Serial to Ethernet

Serial communications (RS232/422/485) have traditionally been used in industrial automation to connect various instruments such as sensors, data loggers to standalone monitoring stations like computers. The limitations of serial communications, such as distance, accessibility, the amount of data transferred at any one time and speed has led to a demand for a more flexible means of communicating.

Although slow to catch up with IT infrastructure in commercial environments, Ethernet is increasingly regarded as the defacto standard of communications in industrial markets. However, the sheer volume of serial based products already in existence and the low cost and ease of integration of these 'legacy' protocols means that serial communication is alive and well in many areas of industry.

Due to the minimal processing power required, the ruggedness and reliability of connectors, even relatively new products such as GPS receivers continue to adopt RS232 and RS485.

RS485 has been the physical layer protocol for industrial networks since Modbus was launched by Modicon in the 1970's. Other PLC manufacturers followed suit and used protocols such as Profibus DP and Interbus. The more modern PLC systems are Ethernet based, to allow individual 'islands of automation' to share data captured throughout the plant and the company, 'top floor to shop floor' and in some cases, even the world.

To enable legacy serial based hardware to take advantage of Ethernet, Serial to Ethernet device servers were born.

Advantages of Serial to Ethernet

Cost:

(a) The life time of expensive serial based equipment can be extended

(b) It will allow low cost remote maintenance, reducing system downtime and labour cost.

Data Access:

Control and management intelligence, enables more efficient business decisions.

Security:

Delivers the security features Ethernet affords into previously vulnerable systems.

Device Servers

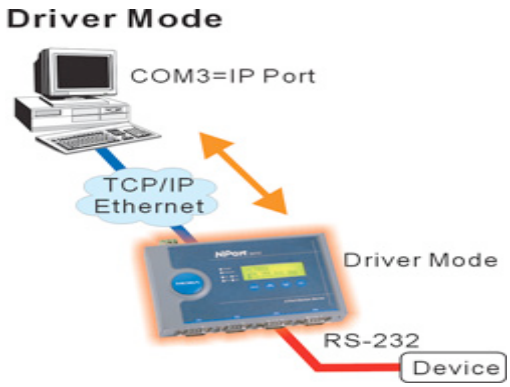
A device server is an instrument that provides access to the system console of another device via a networking technology. A Serial to Ethernet device server is intelligent, with a processor, memory, operating system and a TCP/IP stack built in. It also comes equipped with the required hardware interface such as RS232, RS422 and RS485. This type of device server can transfer and even process data between the serial and Ethernet interfaces to carry out pre-defined tasks.

Operation Modes

There are various ways in which a Serial to Ethernet device server can be used, dependent on the need of the application. For example, some may require that the serial device initiates transmission, with the host (PC) applications waiting for incoming data. For others it could be visa versa. The operating modes supported by the serial device server are divided into 2 classes: Socket and RealCOM.

1. Driver Mode or RealCOM mode(Virtual com)

By supplying software drivers that work with the most popular operating systems, the device server establishes a transparent connection between the host and device by mapping the IP address and port number to a local COM port on the host computer or server.



Benefit:

Enables the upgrade of applications to Ethernet without modifying the source code.

2. Socket Mode – TCP Server, TCP Client and UDP

(a) TCP Server

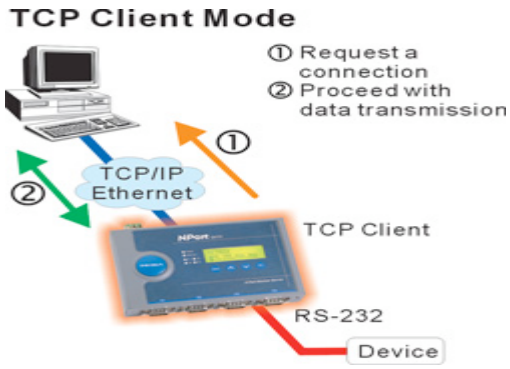
When the device server is set as TCP Server mode, it acts like a server. It waits for the host to contact it. Once the host makes contact, it can send and receive data to and from the serial device. This mode also allows multiple hosts to communicate with the same serial device, at the same time or not as the case may be. It also allows more than one host to share the device server

Benefit:

Enables hosts without operating systems such as PLC's to take advantage of Serial to Ethernet technology. It also allows distributed polling and control across more than one host.

(b) TCP Client

When the device server is set for TCP Client mode, it acts as a client. It actively contacts the host or multiple hosts. Once contacted, the host can send and receive data to and from the serial device.



Benefit:

It is independent of operating systems and enables event handling over TCP/IP, even over simultaneous connections.

(c) UDP Mode

UDP is faster and more efficient than TCP. It enables unicast, multicast or broadcast data from the serial device to one or more hosts. In addition, the serial device can also receive data from one or more hosts, ideal for variable message sign applications for example.

Benefit:

It is completely independent of an operating system and allows multicasting or broadcasting of data.

Advances in Serial to Ethernet Technology

1. Secure data transfer: More traditional Serial to Ethernet device servers operated without data encryption, leaving data vulnerable. Secure Socket Layer (SSL) is now used to provide secure end to end data transfer.
2. Port Buffering: This enables the device server to act as a serial port buffer if the network connection is lost. Buffer sizes can be increased by using SD Cards in some instances.
3. Power over Ethernet (PoE): Device servers are now available with support for PoE (802.3af). This reduces cabling and facilitates ease of installation, saving time and money.
4. Redundant Ring Operation: Ring redundancy has become common practice in industrial networks, increasing the availability of serial based devices. It also saves cost in not having to employ an additional Ethernet switch.
5. Any Baud Rate: Serial to Ethernet device servers now supports any data rate up to 1Mbp, which is useful for specialist devices.
6. Integration of digital and analogue signals to the Ethernet network to assist Supervisory Control and Data Acquisition (SCADA). Distributed I/O traditionally using RS485 can now be connected to a Serial to Ethernet device server. These I/O Modules can use Simple Network Management Protocol (SNMP) traps, allowing information about the status of digital or analogue devices to be easily integrated into existing SNMP deployments (company infrastructure for example).
7. Using the Cellular Network: GPRS, 3G and HSPA are protocols based on IP. The use of software drivers, together with cellular routers with serial connectivity suddenly enables virtual COM ports over the cellular network. Mobile applications such as in vehicles and transport, variable message sign and digital signage are a few examples

Applications

1. Campus attendance and entrance control – Card readers, RFID with serial connectivity.
2. Remote environmental condition monitoring – For example monitoring efficiency of gears in wind turbines and prompting service before ant faults occur.
3. Remote management of rack servers.
4. Power distribution management – Monitoring and control of power distribution grids, by interfacing remote terminal units (RTU's) to a central monitoring system.
5. Variable message signs – Typical example is traffic management, deployed by using cellular routers.

Conclusion

Serial to Ethernet is the natural next step, allowing simple, cost effective systems integration into existing infrastructure. By centralising monitoring of these systems, it enables business decisions to be made more efficiently and ultimately reducing complexity and cost.