Product Brief
Intel® IXP422 Network Processor
Embedded Computing

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Intel® IXP422 Network Processor

Product Overview

The Intel® IXP422 network processor is a versatile, single chip processor that integrates robust security features with the necessary interfaces, wire-speed performance and processing headroom to meet demanding applications, including wireless access points, residential gateways, VPN firewall appliances, SME routers and switches, industrial control, and networked imaging applications. It is a member of the Intel® IXP4XX product line of network processors, providing cost-effective implementations that extend the rich performance and features of the Intel® IXP425 network processor into targeted market segments.

The feature set for this network processor includes a 266 MHz Intel XScale® processor, high performance PCI interface, USB controller, two 10/100 Ethernet MACs and an IPsec-enabled Network Processor Engine (NPE) to accelerate cryptography and authentication algorithms.

Product Highlights

- Member of the Intel® IXP4XX product line of network processors, designed for residential and small-to-medium enterprise (SME) applications

- Intel XScale processor at 266 MHz provides headroom for customer-defined applications

- Integrated hardware acceleration of popular cryptography algorithms (SHA-1, MD5, DES, 3DES, AES) for protected applications

- Two integrated 10/100 Base-T Ethernet MACs with Media Independent Interface (MII) for design flexibility and cost-effective wire-speed performance

- 33/66 MHz PCI v2.2 host and option interface for glueless connection of up to four devices

- SDRAM controller supports from 8 to 256 Mbytes of SDRAM memory

- Average consumption of 1.5W to a maximum of 1.9W

- USB version 1.1 device controller

- Two high-speed UARTS can be configured to support speed from 1200 baud to 921 Kbaud each

- Sixteen GPIO pins

- 16-bit configurable expansion bus allows easy glueless connection to peripheral devices

- 266 MHz commercial temperature (0°C to 70°C)

Common Intel® IXP4XX Product Line Architecture for Application Flexibility

The Intel IXP4XX product line of network processors has a unique distributed processing architecture that speeds development for a range of applications. Each processor combines a high-performance Intel XScale processor with additional NPEs to achieve wire-speed packet processing performance.

The Intel XScale processor and the NPEs run their instruction streams in parallel. The processor is fully compatible with the ARM* V5T Thumb instructions set and V5E DSP extensions. Designed on Intel's 0.18-micron process technology, the processor delivers a high MIPS/power consumption ratio and provides ample processing headroom for value-added software features.

The two NPEs in the Intel IXP422 network processor complement the Intel XScale processor for many computationally intensive data plane operations. These tasks include IP header inspection and modification, packet filtering, packet error checking, checksum computation, and flag insertion and removal. The NPE architecture includes an ALU, self-contained internal data memory and an extensive list of I/O interfaces, together with hardware acceleration elements which a set of networking applications. Each hardware acceleration element increases the speed of a specific networking task that would otherwise take many MIPS to complete by a standalone RISC processor.

Both Ethernet NPE A and the Ethernet NPE B include an MII interface. Either NPE is capable of handling 100 Mbps full-duplex Ethernet

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packet filtering. Ethernet NPE B also has three hardware acceleration elements to accelerate VPN-related tasks such as Date Encryption Standard (DES), Triple DES (3DES), Advanced Encryption Standard (AES) and hashing at speeds up to 70 Mbps. The extensive hardware capabilities of the NPEs are under the control of microcoded algorithms that are accessed via application programming interfaces (APIs) released as a software library with the processor. Customer applications configure and interact with the NPEs through the high-performance API layer running on the Intel XScale processor. Sample "codelets" demonstrate how to use each service or function provided by the Intel XScale processor library and the underlying hardware.

Highly-integrated Data Functionality and LAN/WAN Capabilities

On-chip integration of data functions saves the cost of implementing separate devices. In addition to the two 10/100 Base-T Ethernet MACs with MII interface and simultaneous full-duplex operation, the processor integrates an SDRAM controller and peripheral functions including an interrupt controller, GPIO port, UARTs, watchdog timer and general-purpose timers. The processor includes a USB version 1.1-device controller, while the PCI 2.2 host and option interface provides the flexibility to directly connect devices, including 802.11x chips, PCMCIA controllers and cable MAC/PHYs.

## Integrated Security Hardware Acceleration Elements

The IXP422 network processor provides integrated hardware acceleration for security applications. It implements DES, 3DES and AES data encryption algorithms, in addition to SHA-1 and MD5 authentication algorithms, typically used in applications such as VPNs. 802.11 and 802.11i wireless applications also benefit from the network processor's ability to accelerate RC4-based WEP services and AES-CCM mode operations.

The Intel IXP422 network processor silicon contains the following cryptography hardware acceleration elements:

▪ DES (64-bit block cipher size, 56-bit key)

▪ 3DES (64-bit block cipher size, three 56-bit keys)

▪ Authentication hardware acceleration element with support for the following authentication algorithms:

　—HMAC-SHA-1

　—HMAC-MD5

▪ AES containing a 128-bit block cipher size with key sizes of 128, 192, or 256 bits

Using the NPE for dedicated hardware acceleration enables the processing of cryptography and authentication algorithms to be offloaded from the Intel XScale processor. Processor API calls allow the cryptography and authentication elements to be used by any interface within the Intel IXP422

