Serial to LAN Embedded Module

White Paper

English ver 1.0
Sept 4, 2007

Overview

In the field of device networking, serial to LAN embedded modules have been playing a huge role in providing network connectivity for serial devices. A serial to Lan embedded module connects individual serial device to the network, working as a serial to LAN converter. It is composed of at least one LAN port and one or more serial ports, so that serial devices can be connected to the serial to LAN embedded module using their serial ports, and eventually can be connected to LAN with a single LAN cable. Devices attached to the serial to LAN embedded module operate as if they were connected to LAN directly, yet using serial communication internally. With the help of the serial to LAN embedded module, devices are logically and indirectly, rather than physically and directly, linked to the target machine through LAN connection. Consequently, more effective and dynamic tasks can be performed.

There are many kinds of device servers available in the market, and they are slightly different in features including extended temperature, serial port isolation, power requirement, etc. These could be considered rather minor advancements, compared to the recent major trends in serial to LAN embedded modules: wireless and embedded. With wireless serial to LAN embedded modules, now serial devices can transfer data over the wireless network. Mobility can be significantly increased with wireless products. With serial to LAN embedded module, device manufacturers can network-enable their products in a built-in style. In a customized and an easier way, serial to LAN embedded modules internally serve as device server , without an additional external device server.

This white paper focuses on the background of serial to LAN embedded module, key factors of selecting a serial to LAN embedded module, SystemBase's serial to LAN embedded module, Eddy and its applications.

Serial to LAN Embedded Module

Nowadays, vast majority of electronic devices require data transfer over the network. They send, receive, and share data with embedded network interface. In order to implement network interface inside these devices, designers had to build the feature from scratch. This often led to delay in time-to-market, and engineers occasionally fell into trouble with hardware and software design issues. Serial to LAN embedded modules provide device designers/engineers with an easy network-enabling solution, helping them to concentrate on other design aspects. With serial to LAN embedded modules, network interface can be simply added to the target device in a reliable, fast, and cost-effective manner.

What are key factors in choosing the best serial to LAN embedded module?

System Integration

How easy it is to integrate the serial to LAN embedded module with user's hardware and software environment ? How can the serial to LAN embedded module be connected? By what kind of pins and connectors ? How are the serial and LAN interface outputs provided? Are software / hardware manuals and documents thorough and fully described ?

Customization

How much can the serial to LAN embedded module be modified to reflect user's customized environment ? SDK (Software Development Kit)/API (Application Programming Interface) can be helpful for programmers.

Size

Since the serial to LAN embedded module is not a stand-alone device and therefore should be embedded in another hardware case, size can be a major concern. Also, the shape and connection options should not conflict with user's hardware design.
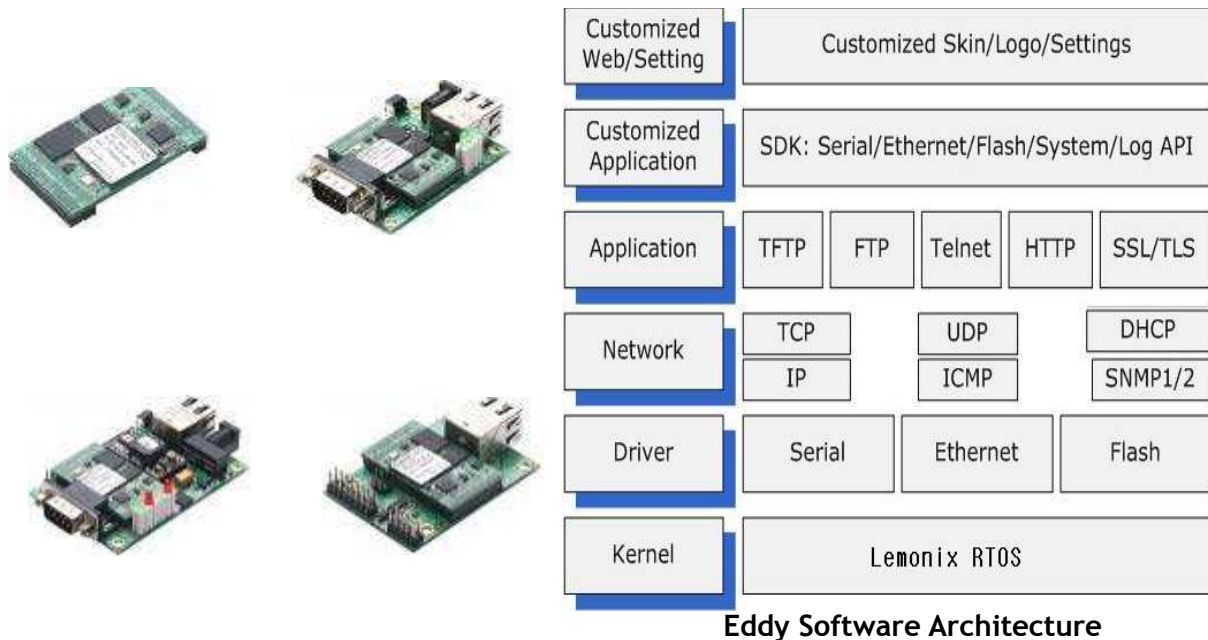
Price

