

Synopsys and EZchip

EZchip Develops C-Programmable NPS-400 Network Processor With Synopsys DesignWare ARC 770D Processor



The ability to extend the ARC processors with our own instructions enabled us to preserve the performance of our market-proven TOP core while enabling a more productive C programming environment. This was a key requirement in our design and was possible only because of the flexibility of the ARC processors.”

Erez Shaizaf

NPS Project Director, EZchip

Business

EZchip Semiconductor, Ltd. is a fabless semiconductor company that provides Ethernet network processors for networking equipment. EZchip provides solutions that scale from a few to hundreds of Gigabits-per-second. Their network processors provide great flexibility and high performance coupled with superior integration and power efficiency for a wide range of layer 2 to 7 applications in Carrier, Cloud and Data Center networks, to enable new scalable architectures based on Network Virtualization, SDN and NFV.

Challenges

- ▶ Meet time-to-market schedule
- ▶ Enable C programming and run Linux OS without sacrificing performance
- ▶ Ability to customize processor with special configurations

Synopsys Solution

- ▶ DesignWare® ARC® 770D Processor Core
- ▶ Linux for DesignWare ARC Processors
- ▶ DesignWare ARC nSIM instruction set simulator

Benefits

- ▶ Customizable and extensible ARC processors enabled addition of EZchip's own instruction set
- ▶ Achieved 1 GHz processor speed requirement
- ▶ Ability to easily model a virtual platform with the nSIM instruction set simulator
- ▶ Ability to develop a Linux-based NPU with Linux kernel and GNU Toolchain for ARC processor and Synopsys support

Overview

EZchip's next-generation NPS-400 NPU is designed to deliver 400 Gbps of wire-speed throughput and combines programmable packet processing with a hardware traffic manager. Its multithreaded CPU is C-programmable and runs Linux for greater flexibility and easier programming. The optimized design allows the integration of 256 such processors, each with 16 threads, for a total of 4K virtual processing engines, a necessity for high-speed data-plane processing where packets are arriving at an extremely high rate and every packet is processed. NPS' efficient design enables a large number of cores, the company's market-proven hardware traffic manager and a variety of accelerators for efficient table lookups, DPI and security to be incorporated into the chip.

To achieve their goal of developing this data-plane C-programmable processor optimized for layer 2-7 packet processing with unmatched performance and flexibility, EZchip needed a power-efficient processor solution that could be customized to their specifications. Knowing that Synopsys' DesignWare ARC processors offered all the features they needed to develop their product to their specifications, EZchip was confident the ARC 770D Processor was the right choice for their next-generation NPU.

Extensible DesignWare ARC Processors

To successfully break the barriers imposed by traditional CPUs and NPUs and deliver a high-performance and versatile solution for demanding carrier and data-center applications, EZchip needed a high-performance, low-area processor solution that could be customized with their own logic. After evaluating solutions from the leading CPU providers, EZchip selected the ARC 770D Processor because of its superior performance efficiency (MHz/mW and MHz/mm²) and memory management unit (MMU) for Linux support, as well as its extensibility, which enabled them to develop the product they needed and still meet their schedule.

In addition, the ability to use the ARC nSIM instruction set simulator in a virtual platform enabled EZchip to deliver a model of the NPS-400 NPU to their customers ahead of silicon availability.

EZchip selected Synopsys because they knew it would be a one-stop shop for all their needs, from offering a full breadth of products and services to the customer driven development that would deliver a processor to their precise specifications. Synopsys provided EZchip with a small-footprint ARC 770D Processor running at 1 GHz to meet the high performance requirements of their multicore design.

In addition, the extensibility of the ARC 770D Processor enabled EZchip to add special instructions, special registers, and special function units for processing packets from their legacy TOP processors, to preserve the performance advantages of the TOP processor cores.

Linux Support

EZchip wanted to provide their customers with an easy-to-program solution that supports C-programming and runs Linux without the code size limitations of traditional NPUs. Therefore, another key factor in EZchip's selection of the ARC 770D Processor was its support for Linux, including its enhanced MMU and Linux acceleration package. With the strong foundation of the ARC Linux solution already supporting multiple customer SoCs, EZchip and Synopsys Linux experts closely collaborated to enable EZchip NPU support as well as Symmetric Multi-Processing (SMP) support in the Linux kernel and verified the functionality using the ARC nSIM-based virtual platform, complete with virtual peripherals including Ethernet and UART. The availability of a complete Linux development environment allowed the design team to leverage Linux-based application software to quickly build a complex network processor that provides their customers with a high-performance network processor, which runs at 400 Gbps, but can still be programmed and debugged in Linux.

With a platform that will yield multiple chip derivatives, EZchip deliberately selected the vendor they believed would best be able to support their development over the next 10 years. Having integrated the DesignWare ARC core into their design quickly and to their satisfaction, EZchip intends to continue using ARC processors for future designs.

“The extensibility of the ARC 770D Processor, along with Synopsys' willingness to work closely with us on implementing Linux and on our modeling requirements, were critical factors that enabled us to design our NPS-400 network processor to our exact specifications of high performance, flexibility and easier programming within a small footprint.”

Erez Shaizaf

NPS Project Director, EZchip