



# High Power on a Small Footprint

## New Application Prospects For Intel® IXP425 Network Processor



**C H A L L E N G E**

To make a small-footprint, full-featured real-time database management system available on the Intel® IXP425 Network Processor for innovative “network based” applications

**S O L U T I O N**

In the course of developing its innovative self-contained security solution S2 NetBox™, S2 Security Corporation ported the Embedded MySQL DBMS to the Intel IXP425 Network Processor, running under a real-time Linux\* derivative

**B E N E F I T**

Porting Embedded MySQL onto the Intel IXP425 Network Processor has facilitated a breakthrough in cost-effective security management and enables the development of many other highly attractive network-based applications.

A whole new realm of network-based applications has opened up for the Intel® IXP425 Network Processor. This was brought about by the port of a full-featured embedded SQL database in a real-time environment, creating a breakthrough network application solution. Carried out by S2 Security Corporation in the course of developing the S2 NetBox™ – an innovative, self-contained security appliance – by S2 Security Corporation. But the scope of a real-time DBMS running on a Network Processor in the Intel IXP42X Product Line reaches far beyond this solution.

The Intel IXP425 Network Processor is a highly integrated, versatile single-chip device that can be used in a variety of products that run their software applications in a network connectivity environment. The processor combines high performance with support for multiple WAN and LAN technologies in a common architecture. With its unique combination of integrated features, it meets the requirements for high-end gateways, Voice over IP (VoIP) applications, wireless access points, SME routers, switches, security devices, DSLAMs (Digital Subscriber Line Access Multiplexers), xDSL line cards, industrial control as well as networked imaging applications.

The Intel IXP425 Network Processor is a member of the IXP42X Product Line that also includes the Intel IXP422, Intel IXP421, and Intel IXP420 Network Processors. It comes with a choice of 266, 400, and 533 MHz clock speeds.

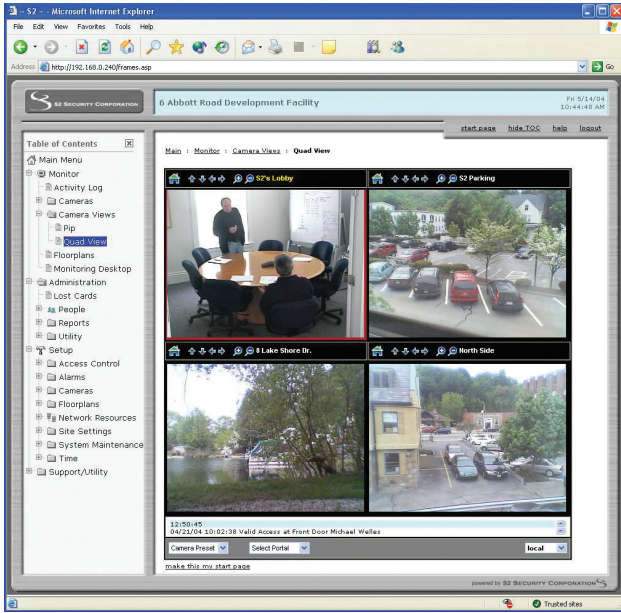
With more than 5 million active installations, MySQL\*, the leading open source database server, is proven as a full-featured, reliable, and high-performance database management system. MySQL will run in as little as 1 megabyte of memory and requires a minimum of just 4 megabytes of mass storage. It also features an embedded server library which makes it ideally suited for small footprint integrated solutions.

Leading Independent Software Vendors and Value Added Resellers are using this library to integrate MySQL transparently into software as well as hardware/software applications. In addition, MySQL provides a low or zero administration environment, thus lowering management costs. Finally, favorable licensing terms render MySQL well-suited for distribution with turn-key solutions.

**An Ideal Basis**

Combine the powerful and versatile Intel IXP425 Network Processor with the full-featured Embedded MySQL database management system and what do you get? An ideal basis for the S2 NetBox, a cost-effective self-contained solution for the security needs of facilities of any kind, large or small – literally, a “security management system in a box”.

The S2 NetBox is the first product of S2 Security Corporation, headquartered in Wellesley, Massachusetts, an innovator in the development of network-based integrated physical security solutions. These systems provide key security functionality including



access control, alarm monitoring, temperature monitoring, video and intercom. The appliance allows facilities of all sizes to manage their physical security from any place across an IP network using nothing more than an Internet browser.

Typically, security system users have had to put up with either inflexible low-end equipment or over-featured, expensive high-end systems. In contrast, the S2 NetBox is

designed to scale down to fit in a single small office or scale up to handle a large facility with complex security needs.

At the heart of this solution is an embedded network controller based on the Intel IXP425 Network Processor, running Linux\*, and accompanied by application-specific network modules. By employing a network appliance architecture, S2's product line is cost-effective enough for use at a single location yet easily scales up to accommodate the largest wide-area security networks. Managing the network controller unit requires no client-side software other than a web browser. Attached application modules are discovered automatically, making the system truly plug-and-play.