Since major customers for the serial to Ethernet embedded module is serial to LAN embedded module distributors and industrial device manufacturers, not end users, price does matter and volume pricing can be effective.

Eddy™

Eddy is a programmable serial to LAN embedded module that users can easily modify to their own requirements. Eddy has been designed to maximize user's integration and customization needs.

Can Upload & Execute your own programmed applications.

Eddy is distinguished with other serial to LAN embedded module in that it can upload and execute customized user applications. SDK (Software Development Kit), API (Application Programming Interface) and an integrated development environment, LemonIDE is provided, enabling developers to program their own socket/serial communication applications with least amount of effort.

Customized Web/Setting	Customized Skin/Logo/Settings				
Customized Application	SDK: Serial/Ethernet/Flash/System/Log API				
Application	TFTP	FTP	Telnet	HTTP	SSL/TLS
Network	TCP		UDP		DHCP
	IP		ICMP		SNMP1/2
Driver	Serial		Ethernet		Flash
Kernel	Lemonix RTOS				

Eddy Software Architecture

Powerful Specs

Tired of constraints on your serial to LAN embedded module 's 8-bit CPU and 256KB memory ? Eddy provides a simple and complete relief to these concerns by adopting a 32-bit ARM9 CPU with 180MHz clock, 4MB Flash memory, and 32MB SDRAM. Your applications can be large in size and will run faster, in a more stable manner under the real time embedded Linux operating system, Lemonix. And all this comes in a small sized board of 55mm * 38mm that would fit into just about any hardware.

Device Connectivity Management

As a qualified serial to LAN embedded module, Eddy receives RS232 or RS422/485 signals from connected devices and transmits them to the network, and vice versa. Maximum serial communication speed can reach up to 921.6Kbps, providing a fast and a stable data transmission. Various network protocols are supported, including TCP, UDP, Telnet, ICMP, DHCP, TFTP, HTTP, and PPP providing wider communication flexibility. World's standard network management protocol SNMP (Simple Network Management Protocol) 1 and 2 are also supported, providing a complete control of your device.

Configuration

There are many factors that determine the serial to LAN embedded module's environment, and Eddy offers you easy but in-depth configuration selections. The settings include serial communication, network, security, management, and other advanced settings. You can configure settings through web or telnet. When configuring by web, you can just use your web browser to access your Eddy and easy web interface will guide you through options. You can also access Eddy via telnet, and use preset commands to apply changes.

