Intel® Celeron® processor J1900 (formerly codenamed "Bay Trail")—whereas the Intel Atom processor D525 in the FW-7540 can only reach this point at the largest packet size: 1518 bytes. The Intel Atom processor C2358 performance advantage over the Intel Celeron processor J1900 in handling small packets is approximately 1.3x while it is around 1.65x over the Intel Atom processor D525.

Conclusion

The Intel Atom processor C2000 product family delivers a major leap forward for entry to mid-range communications appliances through a feature-rich SoC design. SKUs providing Intel QuickAssist Technology provide excellent hardware acceleration for improving crypto performance. Through three new network appliances, Lanner enables developers and customers to take advantage of these next generation gains to deliver excellent packet processing performance and energy efficiency.

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