



Intel® Storage Solutions for Small Office and Home Office

**Scalable, secure and affordable Network Attached Storage (NAS)
Solutions, built on proven Intel® technology**

Solution Highlights

- A new class of storage solutions based on standard Intel® building blocks (Intel XScale® technology-based I/O Processors, Serial Advanced Technology Attachment (SATA) Disk Controllers, and 10/100 Ethernet and Wireless components)
- Optimizes the price and performance advantages of Intel XScale microarchitecture
- Easy to install and manage
- Tailored to Small Office/Home Office (SOHO) market segments
- Attractive to a large population of price-sensitive storage buyers seeking straightforward, scalable and secure storage solutions

Low-cost Storage Options Utilizing Intel XScale® Technology and SATA Disk Controllers

Network Attached Storage (NAS) is generally implemented as a network appliance and, until recently, no attention had been given to small form factor, fanless designs. Intel® products using Intel XScale technology are ideal for that mission. Intel® microarchitecture is specifically designed to optimize power consumption and performance — in a phenomenally limited space — while serving a wide range of Internet devices using the same processor core.

Traditionally, Intel® storage silicon has been used in servers and large enterprise designs. But the SOHO market segment is increasingly attractive, and Intel XScale technology products closely match SOHO requirements. Intel silicon building blocks can be used to help reduce cost, size and power draw associated with entry-level NAS. The solution combines user-friendly NAS management software, and Intel SATA disk controllers with the performance of Intel XScale microarchitecture — a combination now available at relatively low cost.

The Opportunity

There is an emerging demand for networked storage solutions custom-built to the needs of the SOHO market segment. This business community, consisting of 34 million¹ companies, wields tremendous purchasing power.

Keeping knowledge assets safe but accessible — at a reasonable cost — has become a major challenge for the SOHO owner. The volume of digitized data that needs to be retained is constantly increasing.

The majority of new knowledge assets (99.97 percent by some estimates²) are in digital form. Furthermore, an increasing amount of material trafficked on the Internet is multimedia-intensive. Much of this material needs to be stored safely, with reliable backup protection for irreplaceable information. Critical data found in networked storage can include: e-mail, financial transactions, medical records, workgroup files, entertainment media, business records, product designs, technical drawings, audio recordings, survey data, blueprints, pre-press images, photographs, video recordings and legal documents.

As a result, there is a growing opportunity to serve the specialized storage needs of the SOHO market segment. Until recently, SOHO storage needs were answered with the basic personal computer. But today's small office is beginning to understand the complexities of a computerized business environment: How do I get data protection? What happens if my hard drive crashes? Where do I get data storage that is affordable? How do I add storage when I run out of space? The answers reside in flexible, yet highly manageable NAS technology.

Entry-level NAS appliances will fill a gap in the existing storage matrix, offering cost-effective solutions to the SOHO market segment, without sacrificing storage performance.

Entry-level NAS

Within the SOHO market segment, storage trends are reflecting a variety of factors. The number of broad-band connections has been growing. In 2004, two out of five Internet users were using broadband. Small offices and home-based businesses are more likely to have multiple PCs and laptops. Wireless networking is gaining momentum. As a result, SOHO storage devices are often required to do double-duty, storing business information and multimedia/entertainment files.

For this group of users, a basic external hard drive no longer provides the necessary reliability, performance and flexibility. The next logical step would be a modular multi-drive storage system. But today's NAS devices generally cost over \$1,000.

A complete NAS solution, including RAID data-protection capabilities, can be developed for the SOHO market segment using standard Intel building blocks (Intel® 31244 SATA controller, Intel® 80219, Intel® IOP321, or Intel® IOP331 with Intel XScale technology-based processors).

Intel offers an entry-level NAS reference design as a viable bridge to the next generation of SOHO data storage: an appliance with modular architecture, support for up to four SATA drives, scalability to over 1 TB capacity, and Ethernet connections for easy LAN installation.

Based on this reference design, total device costs are now well within range of the price-sensitive SOHO market segment. Intel also offers inexpensive evaluation boards to enable OEMs and ODMs to quickly build and deploy an entry-level NAS solution. Independent software vendors are ready to support this storage solution now.

SATA and Intel XScale Benefits

The potential benefits of NAS are further enhanced with SATA and Intel XScale technology, resulting in scalable, low-power, high-disk-density, low-cost and fanless solutions.

With entry-level NAS, buyers can gain the data protection and backup capabilities they want, along with other valuable benefits.

- Small form factor, fanless (quiet) designs
- Intuitive, easy to use
- Deploy within 15 minutes
- Utilize RAID to increase storage efficiencies and data protection

Be Ready for the Future

Intel is ready to catch the coming wave of demand for SOHO storage. Entry-level NAS schematics and a complete reference design are available now. An Intel® EP80219 Development Kit, including third-party software, is being offered at a substantial discount.

