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Digi International: Digi One IA RealPort Latency Performance Testing

Test report prepared under contract from Digi International

Executive summary

Digi International commissioned eTesting Labs, a division of Veritest, to compare the latency performance of the following device servers:

- Digi One IA RealPort
- Comtrol DeviceMaster DMSH-1
- Comtrol RocketPort Serial Hub ia
- Moxa NPort Express DE-311
- Lantronix UDS100
- Lantronix UDS-10
- Lantronix CoBox-DR1
- Lantronix MSS-VIA

Key findings

- Our testing showed that the Digi One IA Real Port device server generated significantly lower overall average latency compared to the other device servers we tested.

The device servers listed above allow serial devices to connect to and move data to and from a device on an Ethernet network configured with vendor specific COM port redirection software and drivers. The COM port redirection software associates an IP address with a COM port identifier. It is the function of the device server and related software and drivers to convert data from a serial based system into data that can be delivered to an Ethernet based client system.

The goal of the testing was to measure the average round trip latency required to send a stream of single 8-bit characters from the serial port of a “master” system through the device server under test to an Ethernet based “slave” system and then back to the master system. The lower the latency for this round trip, the faster the device server and associated COM port redirection software processed and moved the data.

Digi International provided eTesting Labs with software to measure this latency for each of the devices tested. The software consisted of two separate applications that operated in a master/slave relationship to each other. We installed the master application on the serial based master system described above. The master application generated the load for the testing, controlled the execution of the test and measured the latency during the testing. We installed the slave application on the Ethernet based slave system connected through an Ethernet connection the network port of each device server under test. The slave application was responsible for reading the character data sent from the master application and echoing that data back to the master application as fast as possible.

Please refer to the Test Methodology section for complete details on how the tests were conducted and our review of the tools used for these tests.

A single iteration of the test using the latency tools described above consists of the Master application sending a single 8-bit character to the device server under test and then waiting for the character to be received by the Slave application and echoed back to the master application. Once the master application receives the character back from the Slave application, it records the time that elapsed between when it initially sent the character and when it received the character back from the Slave application. This elapsed time is the latency required to send a single character through each device server and get a response back.

For each device server tested, we configured the master application to complete 10,000 iterations of the test described above. For all devices servers tested, we configured the master and Slave applications to function at 9600 baud with 8 data bits, 1 stop bit and no parity. We conducted two tests using 10,000 iterations for each device server tested to ensure the repeatability and accuracy of the test results. We then computed an average based on the two sets of latency results for inclusion in this report. Please refer to the Test Methodology section for complete details and configuration information.

Figure 1 shows the results of the device server testing. In our tests, the Digi One IA RealPort device server required, on average, 5.81 milliseconds to complete each of the 10,000 iterations included in each test. This is significantly better than the 10.49 milliseconds required, on average, to complete an iteration using the second best finisher, namely the Moxa Nport Express DE-311. The Lantronix UDS-10 device server generated the highest average latency for a single test iteration of any device server we tested at 860.80 milliseconds. In general, our testing showed that all the Lantronix devices required significantly more time, on average, to complete a single iteration of the test. For these tests, lower results are better.

Device Server	Average Latency(ms)
Digi One IA RealPort	5.81
Moxa NPort Express DE-311	10.49
Comtrol DeviceMaster DMSH-1	12.18
Comtrol RocketPort Serial Hub ia	29.31
Lantronix UDS100	586.29
Lantronix CoBox-DR1	707.35
Lantronix MSS-VIA	762.73
Lantronix UDS-10	860.80

Figure 1. Device Server Average Latencies

In our testing, we found that the Digi One IA RealPort device server exhibited significantly lower round-trip latencies compared to all other device servers we tested.

Testing methodology

Digi International commissioned eTesting Labs, a division of Veritest, to compare the performance of the following device servers moving a stream of single 8-bit character data:

- Digi One IA RealPort
- Comtrol DeviceMaster DMSH-1
- Comtrol RocketPort Serial Hub ia
- Moxa NPort Express DE-311
- Lantronix UDS100
- Lantronix UDS-10
- Lantronix CoBox-DR1
- Lantronix MSS-VIA

The device servers listed above allow serial devices to connect to and move data to and from a device on an Ethernet network configured with vendor specific COM Port redirection software and drivers. The COM Port redirection software associates an IP address with a COM port identifier. It is the function of the device server and related software and drivers to convert data from a serial based system into data that can be delivered to an Ethernet based client system.

The goal of the testing was to measure the round trip latency required to send a stream of single 8-bit characters from the serial port of the master system through the device server under test to the Ethernet based slave system and then back to the master system. The lower the latency for this round trip, the faster the device server was able to move the data.