Using the Intel IXP425 Network Processor in combination with Embedded MySQL, S2 has been able to embed full database functionality into the S2

NetBox, making it much more cost-effective than any competitive product.

S2 NetBox's powerful predefined and ad-hoc reporting is one differentiator for the product. Its proprietary "English based" free-form report language makes the otherwise complex retrieval of specific historical information easy even for inexperienced users. Other reports are easy to specify and run with an easy-to-use graphical browser interface. NetBox can even forward a report automatically by email, keeping the user informed about events at the facility regardless of where the user is.

Using the MySQL ODBC driver, S2 Security can interface the S2 NetBox with third-party tools such as Crystal Reports\* to create even more customized reports. Although this type of functionality is typically not data intensive, tables can grow to hundreds of thousands of records for activity logs. With SQL compliance, it is easy to develop reports and fit them into the increasingly converging world of security systems in the Enterprise. "In the largest systems, we achieve true scalability by connecting multiple S2 NetBox units to a centralized management system. MySQL is essential for doing this", says John Moss, CEO of S2 Security Corporation.

The S2 NetBox provides an online database of personnel, contractors, and visitors; along with vehicle information; an historical audit record of events along with recall by name, time, or vehicle tag. The MySQL database is essential in providing these key features.

### Designed for High Performance and Security

All this adds up to a broad range of performance requirements the S2 NetBox appliance places on the Intel IXP425 Network Processor. But this single-chip processor comes well-equipped to tackle the challenge. Like all network processors in the 42X Product Line, the Intel IXP425 Network Processor has a unique distributed processing architecture, combining a high-performance Intel XScale® core with additional network processor engines (NPEs) to achieve wire-speed packet processing performance. The Intel XScale core and the NPEs run their instruction streams in parallel. Designed on the Intel 0.18-micron process technology and fully compatible with the ARM V5T Thumb Instruction Set\* and V5E DSP

## ABOUT MYSQL

Based in Uppsala, Sweden, and with US corporate offices in Cupertino, California, MySQL AB develops, markets, and supports the MySQL database server, the world's most popular open source database. With over 5 million active installations, MySQL has quickly become the core of many high-volume, business critical applications.

Companies embedding MySQL into their hardware and software systems include Adobe Systems, Blue World Communications, CoreSense, Motorola, NetIQ, Novell, NEC, S2 Security Corporation, SAS, SS8 Networks, Sterling Commerce, and Virage. MySQL is available under the free software/Open Source GNU general public license (GPL) or a non-GPL commercial license.

extensions, the Intel XScale core provides ample processing headroom for the Embedded MySQL database management system.

Because security data is sensitive data, the browser communication traffic is protected by encryption. And here the Intel IXP425 Network Processor shines, offering hardware accelerated VPN-related tasks such as DES (Data Encryption Standard), 3DES (Triple DES), AES (Advanced Encryption Standard), and hashing at speeds up to 70 Mbps through one of its three NPes.

The Intel IXP425 Network Processor's direct connection to flash memory through its expansion bus interface is another crucial feature for the S2 NetBox: the appliance performs periodic database backups to internal flash ROM, rendering it independent from local or network-attached moving storage devices. In accordance with the real-time character of its security solution, S2 Security chose Lineo\*, a real-time Linux derivative, as the operating system platform for Embedded MySQL.

"We had three primary considerations in selecting the database to embed in our system: cost, footprint, and functionality", says John Moss. "The first and foremost reason for choosing open source and MySQL was cost. We're delivering an embedded product and needed a full-featured and reliable, yet low-cost database to be competitive. The database needed to have a small footprint since it has to run from memory only. In addition to footprint, we required that the database be ODBC compliant. No other database management system could meet these requirements while satisfying our stringent footprint demands."

The depth of the implementation of MySQL database in the product is a key competitive advantage of S2 NetBox. MySQL stores everything from reports, user information, and customized features to facility diagrams. The full relational capabilities of MySQL are essential for getting this job done. And that's not all: in the future, S2 plans to use MySQL's replication abilities to help consolidate multiple S2 NetBoxes installed in a campus environment and aggregate the information to a central server.

Developing the NetBox took a mere 15 months, including the software port. Employing MySQL's full

functionality to resolve all storage issues jointly contributed to this short time to market. Also, the unique multiple storage engine architecture of MySQL enabled S2 to use the space-saving MyISAM storage engine and thus account for the need for a small application footprint. "A miniature footprint is obviously the primary factor in choosing components for embedded network applications like the S2 NetBox," said Bertrand Matthelié, director of alliances for MySQL AB. "However, factors like performance, cost, and reliability are also very important. For S2, the combination of a full-featured MySQL database running Linux on an Intel IXP425 [Network Processor] has proven to be the perfect fit."