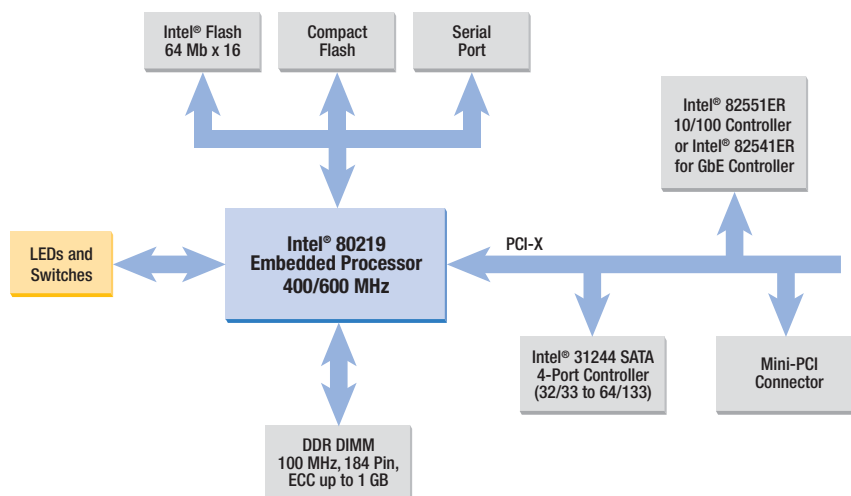
In addition to the SOHO market segment, exciting opportunities are growing in the consumer market segment. The volume of digital content is expanding rapidly, and consumers are demanding new ways to store digital media. Whether they have digital pictures, movies or music, consumers are looking for cutting-edge solutions. Entry-level NAS, built with Intel XScale and SATA technologies, will be one of these solutions.

Take this opportunity to learn more about the entry-level NAS solution. Be on the lookout for information about emerging NAS opportunities.

Intel® EP80219 Development Kit

A Production-ready Embedded Development System for the Intel® 80219 General Purpose PCI Processor

- Hardware (board and memory)
 - Compiler tools
 - Debug monitors
 - Target RTOS/Embedded OS
- Software development environment
 - JTAG emulator
 - Third-party application software



Intel® Industry-Leading Storage Building Blocks

Intel XScale® technology-based I/O Processors

	Lowest Cost Intel® 80219 General Purpose Processor	RAID 5 Enabled Intel® IOP321 I/O Processor	Highest Performance Intel® IOP331 I/O Processor
Intel XScale® Core	Integrated	Integrated	Integrated
Core Speed	400/600 MHz	400/600 MHz	500/667/800 MHz
Package Size	35 mm x 35 mm	35 mm x 35 mm	37.5 mm x 37.5 mm
Integrated Bridge	133 MHz, 64-bit PCI-X Interface	133 MHz, 64-bit PCI-X Interface	133 MHz, 64-bit PCI-X Bridge
Memory Controller	DDR 200 MHz	DDR 200 MHz	Dual-ported DDR 333 MHz/DDR2-400 MHz
Max Memory	1 GB	1 GB	2 GB (DDR); 1 GB (DDR2)
Internal Bus Frequency	200 MHz Bus	200 MHz Bus	266 MHz (2.1 GB/s) Bus
Local Bus Width	32 Bits (up to 100 MHz)	32 Bits (up to 100 MHz)	8/16 Bits (up to 66 MHz)
DMA Buffer Size	1024 Bytes	1024 Bytes	1024 Bytes
ATU Buffer Size	4096 Bytes	4096 Bytes	4096 Bytes
Application Accelerator w/ XOR Application Capability	No	Yes	Yes
I ² C Bus Interface Unit	2 Serial Units	2 Serial Units	2 Serial Units
Hardware-based CRC32C offload	No	No	Yes
Timers	2 – 32-bit	2 – 32-bit	2 – 32-bit
UART	SPI	SPI	2 – 4-Pin (16550)
GPIO	8 Pins	8 Pins	8 Pins
External Interrupt Pins	5	5	17

Intel® 31244 PCI-X to Serial ATA Controller

Features	Benefits
PCI-X 133/100/66 MHz	Provides an attachment to PCI-X-based systems
DPA mode	Enhanced concurrency over ATA by allowing data transfer to all four drives simultaneously
Enhanced voltage support	Enables customers to deploy SATA in storage backplanes
Activity LED support	Enables the user to visually determine if an individual disk is active
256 TE-PBGA package (17x17 mm)	Cost-effective, small package for motherboard implementation
Supports programmable TX voltage and five LEDs	Simplifies chassis design

