Sena Technologies White Paper:

Serial to Ethernet Latency Time Test of Serial Device Servers/Terminal Servers

October 21, 2005

Overview

Sena Technologies is a provider of device networking solutions that connect almost any electronic device and equipment to the Internet or Ethernet network using open standard protocols. Sena Technologies offers highly scalable and affordable end-to-end products that provide out-of-box installation functionality to meet industry needs, under a constantly evolving networking environment. In the world of "networked" devices, it is important to understand the basic concepts of the "connection". This paper will discuss the basics of latency and the impact it may have on your network with our Devices.

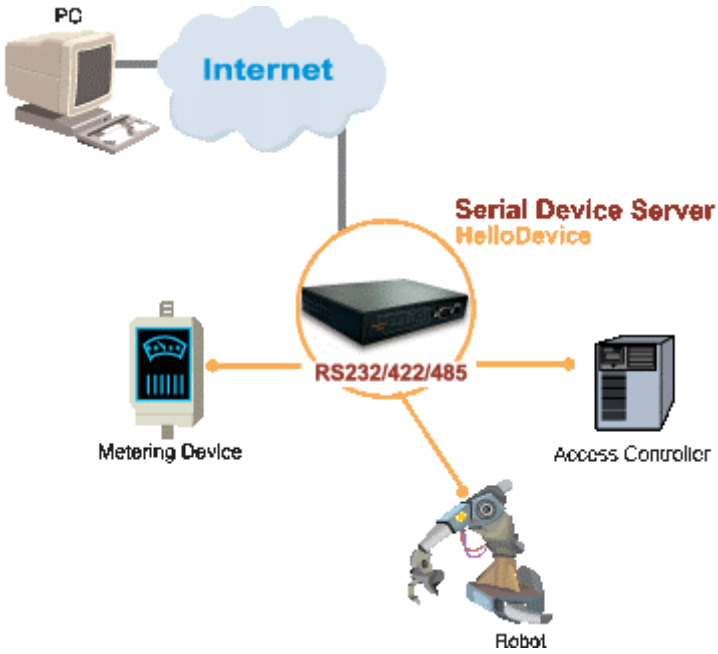

Figure 1: Serial Device Server Application

What is Latency?

In general, latency can be described as an expression of how much time it takes for a packet of data to get from one designated point to another. Some may also view latency as a measurement of how much time it takes to send a packet that is returned to the sender or what we call "round-trip time".

In theory latency assumption data should be transmitted instantly between one point and another, with no delay. Unfortunately, in the real world, contributors to network latency include:

- **Propagation:** The time it takes for a packet to travel between one place and another.

- **Transmission:** The medium itself introduces some delay. Depending on the medium quality, this may create a delay factor.
- **Routers and Other Network delays:** Each gateway may take time to examine and determine where to send the packets. Other network delays may include network congestion at local switches, network bandwidth limitations, or the number of hops in a network required to cross a network. For Example: The more stop over flights a person makes in a airplane trip from point A to B will increase the time it takes for that person to reach their destination.
- **Message Size:** Depending on the application, the message size can influence the speed at which the message will be sent. For Example: The heavier the box the longer it will take for a person to move the box from one room to another.
- **Network Application:** Applications can be a source of network delay. Network applications include, various operating systems and the actual host application (server configuration, telnet, internet explorer, etc) used in network communication.

Sena Technologies Products and Latency

As it was stated earlier, Sena Technologies is committed to providing highly scalable and cost effective network solutions to the ever changing network and communication environment. We here at Sena Technologies views latency as the time it takes to send one character from a host application to the device server and back again to the host application, or “round trip time” (Due to the variance in different operating system architecture latency measurement times may vary). Testing for latency times were done in-house by Sena USA with the full line of Sena products. Figure 2 shows how Sena carried out its testing methodology.

