

# Intel® IXP425 Network Processor Family

## Optimized for Broadband Applications

### Product Highlights

- Intel® XScale™ RISC core up to 533 MHz
- Three network processor engines
- Two high-speed serial interfaces
- Two 10/100 Base-T Ethernet MACs with MII/RMII interface
- UTOPIA 2 interface—multiple ADSL/G.SHDSL or VDSL support
- PCI version 2.2 Host and Option interface
- Hardware Security Accelerator (IPsec: DES, 3DES, SHA1, MD5)
- USB version 1.1 device controller
- Two UARTS—one High-Speed UART (921.6 Kbaud) and one Console UART (230.4 Kbaud)
- 32-bit wide SDRAM controller
- Sixteen GPIO pins
- 16-bit configurable expansion bus
- ATM, TDM, Ethernet MAC filtering, and HDLC support
- Operating system support for VxWorks\* and Linux\*
- Commercial and Extended temperature options

### Product Overview

To meet the growing demand from homes and businesses for high-performance broadband access services, manufacturers must develop new networking products that are capable of provisioning rich services. The Intel® IXP425 network processors are designed to meet the needs of last-mile applications, such as customer premises equipment, and mini-DSLAMs for multi-dwelling units (MxUs). These network processors deliver wire-speed performance and sufficient "processor headroom" for manufacturers to add a variety of rich software services to support their networking applications. These are highly integrated network processors that support multiple WAN and LAN technologies giving customers a common architecture for multiple applications.



With their Development Platform, a choice of operating systems, and a broad range of development tools, the Intel IXP425 network processors provide a complete development environment for faster time-to-market. This network processor family offers the choice of multiple clock speeds at 266, 400, and 533 MHz, with both Commercial (0° to 70° C) and Extended (-40° to 85° C) temperature options.

### Architected for Broadband Applications

The Intel IXP425 network processor family meets the requirements of next-generation broadband applications by integrating a unique distributed processing architecture that features the performance of the Intel XScale core and three Network Processor Engines (NPEs). The combination of the four high-performance processors provides tremendous processing power and enables wire-speed performance at both the LAN and WAN ports.

### Distributed Processing Architecture

The Intel XScale core and the three NPEs run their instruction streams in parallel. The Intel XScale core is fully compatible with ARM® V5T Thumb instructions set and V5E DSP extensions. Designed on the Intel® 0.18-micron process technology, the Intel XScale core delivers the industry-leading MIPs to power consumption ratio and provides ample processing headroom for the customer to add differentiating product features.

## Distributed Processing Architecture (continued)

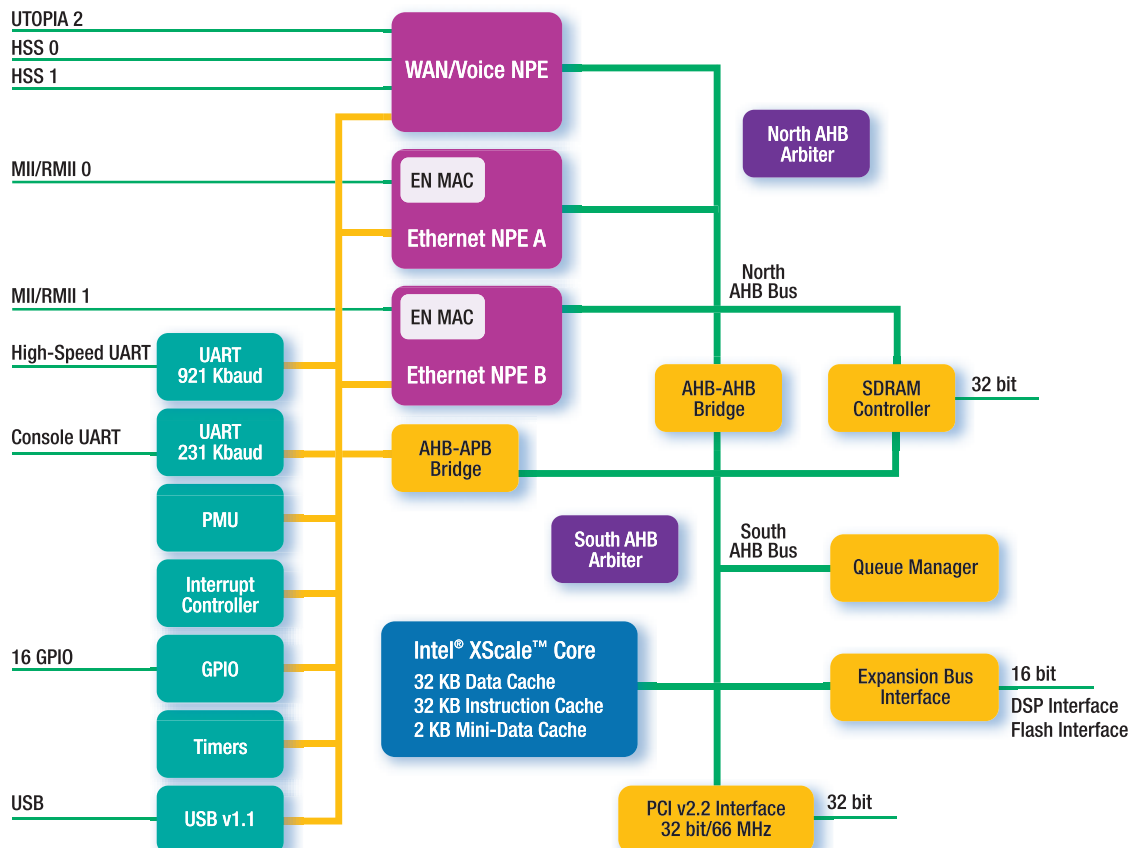
The three NPEs are designed to offload many computationally intensive data plane operations from the Intel XScale core. These tasks include: IP header inspection and modification; packet filtering; packet error checking; check sum computation; flag insertion and removal; PDU segmentation and assembly; and encryption. The NPE architecture includes an ALU, self-contained internal data memory, an extensive list of I/O interfaces, together with hardware acceleration engines (also known as NPE coprocessors). It is the NPE coprocessor associated with an NPE that targets a set of networking applications. Each NPE coprocessor is designed to accelerate a specific networking task that would otherwise take many MIPs to complete by a stand-alone RISC processor.

Each NPE can take care of Layer 2 and, in some cases, Layer 3 packets that are passed through them. For example, the WAN/Voice NPE has one UTOPIA 2 interface and two high-speed serial interfaces so its internal processing is targeting the handling of AAL (1/2/5) SARing, TDM framing, and HDLC processing. An MII/RMII interface is attached to both the Ethernet NPE A and the Ethernet NPE B respectively. The Ethernet NPE A also has two internal coprocessors to accelerate VPN related tasks such as 3DES and Hashing at speeds up to full-rate ADSL. The Ethernet NPE B is capable of handling 100Mb/s, full-duplex Ethernet packet filtering. The extensive hardware capabilities of these NPEs are all under the management of a set of NPE microcode drivers that are released as a software

library together with the Intel IXP425 network processors. Customer applications configure and interact with the NPEs through a high-performance API layer running on the Intel XScale core.

## Wire-Speed Performance

The Intel IXP425 network processors implement a fast path design in the NPE software library to provide optimized performance for broadband applications. The fast path design passes non-inspection IP packets directly from the ingress port NPE (usually WAN/Voice NPE with the xDSL WAN port) to the egress port NPE (usually Ethernet NPE A or B with the Ethernet LAN port) without the involvement of the Intel XScale core. Since the vast majority of IP packets move from the WAN to the Ethernet LAN, isolating these data flows to the NPEs within the Intel IXP425 network processor produces a significant throughput improvement by eliminating the need to route packets through a central processor. The most demanding situation occurs when small (64 byte) IP packets are sent at the speed that saturates the physical layer (wire speed). For example, nearly 10,000 (64 byte) packets per second will be sent downstream in an ADSL connection that runs at the maximum wire speed (8 Mb/s downstream). The NPEs and fast path design in the Intel IXP425 network processors are capable of providing, at minimum packet sizes, wire-speed performance up to 52 Mb/s on the WAN side and 100 Mb/s on the Ethernet LAN.



## Highly-integrated Data, Voice, and Security Functionality

On-chip integration of data, voice, and security functions saves the cost of implementing separate devices and supports easier integration with other hardware. Integrated into the Intel XScale core are multiply and accumulate functions that give customers the ability to do multimedia processing without the need for external hardware. For example, in a voice application, the Intel XScale core can perform a wide variety of speech coding and telephony algorithms without the need for an external DSP chip. In addition, the network processors integrate two 10/100 Base-T Ethernet MACs with MII/RMII interface and simultaneous full-duplex operation. To further reduce the total solution chip count, a SDRAM controller has been integrated along with peripheral functions that include interrupt controller, GPIO port, UART, watchdog timer and general-purpose timers. A USB version 1.1 device controller is integrated for those applications that require USB support. The Intel IXP425 network processors also provide hardware acceleration for security applications. These chips implement, in hardware, DES and 3DES data encryption algorithms as well as SHA-1 and MD5 hashing algorithms typically used in VPN applications. A direct connection to DSP chips and flash memory is achieved through the expansion bus interface. By integrating more functionality, Intel is reducing the total solution chip count and cost for broadband applications.

## Broad Range of LAN and WAN Capabilities

The Intel IXP425 network processors offer a full range of broadband and LAN access solutions through multiple integrated interfaces. Through the UTOPIA 2 interface, there is performance to support up to eight ADSL PHYs, eight G.SHDSL PHYs or one VDSL PHY. The PCI version 2.2 Host and Option interface gives customers the flexibility to directly connect such devices as 802.11x

chips, PCMCIA controllers, Ethernet MACs, and cable MAC/PHYs. These network processors also feature two high-speed serial interfaces. These interfaces can serve as high-speed ports for direct connection to T1/E1 framers or to industry-standard SLIC/CODECS.