Figure 2 below shows the typical setup for the device servers used in these tests. Each of the device servers under test was outfitted with one or more serial ports and one or more 100 Mbps Ethernet ports. We connected a "master" system to the serial port on each device server under test using a standard serial cable. For the master system we used a Gateway Performance 1700 configured with a 1.7GHz Pentium 4 processor, 256MB of RAM and running Windows 2000 Professional/SP2. We then connected the Ethernet port on the device server into a 100 Mbps NetGear FS108 Ethernet hub using standard Category 5 cable. Finally, we configured a second "slave" system. For the slave system, we used a Gateway G6-450 configured with a 450MHz Pentium III processor, 128MB of RAM and running Windows 2000 Professional/SP2. We then connected the slave system into to the 100 Mbps Ethernet hub using standard Category 5 cable.

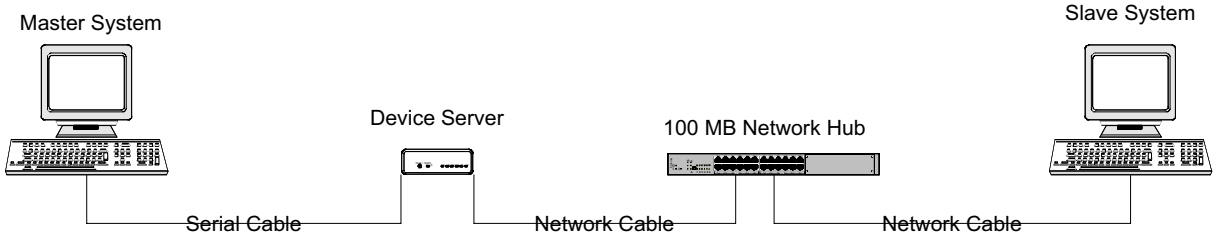

Figure 2. Device Server Interconnect Diagram

Digi International provided eTesting Labs with software to measure this latency for each of the devices tested. The software consisted of two separate applications that operated in a master/slave relationship to each other. We installed the master application on the serial based master system shown in figure 2 above. The master application generated the load for the testing, controlled the execution of the test and measured the latency during the testing. We installed the slave application on the slave system shown in figure 2 above. The slave application was responsible for reading the character data sent from the master application and echoing that data back to the master application as fast as possible.

Digi provided the device servers listed above for testing. For all devices tested, we utilized the following driver versions to configure the vendor specific COM port redirection software. For all the Lantronix device servers tested, we downloaded the latest software and drivers from the Lantronix Web site. Digi provided the software and drivers for all other products tested.

Device	Driver Version	Date
Digi One IA RealPort	2.5.64.0	7/23/2002
Comtrol DeviceMaster DMSH-1	1.0.2.0	8/21/2000
Comtrol RocketPort Serial Hub ia	N/A	3/1/2001
Moxa NPort Express DE-311	1.0.3	11/16/2001
Lantronix UDS100	1.0.00 Build 107	N/A
Lantronix UDS-10	1.0.00 Build 107	N/A
Lantronix CoBox-DR1	1.0.00 Build 107	N/A
Lantronix MSS-VIA	1.0.00 Build 107	N/A

Figure 3. Device Server Driver Information

Before conducting these tests, we spent considerable time reviewing these latency measurement tools to ensure they were operating as expected. Before testing any of the device servers, an eTesting Labs analyst reviewed and evaluated the 'C' language source code used to create the master and Slave applications to ensure that the application code matched the observed operation of the applications during testing.

In addition to reviewing the application source code, we installed EtherPeek network monitoring software on a separate system and connected it to the NetGear Ethernet hub to record and evaluate the network traffic between the device servers under test and the Client system running the Slave application. Because the device servers under test and the slave system communicate using the TCP/IP protocol, we evaluated the network traffic to ensure that there was indeed only a single character being sent from the master application to the Slave application and that the same character was indeed being sent back from the Slave application through the device server to the master application.

Finally, we measured the time difference between the time stamps recorded on the Ethernet frames captured by EtherPeek during a test to verify that the latency results recorded by the Digi applications closely matched the actual elapsed time required to move the data. As a result of our reviews, we believe the Digi applications used to conduct these tests performed as expected and generated realistic test results.

A single iteration of the test using the latency tools described above consists of the master application sending a single 8-bit character to the device server under test and then waiting for the character to be received by the Slave application and echoed back to the master application. Once the master application receives the character back from the Slave application, it records the time that elapsed between when it initially sent the character and when it received the character back from the Slave application. This elapsed time is the latency required to send a single character through each device server and get a response back.