Real Time Linux, Lemonix™

Lemonix is a real-time Linux system built on Linux kernel 2.6.x. Standard Linux kernel 2.6.x has been revised to support Real Time capability while retaining the stable traits and merits of Linux kernel 2.6.x. Real time scheduler, preemptive kernel and lock-break methods have been implemented on Lemonix to guarantee a maximum response latency of under 37us enabling a stable and reliable means of real time communication. And to provide a complete compatibility with LemonIDE, Eclipse based IDE, an easy debugging and remote control for the target agent system has been implemented. Also, MMU (Memory Management Unit) is supported, enabling developers to explore and compile Linux Open Sources on Eddy without constraints.
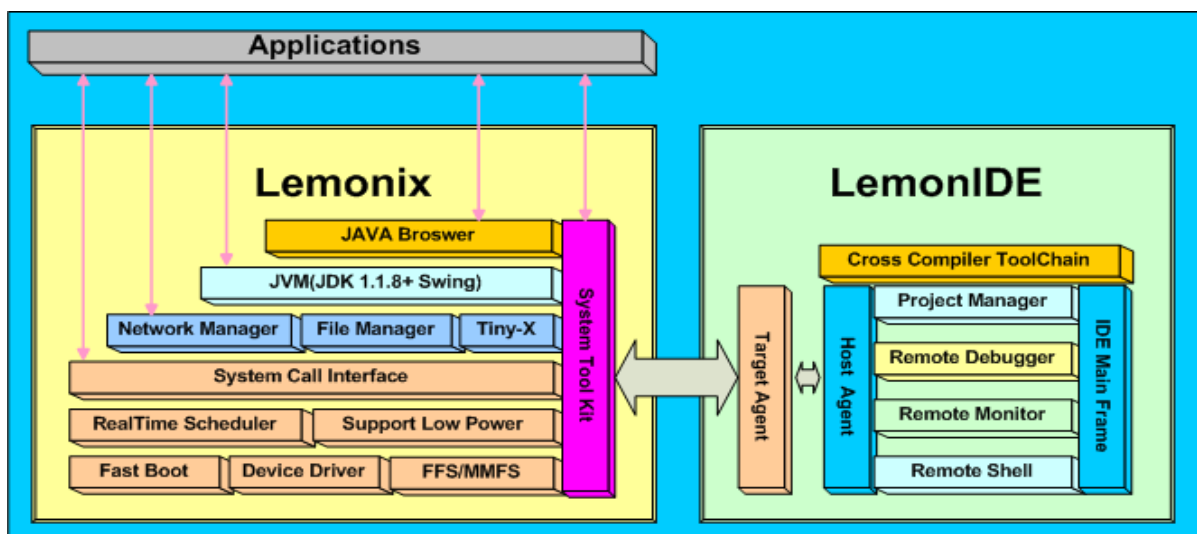
	SystemBase Lemonix	Digi Embedded Linux 4	Lantronix Evolution OS	MOXA
Kernel Base	Linux 2.6	Linux 2.6	Evolution	Linux 2.6
Real-Time	Yes	No	Yes	No
OS Type	Linux	Linux	-	uClinux

Real-Time OS Support Comparison

Preemptive Kernel Support

Lemonix's distinctive lock mechanism provides preemptive kernel with improved task structure.

Real Time Support

Under 37us of Response Latency Rate is guaranteed by applying Lock Break Methods in kernel's long spinlock regions enabling task's preemption.

	Lemonix	Montavista Linux	General Linux
Maximum Latency	36.83	42.95	7,021.25
Minimum Latency	5.58	6.52	2.81
Average Latency	7.16	7.86	29.89

Kernel's Response Latency Rate (usec)
* Sourced from ETRI (Electronics & Telecommunication Research Institute) and Montavista

Eclipse based IDE Support

LemonIDE, a GUI IDE built on Eclipse platform with remote debugging & monitoring features, is available for an easier & faster implementation of the target system.

|	SystemBase LemonIDE	Digi ESP	Lantronix	MOXA
Windows Compatibility	2008. 03	Yes	Yes	No
Linux Compatibility	Yes	Yes	Yes	No
Tech Service	Included in Dev Kit Fee No running Royalty	Charged	Charged Compiler sold separately.	Charged

IDE Support Comparison

POSIX Compatibility

Compatible with standard Linux Kernel. C/C++ codes programmed on standard Linux can be reused with Lemonix.

