Introduction to NetStress

Welcome to Nuts About Nets' ***NetStress*** application. ***NetStress*** is a benchmarking tool used to measure network performance -- both wired and wireless. It is a simple tool that employs bulk data transfer using TCP. Network performance is reported in terms of throughput -- that is, bytes-per-second.

NetStress is distributed freely by Nuts About Nets LLC both as a convenience to network engineers, IT administrators, wireless technicians and WiFi users and, also, as a way of drawing attention to and generating interest in our other diagnostic products and RF analyzers. ***NetStress*** can be downloaded from www.NutsAboutNets.com and www.PerformanceWifi.net. You may also distribute ***NetStress*** as long as that is done without charge and you agree to the terms of the License Agreement.

In order to test and troubleshoot networks we need tools that allow us to generate network traffic and analyze the network's throughput performance. This is true for both wired and wireless networks, but we'll mostly focus on 802.11 (WiFi) networks because analysis tools are relatively scarce or, when available, tend to be rather expensive and overly complex to use. Also, because WiFi networks are sensitive to RF interference from other wireless devices, they are more difficult to troubleshoot and transient changes in the local environment may affect their performance. Tools that are typically used to troubleshoot wireless networks report signal strengths of RF interference or beacons from an access point in units of dBm or RSSI (relative signal strength indication). But what do these really mean? How do these translate in terms of the performance of your wireless network?

Our wireless network adapter may report the beacon strength of our access point to be -53 dBm or -65 dBm or -73 dBm or <fill-in some number>. Or, our RF spectrum analyzer displays a -74 dBm interference peak in the middle of channel 6. Or, we and our neighbor or the business next door have our access points configured to use channel 11? Is this good? Bad? Doesn't matter? Ultimately, the bottom line and what we care about most is ***throughput*** -- that is, how many bytes-per-sec can be transferred from one node on the network to another. The dBm and RSSI numbers don't mean much if we can't somehow relate them to a performance metric -- the most relevant being '***bytes / sec***'. The point is before we can really begin to troubleshoot a wireless network we need a way to benchmark its performance, so as modifications are made we can determine whether or not they really make a difference in the network's performance.

This is where ***NetStress*** fits in. It's a simple tool, originally created for our internal business use, which we later realized would also be of value to others. Here's the ideal scenario: You install a new wireless network and it works perfectly. Run ***NetStress*** and record the benchmark results for later reference. Sometime in the future when either you or others suspect performance has declined then run ***NetStress*** again and compare the latest results with those you gathered when the network was first installed and working "perfectly". The results of that comparison will indicate whether or not there really is a problem and dictate which steps to take next (if any). Regardless of your technical expertise or how expensive your diagnostic tools, if you are modifying a wireless network or making decisions to modify it and you are not testing throughput then you risk wasting time and resources going down the wrong path.

System Requirements

System Requirements:

- PC running 32-bit Windows 2000/XP/Vista
- Microsoft .NET Framework version 2.0 (or later)
- CD-ROM Drive (for installing software)
- a minimum of 300 MB available hard disk space

Suggested Hardware Requirements:

- CPU: Intel Pentium 4, 1.2 GHz or faster
- Memory: 512 MB
- Hard Drive: 1000 MB free space
- Video: 32 MB video RAM

