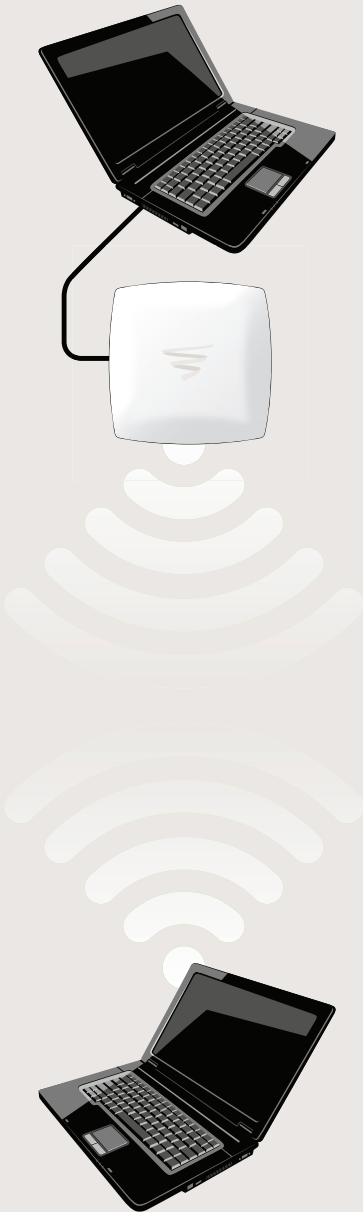


How To:

Use Iperf to Measure Wi-Fi Network Data Rates

Data Rates vs Signal Strength



INTRODUCTION

While signal strength is often the de facto performance benchmark of a wireless network, experts have found that signal strength alone is not enough to determine the viability and usability of the network. All too often, a network's signal strength will fall within acceptable ranges, yet have insufficient data rates for optimal—or even usable—connectivity. With that in mind, savvy network installers will test data rates in addition to testing signal strength. There are several options available for testing data rates. The option we will discuss in this document is a freeware utility called IPerf.

WHAT IS IPERF?

IPerf is a tool for measuring TCP and UDP throughput, jitter, and packet loss performance of IP networks. It is available for use on Windows, Macintosh, and Linux platforms. For more information and to download the Macintosh or Linux versions, visit <http://sourceforge.net/projects/iperf>. For the Windows version, visit <https://publishing.ucf.edu/sites/itr/cst/Pages/IPerf.aspx>.

WHAT AND WHERE TO TEST

Luxul partners have found that using Luxul Xen™ Access Points results in consistently higher data rates and greater signal coverage—providing better connectivity and an enhanced user experience compared to traditional Wi-Fi equipment. When evaluating your wireless network performance and/or comparing the performance of Luxul to other wireless technologies, it is suggested to test the following:

- ▶ **Problem Areas:** Test in a known problem area where standard gear has proven to be insufficient.
- ▶ **Distance:** At short range, standard wireless equipment will likely be sufficient, but will begin to fail at the edges of the coverage area due to data rates dropping off. Luxul equipment helps you maintaining usable data rates over a larger coverage area.

EQUIPMENT REQUIRED FOR THE TEST

- ▶ Two Computers (Laptop or desktop, at least one of which has wireless capability)
- ▶ Wireless Router or Access Point configured with an SSID so that the wireless computer can associate to it. (Please see your owner's manual for proper setup configuration)
- ▶ IPerf software installed on both computers



NOTE: Internet connectivity is not a requirement. The test only requires that the two computers and Access Point can communicate via a local area IP network. This document assumes you have an understanding of IP networks and can configure the devices so they can all communicate (ping) with one another.



NOTE: These instructions are for the Windows XP version of IPerf, but may also apply to the Linux, Windows Vista and Mac versions.

IPERF INSTALLATION

IPerf is a free utility that can be downloaded for Macintosh and Linux here:

<http://sourceforge.net/projects/iperf>

or for Windows here:

<https://publishing.ucf.edu/sites/itr/cst/Pages/IPerf.aspx>

Download the appropriate IPerf version for your setup and run the downloadable executable to save to your systems. Be sure to save it to a location you will remember (i.e. `c:\iperf`). Note that the software will need to be loaded on BOTH computers being used in the test. One of the computers will be setup as the server (connected to the access point via Ethernet cable), while the other will be connected wirelessly as a client computer.

Either computer can act as the server. However, it is recommended that the computer connected directly to the access point be the server, while the other computer acts as the wireless client.

SERVER SETUP

► Determine the IP address of the IPerf server computer:

1. Go to Start -> Control Panel -> Network and Internet Connections -> Network Connections.
2. Double click on the Local Area Connection being used. The status box should appear.
3. Select the Support tab at the top right and note the IP address listed. You will need this IP address later on.

► Start IPerf in server mode:

1. Open a cmd (Command Prompt) window. (Can be found in Start -> All Programs -> Accessories)
2. In the command prompt window, change to the directory where the IPerf executable was installed.
(cd `c:\iperf` in this example)
3. To start IPerf in server mode, type in the following command: `iperf -s`

If the server is setup correctly, the resulting output will look like the following:

```
C:\>iperf.exe -s
-----
Server listening on TCP port 5001
TCP window size: 8.00 KByte (default)
-----
```

CLIENT SETUP

1. Verify that the wireless client computer is connected to the SSID of the access point and can ping the server's IP address.
2. Open a cmd (command prompt) window on the client computer (can be found in Start -> All Programs -> Accessories).
3. Change the directory to the location that IPerf was installed (i.e. cd `c:\iperf`).
4. We are now ready to test throughput.