Ethernet Connectivity Options

Intel® 82551ER Integrated 10BASE-T/100BASE-TX Ethernet Controller

Performance-enhancement Features	Benefits
Offloads TCP, UDP, and IP checksums from Intel XScale® technology-based processor	Speeds data transfers
Multiple priority transmit queues	Enables packet prioritization for faster delivery of business-critical data
Combination 10/100 Mbps Fast Ethernet controller and physical layer interface with glueless 32-bit PCI bus master interface	<ul style="list-style-type: none"> Provides low-cost network connectivity for LAN on Motherboard (LOM) or PCI adapters Reduces board space requirements and external support circuitry
Improved dynamic transmit chaining	Enhances performance
Early-receive interrupt	Processes receive data concurrently
3 KB internal receive and transmit buffers	Prevents data overruns or underruns
Address Resolution Protocol (ARP) and flexible frame filtering	Allows virtually connected IPv6, IPv4, Windows XP* or Linux* systems
Programmable transmit threshold	Utilizes bus more efficiently
Fast back-to-back transmission support with minimum interframe spacing	Maximizes system throughput
Power-reduction Features	
Advanced Configuration and Power Interface (ACPI) Specifications compliant	Provides various power-down states and the ability to “wake-up” on a unique packet addressed to the system
Reduced D3 power consumption	Optimized for power-constraint designs
Supports deep power down and dynamic standby modes	Minimizes Ethernet power consumption when the network connection is inactive
Compatibility Features	
Footprint-compatible with the Intel® 82541ER Gigabit Ethernet controller	<ul style="list-style-type: none"> Enables single-board design accommodating either 10/100/1000 Mbps or 10/100 Mbps Ethernet Provides an easy and safe migration path to Gigabit Ethernet
Physical Features	
Thin BGA 15x15-mm package	Minimizes board space requirements
Lead-free package option	Meets new industry standards

Intel® 82541ER Gigabit Ethernet Controller

PCI Bus Features	Benefits
PCI revision 2.3, 32-bit, 33/66 MHz	Application flexibility for embedded board designs
CLKRUN# Signal	PCI clock suspension for low-power designs
Gigabit MAC Features	
64-KB configurable Receive (RX) and Transmit (TX) packet first-in, first-out (FIFO)	<ul style="list-style-type: none"> No external FIFO memory requirements FIFO size tunable to the application
IEEE 802.3x* compliant flow control support	Reduced frame loss due to receive FIFO overrun
Programmable host memory receive buffers (256 B to 16 KB)	Efficient usage of system resources
Low-latency transmit and receive queues	Network packets handled without waiting or buffer overflow
Gigabit PHY Features	
IEEE 802.3ab* Auto-Negotiation	Automatic link configuration including speed, duplex, and flow control
State-of-the-art Digital Signal Processing (DSP)/analog architecture	<ul style="list-style-type: none"> Implements digital adaptive equalization, echo, cross-talk and baseline wander cancellation Robust 1000 Mbps performance in noisy environments
Auto MDIX	Easier network installation and maintenance
PHY supports 2-pair and 3-pair cable downshift	Controller adapts to sub-standard cable plant
Host Offloading Features	
Transmit TCP segmentation, and IP, TCP, and UDP checksum offloading	<ul style="list-style-type: none"> Increased throughput and lower CPU utilization Compatible with large send offload on RX and TX
Interrupt moderation controls	Reduces interrupts generated by RX and TX operations, resulting in lower CPU utilization
Jumbo frame support up to 16 KB	High throughput for large data transfers on networks supporting jumbo frames
Power Management Features	
Compliance with PCI Power Management v1.1/ACPI v2.0	PCI power management capabilities for embedded applications
Automatic link speed switching from 1000 Mbps down to 10 or 100 Mbps in standby	<ul style="list-style-type: none"> Supports power-down states without software assistance Low power in standby states
Smart Power Down mode when no signal is detected on the wire	Enables very low power consumption
Additional Features	
Four programmable light-emitting diode (LED) outputs	Customizable indications for link speed, activity, duplex, collisions, and port ID on each port
On-chip power regulator control circuitry	Simplified low-cost power supply design
Internal phase-locked loop (PLL) for clock generation using a 25-MHz crystal or a 25-MHz oscillator	Lower component count and cost
Basic input/output system (BIOS) LAN Disable Pin	Enables low-power LAN disable via BIOS

For customers looking for a higher performance network connection on their NAS solution, the 82541ER Gigabit Ethernet Controller offers a footprint-compatible upgrade path from the Intel® 82551ER 10/100 Ethernet Controller for a modest cost adder.

Intel® StrataFlash® Memory

Features	Benefits
Intel® MLC technology	Over five years of leading-edge reliability, performance, and value
32-Mb, 64-Mb, and 128-Mb and 256-Mb densities	Lowest cost-per-bit NOR devices
56-lead TSOP package	Over 100 million TSOP packages shipped, easy migration from existing memory devices
64-ball Easy BGA package	Long-term size and footprint compatibility; 50 percent smaller than 56-lead TSOP
Common Flash Interface (CFI)	Compatibility with future products today
One-time programmable protection registers	64 bits programmed at the factory with a unique ID, and 64 bits can be programmed by the OEM; traceability, license control, and system authentication
Page Mode Interface, 8- and 4-word	Page access mode improves read performance up to 3x
Complete selection of Intel® Flash software	Dramatically reduces the time to market for OEMs and is easily ported to OEM's environment

¹Evaluator Group, Inc., April 2004.

²UDO: Why Professional Optical Storage Makes Sense in a Low-Cost Disk World; *Computer Technology Review*, 2003; Dupont and Tongish.

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