Using Netstress

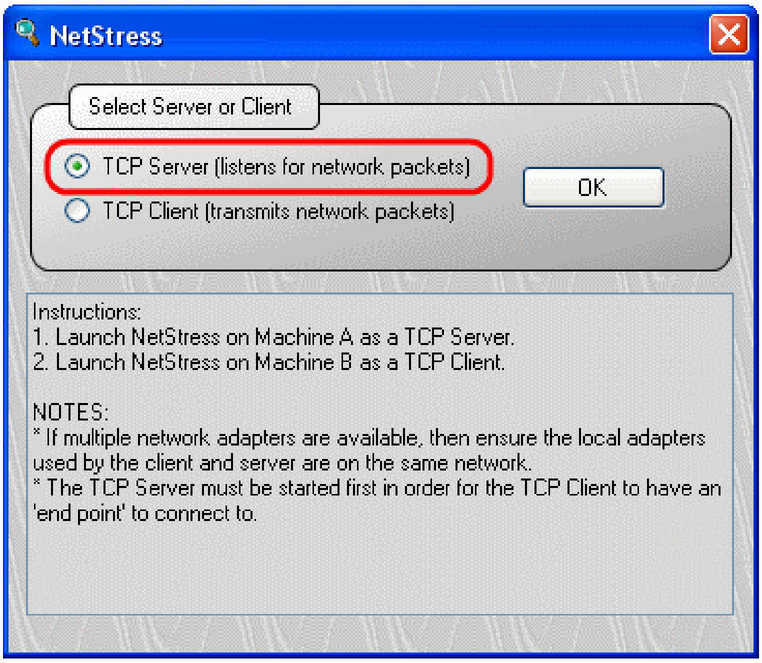
To use ***NetStress*** you launch the application on two different computers on the network -- one instance of the program runs in server/receiver mode and the other in client/transmitter mode. The results of the throughput benchmarking indicate the performance of the path between the client and server machines. By selecting the client and server machines at various points within the network you can analyze critical portions of the data path.

NetStress has an advantage over tools like FTP (File Transfer Protocol) -- which transfers data to and from disks. If you have a high performance network, then using FTP may be insufficient for real network testing -- since data transfer is occurring to/from disks. ***NetStress*** achieves high performance testing by filling buffers in memory with data, then repeatedly transmitting this data using the TCP protocol. Since everything is running from memory, then we have a traffic transmitter and receiver that can operate at true network speeds. In the case of wireless networks -- whose theoretical bandwidth is significantly less than wired networks -- this may not be an issue.

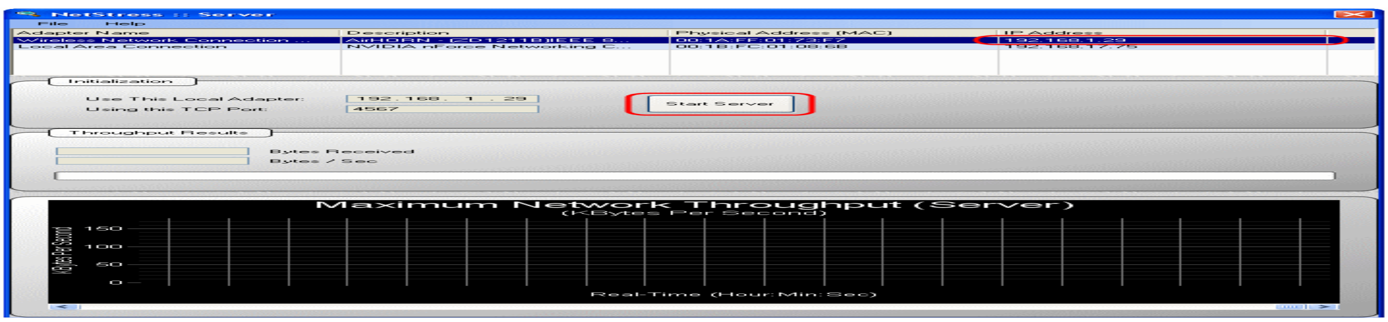
NetStress reports the amount of data transferred and the throughput benchmark in ***'bytes / sec'***. By comparing actual throughput with the theoretical bandwidth between the client and server or with a measurement taken at an earlier date, you can tell whether the network is operating as expected. Variations in throughput may indicate a significant amount of other traffic, overloaded network equipment, communication errors which cause packets to be lost or, in the case of wireless networks, interference from other wireless devices. By performing tests using different machines on the network then you begin to gain clues as to where the problem lies and which areas should be examined in greater detail.

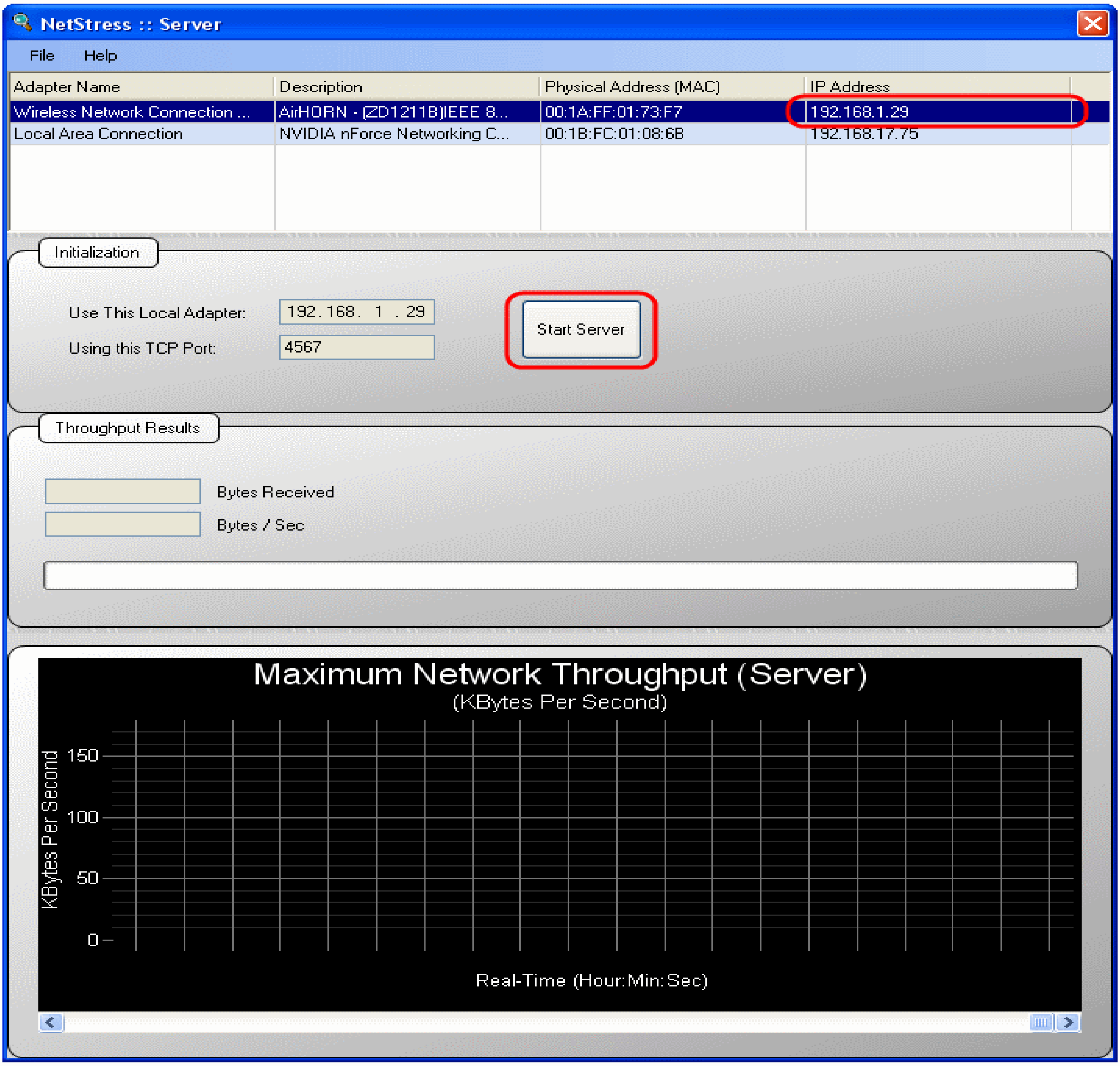
NetStress uses TCP (Transmission Control Protocol) to transfer data between two machines on a network. TCP is a connection-oriented protocol that requires a server/receiver that is "listening" before a client/transmitter can connect. So, to run ***NetStress***, you first launch the application on one machine in server mode and then launch the same application on a second machine in client mode. The only difference between the two modes (besides which transmits and which receives) is the client application needs to know the IP address of the server machine. ***NetStress*** uses the time and the amount of data transferred from the client to server to calculate the throughput benchmark in ***'bytes / sec'***.

