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# EVTM Simulated Testing

## Requirements

1. 2x Windows laptops with ethernet adapters
2. 2x ethernet cables
3. 1x unmanaged network switch supporting multicast frames/groups, with at least 2 ports
4. iperf version 2.0.8 installed on each laptop
  - a. Software: <https://sourceforge.net/projects/iperf2/>
  - b. Manual: <https://iperf2.sourceforge.io/iperf-manpage.html>
5. Wireshark packet analyzer software (4.0.3 used in examples)
  - a. Software: <https://www.wireshark.org/>

## Setup

1. One laptop will simulate being a flight computer, while the other will simulate being a ground support equipment (GSE) computer.
2. Connect each laptop to the ethernet switch using ethernet cables. Turn off Wi-Fi or other network adapter connections which are not involved in the test.
3. Set up a static IP address on each laptop, for example:
  - a. Flight computer
    - i. IP: 192.168.0.10
    - ii. Gateway: 192.168.0.1
    - iii. Subnet mask: 255.255.255.0
  - b. GSE computer
    - i. IP: 192.168.0.20
    - ii. Gateway: 192.168.0.1
    - iii. Subnet mask: 255.255.255.0
4. On each laptop, open a command prompt and navigate to the directory where iperf is installed.

## Running an iperf test

1. On the GSE laptop, type the following command into the command prompt window and hit enter:  
**iperf -s -u -B 239.255.0.1 -i 1 -p 64646**
  - a. The iperf server will start listening for incoming UDP packets sent to the multicast group 239.255.0.1 at port 64646, and report statistics every 1 second once traffic is sent.
2. On the flight computer laptop, type the following command into the command prompt window and hit enter: **iperf -c 239.255.0.1 -u -T 3 -t 15 -i 1 -b 10M -p 64646 -B 192.168.0.10:64646**
  - a. The iperf client will send UDP packets to the multicast group 239.255.0.1 for 15 seconds at a rate of 10Mbps to port 64646, and report statistics every 1 second.
3. If the GSE laptop ("iperf server") successfully receives the UDP traffic being sent by the flight computer laptop ("iperf client"), the laptops are successfully configured for continuing to test. If iperf data is not being transferred successfully, confirm network settings, cables, and switch power and try again.

## Simulating science data transmission over EVTm link

1. Simulating science data transmission follows a similar path as the iperf section above.

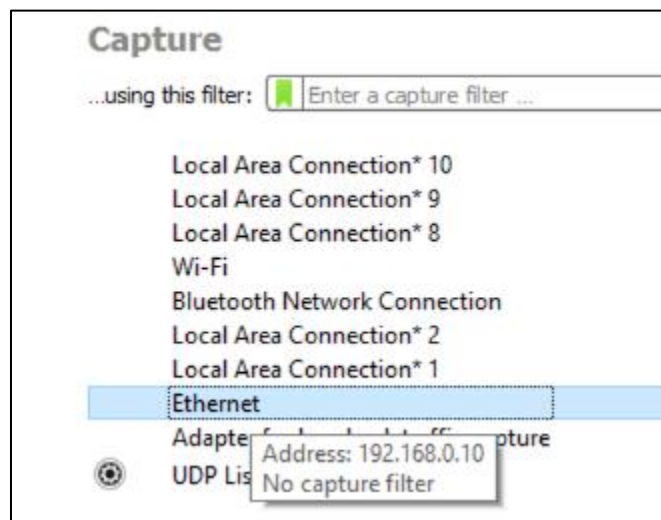
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2. Setup the GSE and flight computer with static IP addresses and network configuration as in the iperf testing section.
3. On the GSE system, have your ground software bind the ethernet adapter to the multicast group **239.255.0.1**, and have your software listen for UDP traffic on a port of your choosing (64646 was used in the iperf example).
4. On the flight computer, configure your flight software to send telemetry/data via UDP to the multicast group **239.255.0.1**, on the port from step 3 above.
5. Confirm UDP telemetry/data packets are received on your GSE system.
6. If successful, your flight computer and GSE are properly configured for interfacing with the CSBF EVTm system. During planning for integration and flight, we will work with you to agree on the actual IP address and ports to be used in flight. The typical IP range given to science is 192.168.1.X, with gateway 192.168.0.1, and subnet mask 255.255.0.0.
7. Note, if TDRSS **and** line of sight (LOS) transmitters will be used (such as on an LDB flight), your flight software **must** be able to:
  - a. Switch telemetry between one of two multicast IPs upon request (when switching from one link path to the other)
  - b. Adjust telemetry/ data rate to match the previously agreed upon bandwidth budgets for the particular link (TDRSS has less bandwidth than LOS)
  - c. Alternatively, two data streams can be sent, one to each multicast group (one for TDRSS, one for LOS), with the data rate of each set to the previously agreed upon bandwidth limits.

## Capturing multicast traffic using Wireshark

1. Set up is the same as shown in the "Setup" section. The example will capture iperf UDP traffic.
2. On one of the two computers, or another computer connected to the same ethernet switch, install Wireshark packet analyzer.
3. Launch Wireshark and double click on the interface connected to the ethernet switch to begin recording network traffic. In the following screenshot the "Ethernet" interface will be utilized:



4. Start the iperf server as shown in the "Running an iperf test" section. Note Wireshark will show the server/GSE laptop attaching to the multicast group:

