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Intel® IXP465 Network Processor

Product Highlights

- Member of the Intel® IXP46X product line of network processors for small-to-medium enterprise (SME) communications and embedded networking applications

- Intel XScale® technology processor up to 667 MHz provides scalable processing headroom for target applications

- Built-in LAN and WAN, I²C and Synchronous Serial Protocol (SSP) port interfaces reduce overall system cost and simplify development

- Integrated support for cryptography, time synchronization and ECC memory improves performance and reliability

- Consistent software and hardware architecture in the Intel® IXP4XX product line protects customers' development investments and speeds deployment of a standards-based product portfolio

- Robust development environment minimizes time-to-market

Product Overview

The highly integrated, single-chip design of the Intel® IXP465 network processor provides a unique combination of performance, reliability and flexibility. It combines Intel XScale technology with a variety of built-in communications features to support requirements for modular routers, security appliances, line cards for telecommunications infrastructure, industrial control and automation applications, interactive clients, test and instrumentation, RFID readers, and networked print imaging applications. The high-performance Intel XScale technology processor provides processing headroom to flexibly support a broad range of OEM applications while minimizing power consumption. In addition, several features help reduce overall system cost and simplify development. These include integration of multiple LAN and WAN interfaces, built-in hardware acceleration for cryptography and time synchronization, and data integrity features such as support for ECC memory.

The Intel® IXP465 network processor is supported by a robust application development environment including pre-integrated and pre-validated development infrastructures and operating systems, development platforms, software components, and debug tools from Intel and members of the Intel® Communications Alliance (intel.com/go/ica) and other third-party providers.

Consistent Intel® IXP4XX Product Line Architecture for Application Flexibility and Ease of Development

Intel IXP465 network processors share a unique distributed processing architecture with the rest of the IXP4XX product line, helping to speed development for a range of applications. Each processor combines a high-performance Intel XScale processor with additional network processor engines (NPEs), running instruction streams in parallel, to achieve wire-speed packet processing performance. The Intel XScale processor is fully compatible with ARM* V5T Thumb instructions set and V5E DSP extensions. Designed using Intel® 0.18-micron process technology, the Intel XScale processor delivers a high MIPS/power-consumption ratio and provides ample processing headroom for value-added software features.

The three NPEs 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. The hardware acceleration elements associated with each NPE target a set of networking applications. Each hardware acceleration element is designed to increase the speed of a specific networking task that would otherwise take many MIPS to complete by a stand alone RISC processor.

Each NPE can support Layer 2 and, in some cases, Layer 3 packet classification and processing. For example, NPE A has one UTOPIA-2 interface and two high-speed serial (HSS) ports, enabling it to handle AAL (1/2/5) segmentation and reassembly (SAR) functions. A 10/100 Ethernet interface is attached to each NPE, capable of handling 100 Mbps, full-duplex Ethernet packet filtering. Ethernet NPE C also has three hardware acceleration elements to speed encryption and authentication for security applications. The extensive hardware capabilities of the NPEs are under the control of micro-coded 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 of the Intel XScale technology library and the underlying hardware.

Highly Integrated Design Lowers System Cost

On-chip integration of a wide variety of functions and commonly used interfaces saves the cost of implementing separate devices and enables easier integration with other hardware. The Intel Xscale processor includes integrated multiply and accumulate functions that support multimedia processing without the need for external hardware. The Intel IXP465 network processor solution includes a floating point library, a powerful DSP software library, and robust general and multimedia signal processing kernels optimized for maximum performance on the Intel XScale processor.

To further reduce total chip count, the processor includes an integrated DDR1-266 SDRAM controller with ECC support, interrupt controller, GPIO port, UARTs, watchdog timer and general-purpose timers. It features a USB version 1.1 device controller and a USB 2.0 low-speed and full-speed compatible host-only controller. Peripheral devices can be directly connected through a 32-bit expansion bus interface.

Value-Added Features for Embedded Applications

The Intel IXP465 network processor includes several features to enable embedded networking applications. It integrates hardware assist logic for time synchronization of multiple clocks in a distributed control system which, along with software running on the Intel XScale processor, can be used to implement full source or sink-capable IEEE 1588-compliant network node. ECC support and parity provide enhanced system reliability.

Low power dissipation along with support for extended temperature eliminates the need for fans and allows for small-form factor designs.

Integrated Security Hardware Acceleration Elements

The IXP465 network processor includes integrated hardware acceleration for security applications, implementing popular IPSec cryptography algorithms. The Intel XScale technology-based API calls allow the cryptography and authentication elements to be used by any interface within the IXP465 network processor, providing maximum flexibility for all interfaces, especially when dealing with security issues over wireless. The IXP465 network processor also includes hardware to accelerate public key exchange, digital signatures, and key generation algorithms.