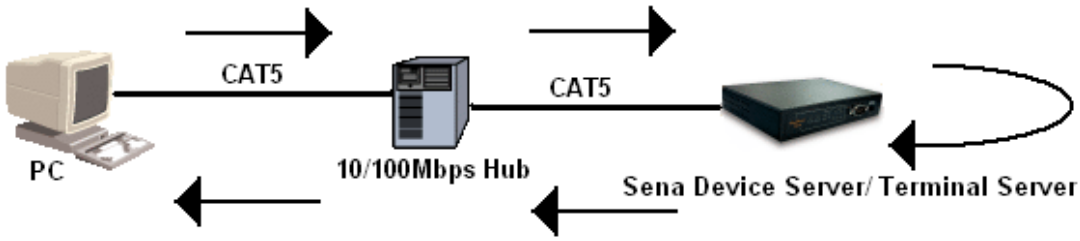

Figure 2: Test System Configuration

The benchmark test (written in Visual C) sends a packet, consisting of one byte of data, over an isolated Ethernet network, to a remote serial device server or terminal server where the data is echoed back to the host PC. A loop-back plug that connects the RS-232 Tx data pin to the Rx data pin was used to echo back the data sent by the host pc. Latency time was measured by the time it takes for the one byte of data to be sent by the Host PC to the Device Server or Terminal Server and back again to the Host PC. Figure 3 displays the parameters that were set to each of the serial ports before testing.

From here two types of tests were then conducted, single-port latency tests and full-load latency tests.

Latency Benchmark Parameters
Serial Port Settings: 9600bps, 8bit, None, 1, No Flow Control
Inter-character timeout: 2ms (except for SS100 which is only capable 100ms or more)
Number of Iterations: 10,000 iterations
Data size: 1 byte
Communication Protocol: TCP

Figure 3: Serial Device Server/Terminal Server Configuration Parameters

Single port tests were conducted by sending one byte data to a single serial port. Full port tests were conducted by sending one byte data to each and every available serial port at the same time. A special test was added for the STS1600 where an 8-port load was placed on the system, to test the performance of the device at half the load. All latency times are taken as an average of the number of iterations made on each port. Figure 4 shows a list of the hardware used in benchmarking our devices:

PC SPECIFICATIONS			
Test PC	**Processor**	**RAM**	**Operating System**
Sony VAIO F-190	Pentium II 366Mhz	192 MB	Windows 2000 Professional (Service Pack 4)

Network Nodes		
Network Node	**Vendor**	**Connection**
D-Link DSH-8 8-port 10/100Mbps Hub	D-Link	10/100Mbps
Linksys PCMCIA PCMPC100 (V3) Network Card	Linksys	10/100Mbps

Figure 4: Hardware Used in the Test

Test Result

Final test results are shown in Figure 5, and 6. Figure 5 displays the latency time of a native RS232 serial port. The IALink100 shows the smallest latency time.

Product Name	Firmware Version	Specifications:	Single Port Latency(ms)	Full Port Latency(ms)	8-port Load (ms)
COM1	n/a	RS232 Serial Port	5.28ms	5.28ms	n/a

Figure 5: Native Serial Port Latency Time Result

Product Name	Firmware Version	Specifications:	Single Port Latency(ms)	Full Port Latency(ms)	8-port Load (ms)
LS100	1.1.4	Ethernet: 10Mbps	29.93ms	29.93ms	n/a
PS100	1.2.21	Ethernet: 10Mbps	10.31ms	10.31ms	n/a
PS200	1.2.21	Ethernet: 10Mbps	10.02ms	13.13ms	n/a
PS400	1.2.21	Ethernet: 10Mbps	16.45ms	26.98ms	n/a
SS100	1.1.2	Ethernet: 10/100Mbps	10.00ms	10.00ms	n/a
SS110	1.1.0	Ethernet: 10/100Mbps	10.06ms	10.06ms	n/a
SS800	1.1.0	Ethernet: 10/100Mbps	10.05ms	28.74ms	28.74ms
STS800	1.1.0	Ethernet: 10/100Mbps	10.05ms	28.12ms	28.12ms
STS1600	1.1.0	Ethernet: 10/100Mbps	10.06ms	60.20ms	28.35ms
IALINK100	1.2.21	Ethernet: 10Mbps	8.62ms	8.62ms	n/a
PS110	1.1.0	Ethernet: 10/100Mbps	10.02 ms	10.02 ms	n/a
PS410	1.1.0	Ethernet: 10/100Mbps	10.04 ms	15.46 ms	n/a
PS810	1.1.0	Ethernet: 10/100Mbps	10.03 ms	26.03 ms	26.03 ms
Moxa : Nport DE 311		Ethernet: 10/100Mbps	15.01 ms	15.01 ms	n/a

Figure 6: Latency Time Test Result

Final Thoughts

The benchmark test and test setup, we feel creates a realistic view of performance under both real-world configurations under a controlled environment, which give users and integrators with strict timing designs a good measure of how a Sena device will react within their network. Although, one must remember that all the latency times reported are an average taken over a number of iterations, real-world results may vary depending on the complexity of various network configurations out in today's technologically advanced society.