To run a test first go to the "server" machine and launch ***NetStress*** in server mode.



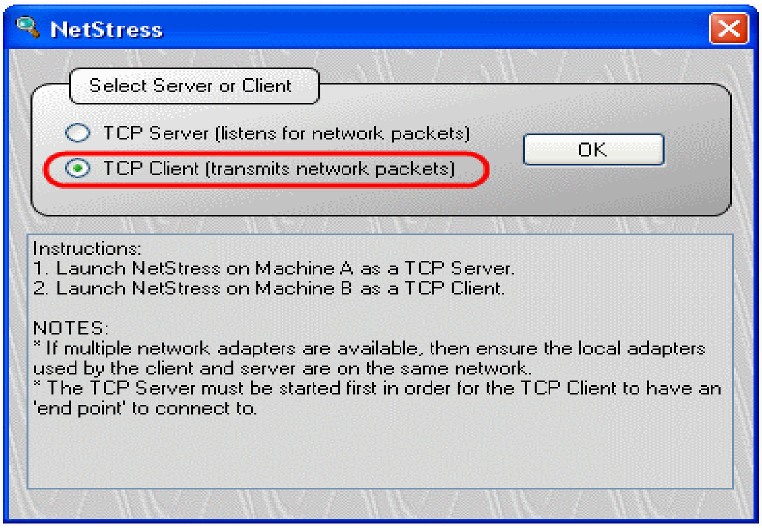
After pressing the 'OK' button then the server's application window appears:

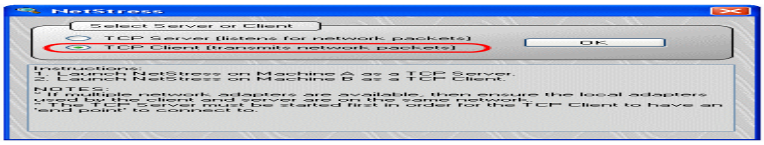




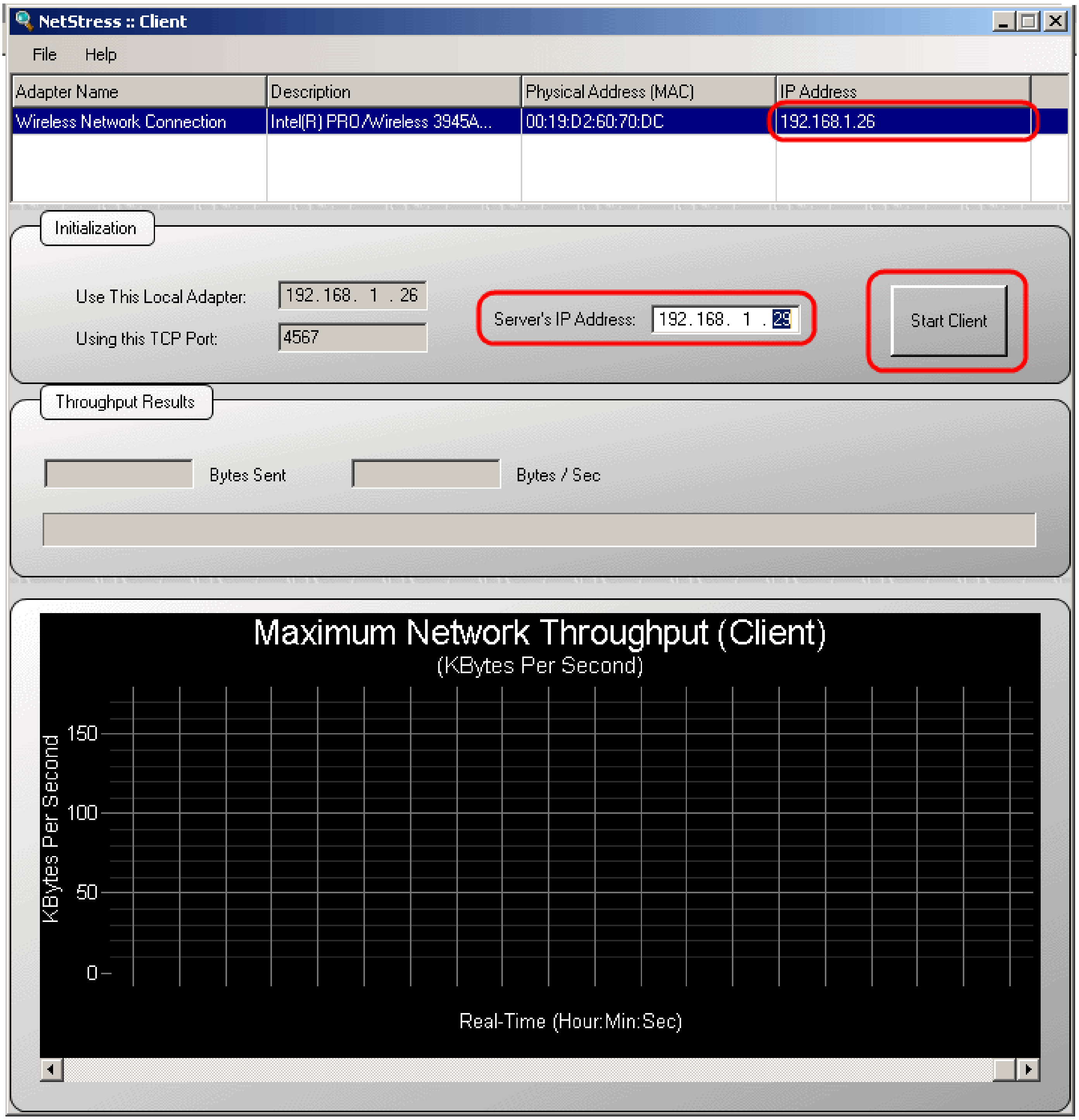
This particular machine has two network adapters installed -- one wireless (192.168.1.29) and one wired (192.168.17.75), so we need to specify to the application which one to use. Since we are interested in testing our wireless network then we select the 192.168.1.29 adapter. After selecting which adapter to use then press the 'Start Server' button. The application is now running in server mode and "listening" for a TCP connection. Take note of the server's IP address -- in our case it is 192.168.1.29.

Next go to the "client" machine and launch ***NetStress*** in client mode.