## Choice of Tools and Operating Systems Supports Rapid Development

The Intel XScale microarchitecture offers a broad range of tools together with support for two widely adopted operating systems. The Intel IXP425 network processors support VxWorks and the standard Linux 2.4 kernel. MontaVista Software\* will provide the support for Linux. To help speed time-to-market and reduce development costs, developers will have a wide choice of third-party tools, including compilers, linkers, debuggers and board support packages (BSPs). Tools include Wind River\* Tornado\* 2.1.1 for the VxWorks 5.4 real-time operating system, and the complete GNU\* Linux development suite.

## Development Platform For Faster Time-to-Market

The Intel® IXDP425 Network Processor Development Platform is a powerful tool for developing and verifying hardware and software for the Intel IXP425 network processors. Developers can use this flexible and extendable platform to conduct rapid initial chip evaluation, chip performance evaluation, product development and prototyping. For additional information, refer to the Intel IXDP425 Development Platform product brief.

## Features

- Four high-performance processors in a distributed processing architecture
- Highly-integrated data/voice/security functions
- Broad range of WAN/LAN capabilities
- Development Platform
- Commercial and Extended temperature options

## Benefits

- Wire-speed performance; Able to offer rich data, voice and security services
- Reduced chip count; Cost savings; Simplified design
- Flexibility; Common architecture for multiple platforms
- Faster time-to-market
- Flexibility

## Intel® Internet Exchange Architecture

The Intel IXP425 network processors are part of Intel® Internet Exchange Architecture (Intel® IXA) which is a packet processing architecture that provides a foundation for software portability across multiple generations of network processors and is based on the Intel XScale microarchitecture. Additional information on Intel IXA is available on the Web site listed at the end of this document.

### Product Ordering Information

### Order Number

■ Intel® IXP425 Network Processor, 266 MHz	FWIXP425AB
■ Intel® IXP425 Network Processor, 400 MHz	FWIXP425AC
■ Intel® IXP425 Network Processor, 533 MHz	FWIXP425AD
■ Intel® IXP425 Network Processor, 266 MHz Extended Temperature	GWIXP425ABT
■ Intel® IXP425 Network Processor, 400 MHz Extended Temperature	GWIXP425ACT
■ Intel® IXP425 Network Processor, 533 MHz Extended Temperature	GWIXP425ADT
■ Intel® IXDP425 Network Processor Development Platform	KIXDP425AD

### Intel® IXP425 Network Processor Family Literature

### Order Number

■ Intel® IXP425 Network Processor Family Product Brief	279051-001
■ Intel® IXDP425 Network Processor Development Platform Product Brief	279052-001

Please contact your Intel Representative for the following documents:

- Intel® IXP425 Network Processor Datasheet
- Intel® IXP425 Network Processor Developer's Manual
- Intel® IXP425 Network Processor Programmer's Guide

### Intel Access

Developer's Site	<a href="http://developer.intel.com/">http://developer.intel.com/</a>
Network Processor Web Site	<a href="http://www.intel.com/design/network/ixa.htm">http://www.intel.com/design/network/ixa.htm</a>
Intel® Internet Exchange Architecture	<a href="http://www.intel.com/design/network/ixa.htm">http://www.intel.com/design/network/ixa.htm</a>
Networking and Communications Building Blocks	<a href="http://developer.intel.com/design/network">http://developer.intel.com/design/network</a>
Other Intel Support:	<a href="http://developer.intel.com/design/litcentr/">http://developer.intel.com/design/litcentr/</a>
Intel Literature Center	(800) 548-4725 7 a.m. to 7 p.m. CST (U.S. and Canada) International locations please contact your local sales office.
General Information Hotline	(800) 628-8686 or (916) 356-3104 5 a.m. to 5 p.m. PST

Information in this document is provided in connection with Intel® products. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Intel's Terms and Conditions of Sale for such products, Intel assumes no liability whatsoever, and Intel disclaims any express or implied warranty, relating to sale and/or use of Intel products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right. Intel products are not intended for use in medical, life-saving or life-sustaining applications. Intel may make changes to specifications and product descriptions at any time, without notice.

Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them.

Intel, the Intel logo, and Intel XScale are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

\*Other names and brands may be claimed as the property of others.



For more information, visit the Intel Web site at: [developer.intel.com](http://developer.intel.com)

**UNITED STATES AND CANADA**  
Intel Corporation  
Robert Noyce Building  
2200 Mission College Blvd.  
P.O. Box 58119  
Santa Clara, CA 95052-8119  
USA

**EUROPE**  
Intel Corporation (UK) Ltd.  
Pipers Way  
Swindon  
Wiltshire SN3 1RJ  
UK

**ASIA-PACIFIC**  
Intel Semiconductor Ltd.  
32/F Two Pacific Place  
88 Queensway, Central  
Hong Kong, SAR

**JAPAN**  
Intel Japan (Tsukuba HQ)  
5-6  
Tokodai Tsukuba-shi  
300-2635 Ibaraki-ken  
Japan

**SOUTH AMERICA**  
Intel Semicondutores do Brasil LTDA  
Av. Dr. Chucri Zaidan, 940-10º andar  
04583-904 São Paulo, SP  
Brazil