For each device server tested, we configured the master application to complete 10,000 iterations of the test described above. This ensured there were enough data points to generate valid results. We ran each test twice for all devices tested to ensure the repeatability and accuracy of the test results. We then computed the average round trip latency for each device server based on the two sets of latency results for inclusion in this report. For all devices tested, we configured the master and Slave applications to function at 9600 baud with 8 data bits, 1 stop bit and no parity.

For testing each device server, we used the following procedures:

- Power up the Device Sever under test and the NetGear FS108 Ethernet hub.
- Reboot the Slave system and install the vendor specific COM port redirection software and drivers specifying the IP address of the Ethernet interface of the device server under test and COM3 as the interface through which the device server and the Digi slave application will communicate.
- Start the Digi slave application specifying COM3 as the port through which the software should communicate with the device server under test.
- Reboot the master system using a Digi supplied boot diskette that loaded a minimal Linux kernel and completed the task of setting up to run the Digi master application to conduct the testing. Before testing any device server, we cleared out any previous test results and configured the master application to perform the test at 9600 baud, 8 data bits, 1 stop bit and no parity.
- Started the first 10,000-iteration test on the master system and monitored the test until complete. We then saved the test results.
- Cleared the previous results and performed the second 10,000 iteration test.

Test results

Digi International commissioned eTesting Labs, a division of Veritest, to compare the latency performance of the following device servers moving a stream of single 8-bit character data:

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Figure 3~~1~~ shows the results of the device server testing. In our tests, the Digi One IA RealPort device server showed the lowest round trip latency of all the devices we tested. It required, on average, 5.81 milliseconds to complete a single iteration of the test. This is significantly better than the 10.49 milliseconds required, on average, to complete an iteration using the second best finisher, namely the Moxa Nport Express DE-311. The Lantronix UDS-10 device server generated the highest average latency for a single test iteration of any device server we tested at 860.80milliseconds.

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Lantronix UDS-10	860.80

Figure 3. Device Server Average Latencies

Appendix

A. System disclosures

Gateway Performance 1700(Master System)	
Processor/Speed/Number Of	Intel P4 1.7 GHz / 1
System RAM/Type/Slots	256 MB / Rambus / 2
Motherboard Manufacturer	Gateway
Motherboard Chipset/Model	Intel 850 PCI
Main Bus Type	PCI
L2 Cache	512KB Unified
BIOS	AMI 586-HiFlex-BIOS v23.00
HD Model # / Size	Quantum FireballP AS60.0 / 55.9 GB
HD Controller	Intel 82801BA Ultra ATA Storage Controller
Graphics Adapter	Nvidia Geforce2 Ultra (Gateway)
Graphics Driver & Version	Nv4_mini.sys v5.12.01.0632
Graphics Memory (MB type)	64 MB
Graphics Chip Type	Geforce2 Ultra
Video Resolution Assigned	1024 x 768
Color Depth Assigned	16 bpp
Refresh Rate	75 Hz
Sound Board	Sound Blaster Live! Value
NIC (Driver)	Linksys LNE100TX Fast Ethernet Adapter (LNE100TX v4)
CD-ROM Type & Speed	N/A
DVD Type & Speed	Matsushita DVD-ROM SR-8586
Operating System	Windows 2000 Professional with Service Pack 2
USB Chipset	Intel 82801 BA/BAM USB Universal Host Controller
# PCI Slots	5

Figure 4. Master System Configuration Information

Gateway G6-450 (Slave System)	
Processor/Speed/Number Of	Pentium II 450MHz/1
System RAM/Type/Slots	128 MB / PC100 / 3
Motherboard Manufacturer	Intel
Motherboard Chipset	Intel FW82443BX
Chipset Model	443BX
Main Bus Type	PCI
L2 Cache	512 KB
BIOS	4W4SB0X0.15A.0006.P04
HD Model # / Size	IBM-DTTA 351680 13.5GB
HD Controller	Intel 82371AB/EB PCI Bus Master IDE
Graphics Adapter	3dfx Voodoo Banshee Reference Board
Graphics Driver & Version	Banshee.sys; banshee.dll; 4.00.1381.0226, 4.0.0
Graphics Memory (KB type)	16 MB
Graphics Chip Type	3dfx Voodoo Banshee
Video Resolution Assigned	1024 x 768
Color Depth Assigned	24-bit
Refresh Rate	100 Hz

Sound Board	Creative Sound Blaster Audio PCI 64D Legacy Device
NIC (Driver)	3Com Fast Etherlink XL NIC (3C905B-TX)
CD-ROM Type & Speed	N/A
DVD Type & Speed	Toshiba 2x
# PCI Slots	5
Extra Hardware (ie Zip drive)	Zip 100

Figure 5. Slave System Configuration Information

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