Figure 1. Intel® IXP422 Network Processor
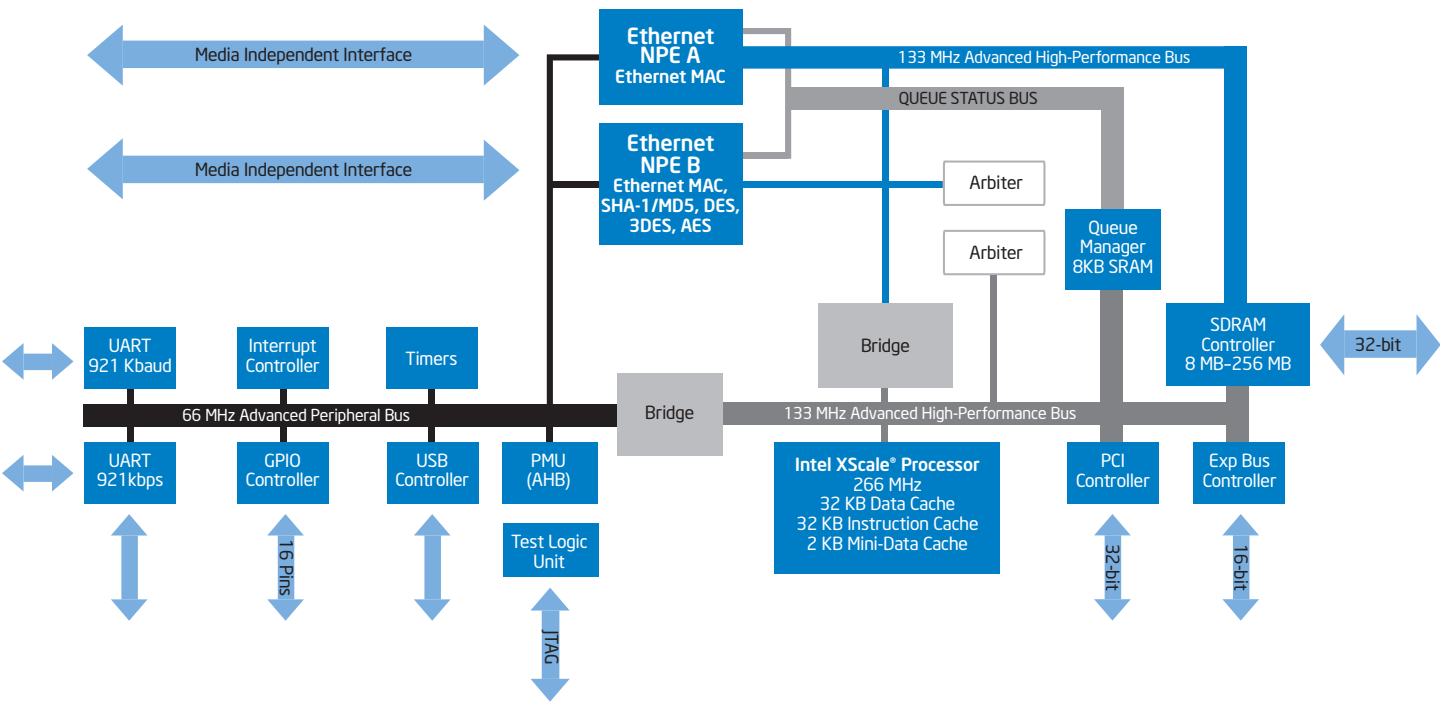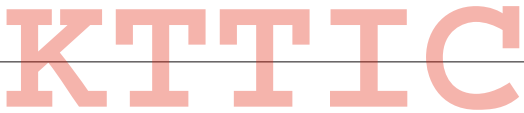
network processor. This provides maximum flexibility for all interfaces, especially when dealing with security issues over wireless. This high-performance architecture can support bulk encryption/decryption rates of up to 70 Mbps for DES, 3DES and AES algorithms.

Tools, Applications and Operating Systems Support Rapid Development

Intel XScale technology includes a broad range of development tools and applications, together with support for multiple operating systems. The Intel IXP422 network processor currently supports Wind River* VxWorks* and the standard Linux* kernel. Associated third-party products are available for the IXP4XX product line of network processors including Wind River* Workbench for VxWorks and the MontaVista* Linux Professional Edition. Multiple third-party vendors also provide application stacks and advanced development environment support.

To help speed time-to-market and reduce development costs, developers have a wide selection of Intel XScale technology-based tools. The Intel IXP422 network processor may be controlled during debug through a JTAG interface to the processor. The Macraigor* Raven*, Wind River Systems visionPROBE*/visionICE, EPI* MAJIC* and other JTAG ICE systems plug into the JTAG interface through a 20-pin connector.

Reference Platform for Faster Time-to-Market

The Intel® IXDPG425 Network Gateway Reference Platform is a multi-service gateway, turn-key solution, allowing developers to adopt and modify platform design and quickly develop a desired solution, thus significantly reducing time-to-market. It also demonstrates the scalability and processing power of the Intel IXP425 network processor in supporting a wide range of residential gateway applications. Pin compatibility among members of the Intel IXP4XX product line further reduces hardware design complexity.

The reference platform includes the Intel IXP425 network processor at 533 MHz, SDRAM memory, flash, a four-port Ethernet switch for LAN, an additional Ethernet port for WAN, four telephone line interfaces, a mini-PCI interface to connect to a 802.11 WLAN, an ADSL mezzanine card interface, two USB 2.0 host ports and power-regulator devices.

Intel Advantage

Intel is a leading supplier of communications building blocks, adding value at many levels of integration. Along with a strong ecosystem of hardware and software vendors, including members of the Intel® Communications Alliance (intel.com/go/ica), Intel helps developers cost-effectively meet design challenges and shorten time-to-market.

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