COM Port Redirector

COM Port Redirector is an automatic serial /LAN conversion driver program. COM Port Redirector enables a user to use Eddy's serial port that is connected through network as if they were COM ports in the user's PC. All previous serial communication programs can be used without any modification, like a socket conversion program.

COM Port Redirector displays a very high performance and expansion compared to other conversion software.
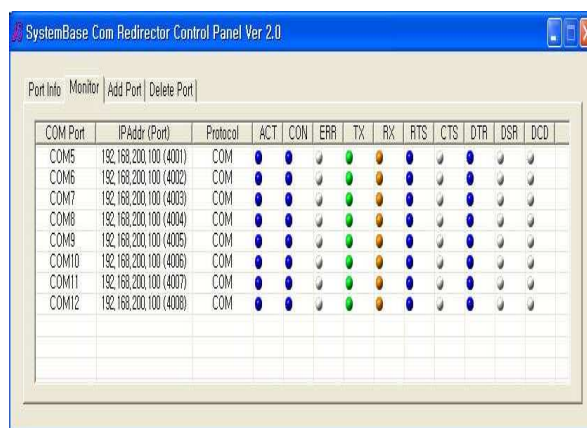
	SystemBase COM Port Redirector	Digi	Lantronix Secure COM Port Redirector	MOXA
Support	Yes	No	Yes	No
Max Ports	256	-	256	-
Cost	Free		$127 (4 users)	-

COM Port Redirector Support Comparison

PortView™

PortView is a real-time communication status-monitoring program for SystemBase serial to Ethernet embedded modules which runs on Windows environment. Communication status and all input/output data through each serial port can be monitored from the remote site for multiple numbers of serial to Ethernet embedded module s using PortView.

Malfunctioned device can be remotely diagnosed and cured. Serial data can also be saved to a file, for debugging purposes.
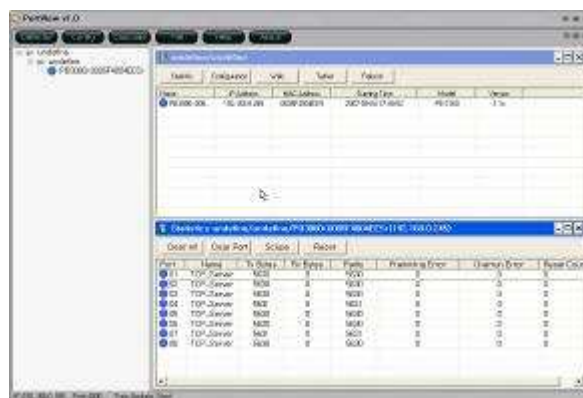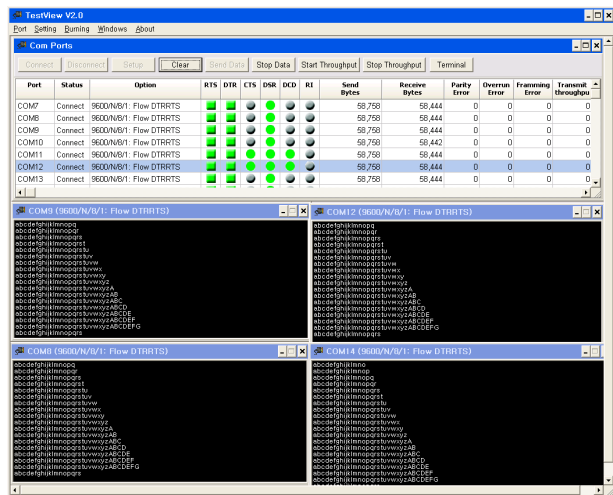
	SystemBase PortView	Digi	Lantronix	MOXA Network Enabler Admin
Support	Yes	No	No	Yes
Features	NMS, N/W configuration Port status monitoring, Scope, Traffic counter	-	-	NMS, N/W configuration Port status monitoring, Scope, Traffic counter
Cost	Free		-	Free

Communication/Port Status Monitoring Program Support Comparison

TestView™

TestView is a Windows based test program that SystemBase uses to test and evaluate communication performance and stability of SystemBase's Serial Multiports, Device servers and Embedded Modules.

Burning tests can be applied to device's serial ports and device's socket ports in TCP/UDP server & client mode. Objective evaluation data can be drawn to gauge devices stability.


	SystemBase TestView	Digi	Lantronix	MOXA
Support	Yes	No	No	No
Features	Serial, UDP, TCP Communication Test, Throughput Test, Aging Test	-	-	-
Cost	Free	-	-	-

Performance Evaluation Program Support Comparison

Eddy DK: the Development Kit

Eddy Development Kit helps developers test their own applications and evaluate Eddy modules easily. Evaluation board itself is a guideline for integrated hardware design with Eddy module mounted. With LED displays on Power, Ready, communication interface, GPIO, and serial line status, engineers can easily recognize the operation status of the module. LemonIDE, SDK, API, sample codes, documentation, and tools are included to accelerate integration and customization process.
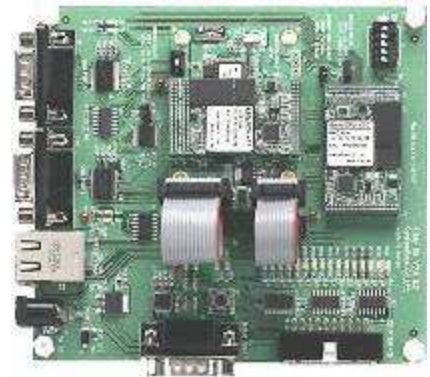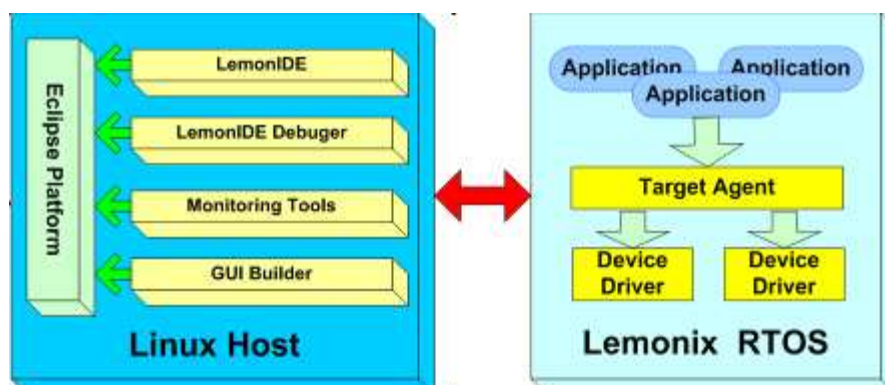
LemonIDE™

LemonIDE is an integrated development environment (IDE) for Eddy modules. Built on open source Eclipse framework, LemonIDE provides an easy & effective GUI (Graphical User Interface) for application and firmware developments that runs on SystemBase's embedded real time Linux, Lemonix.

LemonIDE encompasses GNU C/C++ Compiler, Source Code Editor and Debugger delivering a one-stop development environmnet to embedded developers relieving inconveniences of preexisting TUI(Text User Interface). Commands for compiler and debugger no longer needed to be memorized and punched in as LemonIDE's common GUI provides conveniences of simple mouse click execution. LemonIDE is also equipped with remote development & engineering capabilites, which provides a convenient distance-free development enviromnemt to Eddy developers

Make File Auto Creation, Auto Source Code Completion, Remote Debugging, Plug-in Support and Target System Monitoring features of LemonIDE allows developers to concentrate solely on their programs radically enhancing embedded software productivity. Project creation → Source code edit & build → Remote debugging → Remote monitoring can be all carried out within LemonIDE. LemonIDE is a part of Eddy Development Kit and is not sold separately.