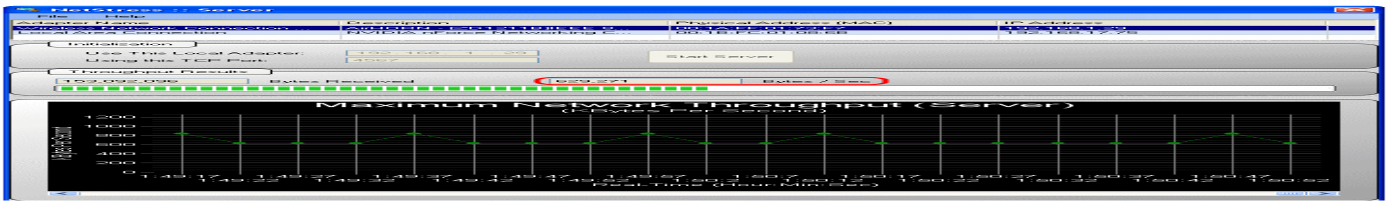


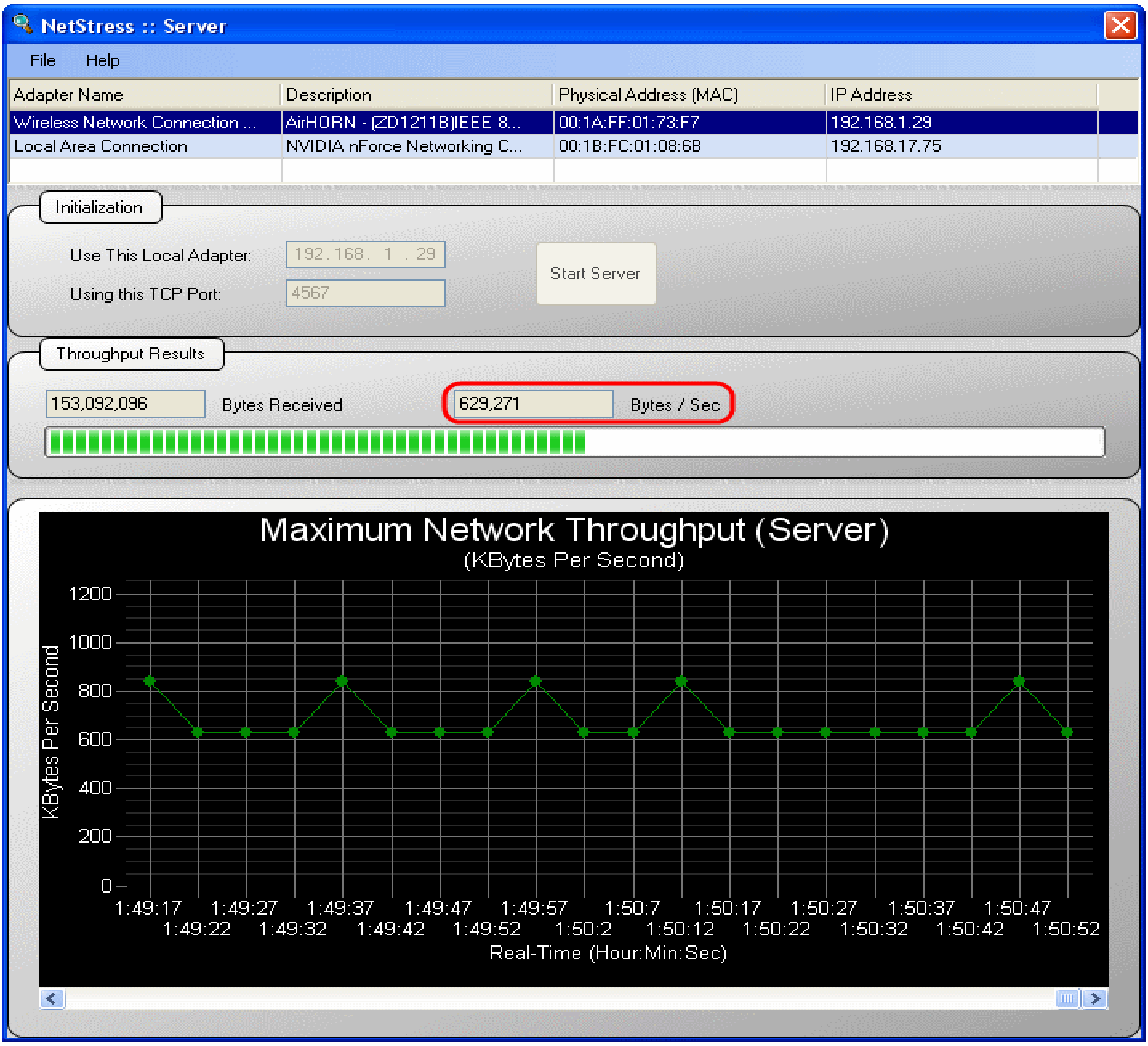
After pressing the 'OK' button then the server's application window appears:



This particular machine only has a wireless adapter -- so the application will use that by default. For the client application we also need to enter the server's IP address which, in this example, is 192.168.1.29. And then press the 'Start Client' button.

Once the TCP connection is made and the session begins then the client repeatedly transmits data to the server application. The current throughput is calculated and also charted as a function of time. The calculations are performed by the server application and reported back to the client. In this way both applications can display the results.




NetStress :: Server
File
Help
Adapter Name
Description
Physical Address (MAC)
IP Address
Wireless Network Connection ...
AirHORN - (ZD1211B)IEEE 8...
00:1A:FF:01:73:F7
192.168.1.29
Local Area Connection
NVIDIA nForce Networking C...
00:1B:FC:01:08:6B
192.168.17.75
Initialization
Use This Local Adapter:
192 . 168 . 1 . 29
Using this TCP Port:
4567
Start Server
Throughput Results
153,092,096
Bytes Received
629,271
Bytes / Sec
Maximum Network Throughput (Server)
(KBytes Per Second)
KBytes Per Second
1200
1000
800
600
400
200
0
1:49:17
1:49:22
1:49:27
1:49:32
1:49:37
1:49:42
1:49:47
1:49:52
1:49:57
1:50:2
1:50:7
1:50:12
1:50:17
1:50:22
1:50:27
1:50:32
1:50:37
1:50:42
1:50:47
1:50:52
Real-Time (Hour:Min:Sec)

Interpreting The Results

Below are three scenarios we'll consider:

1. Both the client and server use a wired connection to the network. We connected our two machines to a wireless router that included 4 100-Mbps ports. The important point about this scenario is the path between the two nodes is wired on both sides. When we ran ***NetStress*** our results reported a throughput of a little over 7,750,460 bytes-per-second. A 100-Mbps port is capable of a theoretical, maximum throughput of 13,107,200 bytes-per-second (100 x 1024 x 1024 bits / 8 bits / byte). Considering that various factors (including the TCP protocol) contribute to an overhead that causes the actual throughput to deviate from the theoretical, then this type of result is reasonable and to be expected.

2. Either the client or server communicates wirelessly -- the other uses a wired connection to the network. We setup a wireless network and configured the wireless router's Network Mode to use Wireless-G only. When we ran ***NetStress*** our results reported a throughput of approximately 2,500,000 bytes- per-second. So, how does this compare with the theoretical maximum of 54 Mbps? 54 Mbps is equivalent to 7,077,888 bytes-per-second (54 x 1024 x 1024 bits / 8 bits / byte). So, is our actual throughput (which is roughly 35% of the theoretical) reasonable? The short answer -- yes. The 54 Mbps is the theoretical maximum of what the hardware and medium are capable of. There are numerous factors that can contribute to the difference -- including network traffic, interference from other wireless devices and, equally important, the overhead of the 802.11 and TCP protocols. The throughput we measure doesn't take into account that every 802.11 packet includes additional bytes besides the data payload. Also, the TCP protocol takes a big chunk out of the performance (http://repository.cs.aueb.gr/getdoc.php?papercode=CPWR -18-2006). Taking into account throughput and coverage factors, others (http://www.atheros.com/pt/whitepapers/Methodology_Testing_WLAN_Chariot.pdf) have determined a theoretical maximum ***user-level*** performance for the 802.11 standards -- and for 802.11 g this turns out to be 24.4 Mbps (approximately 3,200,000 bytes / sec). Our measured throughput of 2,500,000 bytes / sec compares favorably with the theoretical maximum user-level throughput of 3,200,000 bytes / sec.

3. Both client and server machines communicate wirelessly. A setup similar to (2) above, except both nodes use a wireless connection to the network. When we ran ***NetStress*** it reported a throughput rate of 1,300,000 bytes-per-second -- roughly one-half of that reported by scenario (2). The explanation is that each wireless "hop" takes its toll on the overall throughput -- so, this result is reasonable and expected.

Conclusion:

We've presented some of our results here to serve as a guideline to help you with interpreting yours. Your throughput benchmarking results will likely differ from ours but, in general, for similar setups we'd expect the results to be roughly comparable. That is, of course, unless there is something critical going on that is impacting the performance of your network.

Just to be clear, you should not use our results as a reference. The best reference values are those you record during the lifetime of your network. Only in that way will you know for sure whether things are working normally or whether a problem has arisen which now requires further investigation.

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Contact Us

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