Operating Systems, Tools, and Applications Support Rapid Development

The Intel® IXP400 Software solution provides a common software framework for both the Intel IXP46X and Intel IXP42X product lines of network processors, providing customers with a broad range of development tools and applications (please see intel.com/go/networkprocessors), together with support for multiple operating systems from third-party vendors. OS support includes:

- MontaVista* Linux Professional Edition Big Endian version 3.1 and 4.0.
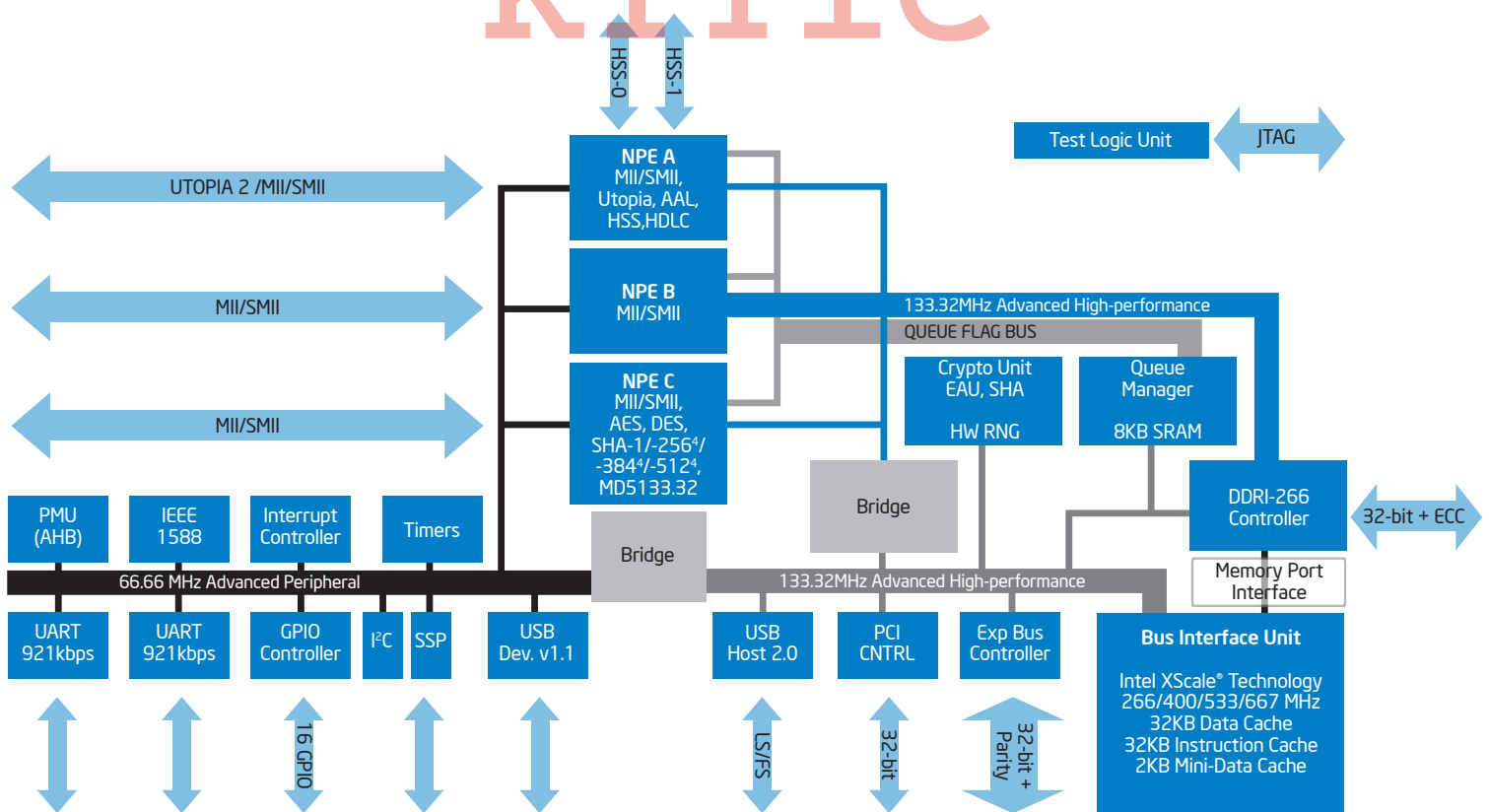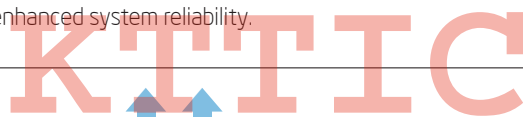- Wind River* Platform for Network Equipment PNE 2.0 and PNE 3.2— Microsoft WinCE 5.0[1]

Figure 1: Intel® IXP465 Network Processor

Features	Benefits
Intel XScale® processor available at 266 MHz, 400 MHz, 533 MHz and 667 MHz	Delivers high MIPS/power consumption ratio and provides ample processing headroom for value-added software features
32-bit 33/66 MHz PCI v2.2, host and option interface	Provides flexibility to directly connect devices including 802.11x chips, PCMCIA controllers and cable MAC/PHYs
▪ USB v. 1.1 device controller ▪ USB v. 2.0 host controller, supports low-speed and full-speed modes only	Industry-standard interface for connection to a wide array of devices
32-bit, DDR1-266 SDRAM interface ▪ Optional ECC ▪ 32MB to 1GB of memory	▪ High-bandwidth memory interface ▪ Optional ECC improves system reliability
32-bit Expansion bus interface with parity ▪ Master/Target capable ▪ 25-bit address	▪ Glueless connection to most other devices ▪ External mastering capability allows external devices to communicate with each other and with internal peripherals resulting in shared memory subsystem design and lower system cost
Integrated Ethernet MACs ▪ Up to three integrated 10/100 Ethernet MACs with SMII interface ▪ Up to three integrated 10/100 Ethernet MACs with MII interface	▪ Industry-standard networking interface lowers system bill of materials (BOM) cost ▪ Multiple ports allow lower system cost, multiple LAN port support and concentration of networking modules
UTOPIA-2 Interface with multiple ADSL/G.SHDSL or VDSL PHY support	Industry standard WAN interface
Two high-speed serial (HSS) ports connect directly to T1/E1 or SLIC/CODEC for voice support. Direct connection to 802.1 chips, PCMCIA controllers and cable MAC/PHYs	Highly integrated design lowers system cost
Silicon functional assistance for Random Number Generation	Accelerates public key exchange and authentication and key generation
Integrated hardware support for popular cryptography algorithms	Acceleration for popular applications such as IPSec and SSL VPNs (AES/AES-CCM/3DES/DES/SHA-1/SHA-256/SHA-384/SHA-512/MD-5/RSA/DSA/Diffie-Hellman algorithms)
Hardware support for IEEE 1588 protocol	Hardware assistance for time synchronization in a distributed control system containing multiple clocks
Two high-speed UARTs support up to 921Kbaud each	Provides an interface for debug and passing control information
Integrated I²C and SSP interface	Provides serial interfaces for common embedded and communications application; reduces system BOM cost
Spread spectrum clocking for reduced EMI	Improves system reliability by reducing EMI
Comprehensive pre-validated pre-integrated "out-of-the-box" development infrastructures ready for application development using Linux*, VxWorks*, or WinCE*	Ease of design and fast time-to-market
544-Ball PBGA Package ▪ 35mm x 35mm, 1.27mm ball pitch ▪ Lead-free packages available ▪ Commercial temperature (0° to 70° C) ▪ Extended temperature (-40° to 85° C)	▪ High-performance package provides improved reliability ▪ Lead-free packages available to meet environmental regulations ▪ Extended temperature support industrial applications
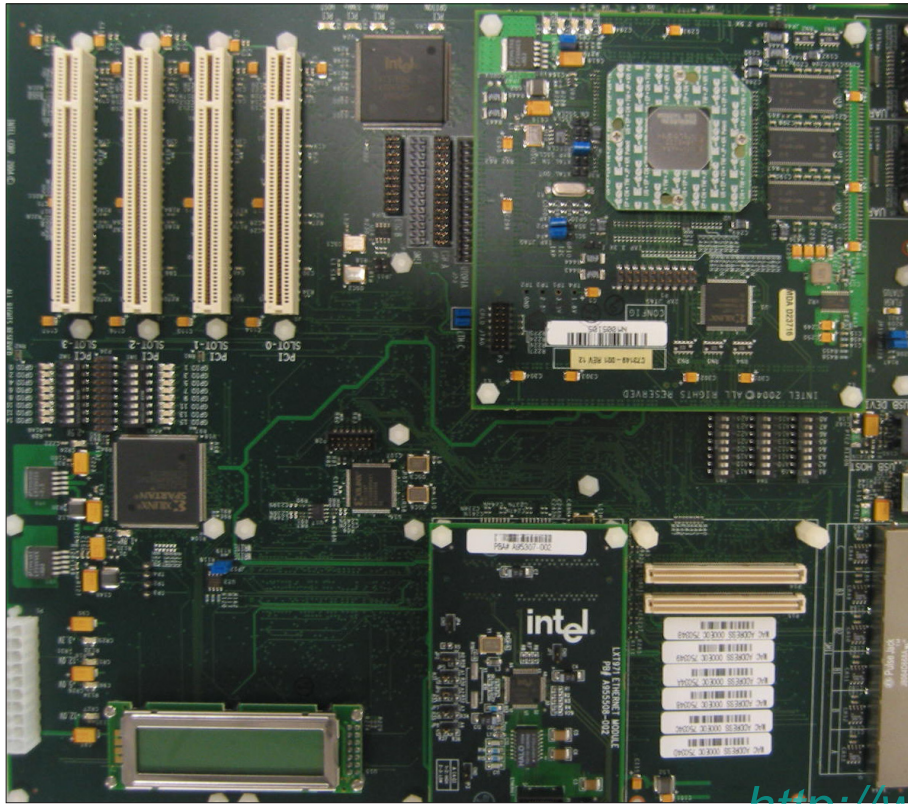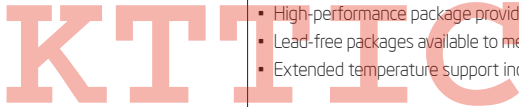
Intel® IXDP465 Development Platform

Intel® IXDP465 Development Platform for Faster Time-to-Market

The Intel IXDP465 Development Platform is a powerful tool for development and verification of hardware and software for the Intel IXP465 and IXP460 network processors. Developers can use this flexible and extendable platform to conduct rapid initial chip assessment, chip performance evaluation, product development and prototyping. Key features are shown in Figure 2.
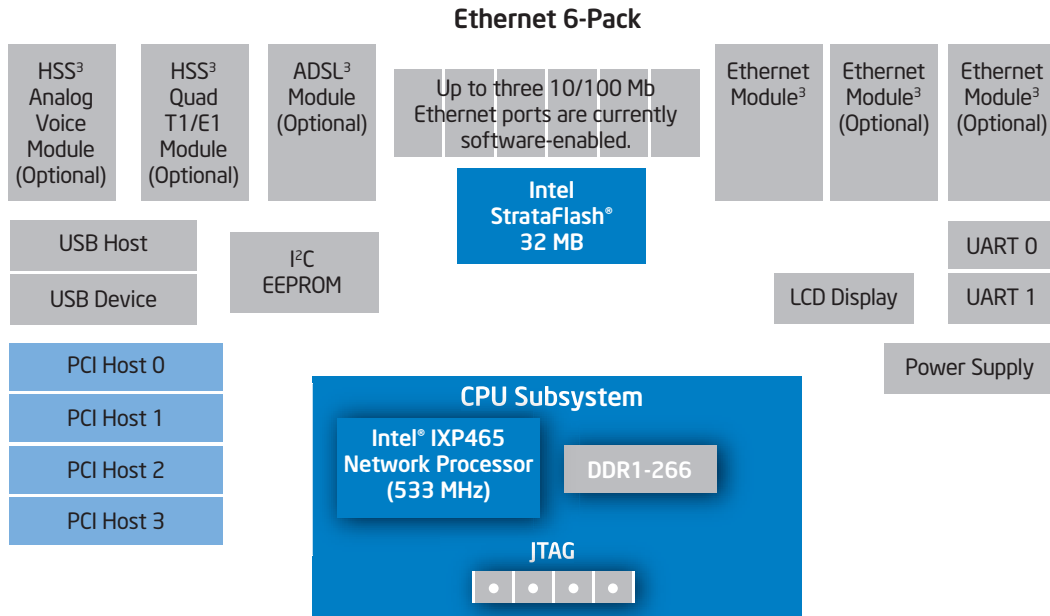
Ethernet 6-Pack

| HSS[3] Analog Voice Module (Optional) | HSS[3] Quad T1/E1 Module (Optional) | ADSL[3] Module (Optional) | Up to three 10/100 Mb Ethernet ports are currently software-enabled. | | Ethernet Module[3] | Ethernet Module[3] (Optional) | Ethernet Module[3] (Optional) |

Intel StrataFlash® 32 MB

USB Host
USB Device
I²C EEPROM

LCD Display
UART 0
UART 1

PCI Host 0
PCI Host 1
PCI Host 2
PCI Host 3

Power Supply

CPU Subsystem

Intel® IXP465 Network Processor (533 MHz)   DDR1-266

JTAG

Figure 2: Intel® IXDP465 Development Platform Board Diagram

[1] Future support

[2] USB 2.0 Host supports only low-speed (1.5Mbps) and full-speed (12Mbps) modes

[3] Requires Intel IXP400 software

[4] Feature is not currently enabled by Intel® IXP400 Software

Intel Access

Intel® Network Processors Home page	intel.com/go/networkprocessors
Developer's Site	developer.intel.com
Intel in Communications	intel.com/communications
General Information Hotline	(800) 628-8686 or (916) 356-3104 5 a.m. to 5 p.m. PST
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

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