IDE Feature Comparison

Provider	SystemBase	Digi	Lantronix	MOXA
IDE	LemonIDE	ESP	Evolution-OS-SDK	None
Basic Framework	Eclipse	Eclipse	Command line	Command line
Project Management	O	O	—	X
Compiler	GNU C/C++	GNU C/C++	—	uClibc
Makefile Auto Creation	O	O	X	X
Syntax Highlighting	O	O	X	X
Code Auto Completion	O	O	X	X
Source Browsing	O	O	X	X
Remote Control	O	X	X	X
Remote Build	X	X	X	X
App Auto Execution	O	O	X	X
Debugger	Gdb	gdb	—	X
Multi-Thread Debugging	O	O	—	X
Multi-core Debugging	X	X	X	X
JTAG Device Support	X	X	X	X
Remote Debugging	O	O	—	X
Target System Monitoring	O	O	—	X
Unit Performance Test	X	O	—	X
Tool Chain	O	O	O	O
Kernel customize	X	X	O	X
File System customize	X	X	—	X
Remote Shell, Telnet	O	O	—	X
plug-in support	O	O	—	X
Host OS	Linux Windows	Window Linux	Linux	Linux
Target OS	Lemonix	NET+OS	Evolution OS	ucLinux
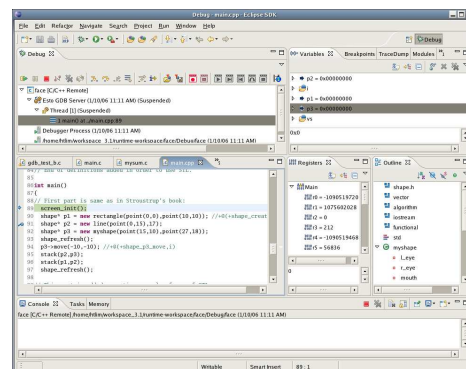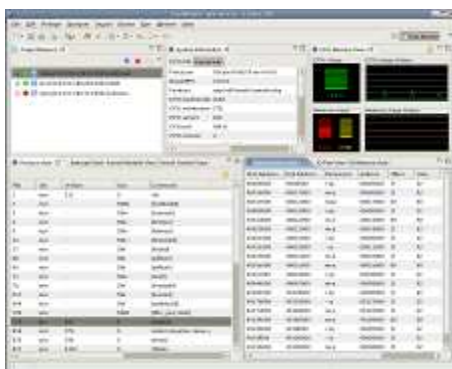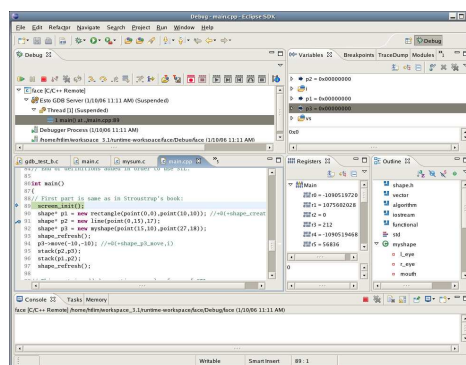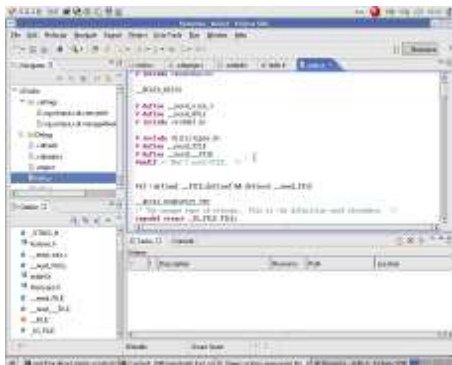
Applications

Factory / Industrial Automation

PLC, Robot arms, Human-Machine Interface, Warehouse rails
Medical instruments, Inspection equipment controllers
Alarming units

Home Appliances / Electronic Devices

Power controller, Gaming machines
Scales, Gas detection units, Water & pollution metering devices
Data collection and distribution units

Financial / Building Automation

Card readers, Barcode scanners, KIOSKs, Point-Of-Sale related devices
Serial printers, Cash registers, Credit card authorization terminals
Biometric detection units, Security devices

OEM Embedded Module Distributors

OEM embedded module with distributor's own case & brand
Ready-to-go device or customized application / setup mode can be inserted
Customized Web interface supported