#### Additional Applications

In all, the port of Embedded MySQL onto the Intel IXP425 Network Processor in a real-time Linux environment has facilitated a breakthrough in cost-effective network-based security management. But given the versatility of the Intel IXP425 Network Processor, many additional applications become feasible.

The Intel IXP425 Network Processor features on-chip integration of data and voice functions saving the time and cost of implementing separate devices.

*"For S2, the combination of a full-featured MySQL database running Linux on an Intel IXP425 Network Processor has proven to be the perfect fit."*

Bertrand Matthelié  
director of alliances  
MySQL AB

### THE INTEL® IXP425 NETWORK PROCESSOR PRODUCT HIGHLIGHTS

- Intel XScale® core at up to 533 MHz providing headroom for customer-defined applications
- Integrated hardware acceleration for multiple cryptography algorithms (SHA-1, MD5, DES, 3DES, AES) for secure applications
- DSP software library on the Intel XScale core supporting 2 to 4 voice channels and reducing system cost
- Two high-speed serial (HSS) ports for VoIP SLIC/CODEC or T1/E1
- Two integrated 10/100 Base-T Ethernet MACs with Media Independent Interface (MII) for design flexibility and cost-effective wire-speed performance
- Intel® IXB8055 UTOPIA/POS Reference Design interface with multiple ADSL/G.SHDSL or VDSL support
- 33/66 MHz PCI v2.2 host and option interface for glueless connection of up to four devices
- SDRAM controller supporting from 8 to 256 MB of SDRAM memory
- Low system power consumption (1.0 to 1.5 Watt typical)
- USB version 1.1 device controller
- Two high-speed UARTS support up to 921 Kbaud each
- Sixteen GPIO pins
- 16-bit configurable expansion bus
- Commercial (0° to 70° C) and extended temperature (-40° to +85° C) versions

## EMBEDDED MYSQL – PRODUCT HIGHLIGHTS

- Full-featured MySQL server running inside a client application, providing increased speed and more simple management for embedded applications.
- Operation transparent to end users who are unaware that a database is embedded within their application.
- Support for a broad subset of the ANSI SQL 99 syntax, along with extra extensions as well as support for other database systems for easy application porting.
- Unique independent storage engines allowing for customized database storage appropriate for any particular need, including row-level locking and transaction support.
- Advanced permissions and security system, including support for SSL transport-layer encryption.
- Query caching for significantly increased performance of commonly-issued queries without any special programming.
- Full-text indexes allowing search for specific words and phrases in fields, including relevance rankings as well as exact phrase matching and Boolean search operators.

Also, the Intel XScale core includes integrated multiply and accumulate functions that enable multimedia processing without the need for external hardware. 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.

Added to that, the Intel IXP425 Network Processor includes a powerful DSP software library and rich and powerful general and multimedia signal processing kernels optimized for maximum performance on the Intel XScale core. This enables implementing voice-processing algorithms for up to four voice interfaces on the Intel IXP425 Network Processor. The hardware accelerated cryptography and authentication elements can be used by any interface within the processor. This provides maximum flexibility for all interfaces, especially when dealing with security issues over wireless.

Also, the processor integrates a SDRAM controller and an interrupt controller, as well as a GPIO port and UARTs. The processor features a USB version 1.1-device controller and achieves direct connection to flash memory through its expansion bus interface.

There is an UTOPIA 2 interface that supports multiple xDSL PHYs (ADSL, G.SHDSL or VDSL). A PCI 2.2 host and option interface provides the flexibility to directly connect devices including 802.11x chips, PCMCIA controllers and cable MAC/PHYs. The network processor also features two high-speed serial (HSS) ports that can serve as high-speed ports for direct connection to T1/E1 framers or to industry-standard SLIC/CODECS.

All these space saving features are complemented by porting Embedded MySQL to the Intel IXP425 Network Processor on a real-time operating system platform to form a development platform for network appliances that combine high performance with sophisticated data storage and retrieval capabilities on a footprint with a size previously hardly conceivable.

### Intel Technology

Intel® IXP425 Network Processor

Intel XScale® technology



### MySQL Inc.

Cupertino City Center  
 20400 Stevens Creek  
 Boulevard  
 Suite 700  
 Cupertino, CA 95014  
 USA  
 Tel: 425-743-5635  
 Fax: 408-213-2807

This paper is for informational purposes only. INTEL MAKES NO WARRANTIES, EXPRESS OR IMPLIED, IN THIS PAPER

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. MySQL and the MySQL logo are trademarks or registered trademarks of MySQL AB.

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

Portions Copyright © 2004, Intel Corporation. All rights reserved.  
 Portions Copyright © 2004, MySQL AB. All rights reserved.

305283-001