TESTING TCP THROUGHPUT

After setting up iPerf we are ready to test throughput this section covers the command structure. The default test mode for IPerf is TCP, which simulates bi-directional IP application communication. The majority of IP applications use TCP, including the World Wide Web, E-mail, and File Transfer.

The TCP command string on the client side takes the following format: `iperf -c 192.168.100.191 -w 64kb -l 64kb -M 1400 -i 10 -t 60` (This would report results every 10 seconds and run for 60 seconds)

- ▶ `-c` (IP address of server)
- ▶ `-w` (only used with Windows version, specifies windows size)
- ▶ `-l` (only used with Windows version, specifies packet length)
- ▶ `-M` (only used with Windows version, specifies the maximum MTU size)
- ▶ `-i` (interval to report throughput in seconds)
- ▶ `-t` (amount of time to run test in seconds)

If IPerf is operating correctly you should see something similar to this:

```
C:\>iperf.exe -c 192.168.100.191 -w 64kb -l 64kb -M 1400 -i 10 -t 60
-----
Client connecting to 192.168.100.191, TCP port 5001
TCP window size: 62.5 KByte
-----
[148] local 192.168.0.108 port 1853 connected with 192.168.100.191
port 5001
[ ID] Interval      Transfer    Bandwidth
[148] 0.0-10.0 sec  21.7 MBytes 18.2 Mbits/sec
[148] 10.0-20.0 sec  24.5 MBytes 20.5 Mbits/sec
[148] 20.0-30.0 sec  22.3 MBytes 18.7 Mbits/sec
[148] 30.0-40.0 sec  21.6 MBytes 18.1 Mbits/sec
[148] 40.0-50.0 sec  23.4 MBytes 19.6 Mbits/sec
[148] 50.0-60.0 sec  24.8 MBytes 20.8 Mbits/sec
[148] 0.0-60.0 sec  138 MBytes 19.3 Mbits/sec
```

Once the test is complete, the cumulative results are displayed on the last output line. In this example, during the 60-second interval 138 Mbytes of data were transferred at a TCP average throughput of 19.3 Mbps per second. After completing the client test, the server will also display the cumulative results for each test.

Proceed to perform multiple tests in different locations, particularly at the edge of network coverage. If comparing more than one wireless network, it is important to perform each comparative test from as close to the same location (including height) each time the test is done. Any variation can cause the test results to inaccurately reflect the true performance. If the testing is done in an environment where multiple wireless networks are present (i.e. office building, residences, etc.), then it is advisable to perform several tests from each location during the course of a day or multiple days. This level of testing will take longer but should result in a more reliable result.

TESTING UDP THROUGHPUT

UDP test mode simulates real-time streaming applications such as VOIP and Video Streaming.

To test UDP throughput, the server side must be restarted with the following command: `iperf -s -u`



NOTE: To stop iPerf at anytime enter “ctrl -c” at the same time.

Example client UDP command string: `iperf -c 192.168.100.129 -w 64kb -l 64kb -M 1400 -i 10 -t 60 -u -b 35m`

- ▶ `-u` signifies the UDP test and the
- ▶ `-b` signifies the UDP bandwidth. (35m = 35Mbits per sec, default is 1Mbit per sec.)

The output should look something like the following:

```
C:\>iperf.exe -c 192.168.100.191 -w 64kb -l 64kb -M 1400 -i 10 -t 60
-u -b 35m
-----
Client connecting to 192.168.100.191, UDP port 5001
Sending 64000 byte datagrams
UDP buffer size: 62.5 KByte
-----
[148] local 192.168.0.108 port 59250 connected with 192.168.100.191
port 5001
[ ID] Interval      Transfer    Bandwidth
[148] 0.0-10.0 sec  27.6 MBytes 23.2 Mbits/sec
[148] 10.0-20.0 sec 26.1 MBytes 21.9 Mbits/sec
[148] 20.0-30.0 sec 25.9 MBytes 21.7 Mbits/sec
[148] 30.0-40.0 sec 27.2 MBytes 22.8 Mbits/sec
[148] 40.0-50.0 sec 26.9 MBytes 22.5 Mbits/sec
[148] 50.0-60.0 sec 25.0 MBytes 21.0 Mbits/sec
[148] 0.0-60.1 sec 159 MBytes 22.2 Mbits/sec
```

In this example, during the 60-second interval, 159Mbytes of data were transferred at a UDP average throughput of 22.2 Mbps per second. The average jitter was 1.280 ms. The packet loss percentage was (0.085%) with 145 of 169745 packets lost. The greater the UDP data rate, the greater the likelihood that your packet loss percentage will increase.

TCP is typically an easier setup to run since it automatically determines maximum throughput. For reference purposes, the UDP throughput is roughly double the TCP throughput.

CONCLUSION

While wireless networking can be a challenge, there are steps that can be taken to ensure optimal performance and user satisfaction. Testing both signal strength and data throughput will help identify potential holes in network coverage and allow network installers to take the appropriate steps to ensure an optimal wireless network experience.