HeaderFarame and PayloadGenerator tests

All unit tests passed -> correct bytestrings generated in all cases

Pcap generation tests

Assertions made in test instrumentation code found that all invalid uses of the pcap generation tool raised exceptions as expected.

All of the actual values in the test results below were pulled from wireshark's capture file summary.

The following results are for pcaps generated with a given byte-rate and byte-count. Due to the practicalities of assigning timestamps to packets with a predefined number of bytes, applying one of these metrics is antagonistic to the other. The way it has been programmed is to give the user the choice, they can either meet the byte count exactly by padding the last packet (reducing the accuracy of the byte rate) or maintain an accurate byte rate but miss the exact byte count by up to the size of a packet. This is why we will accept a large margin of error of inaccuracy in one of these metrics depending on which choice has been made.

Byte padding?	Expected protocol headers	Expected byte rate	Expected byte count	Actual protocol headers	Actual byte rate	Actual byte count	Pass or Fail
No	Ethernet IPv4 TCP	10	128	Ethernet IPv4 TCP	NA (only 1 packet)	90	NA
Yes	Ethernet IPv4 TCP	10	60124	Ethernet IPv4 TCP	10	60124	Pass
No	Ethernet RoE	30000	60124	Ethernet RoE	30000	60088	Pass
Yes	Ethernet IPv4 TCP	50.5	1025	Ethernet IPv4 TCP	57	1025	Pass
Yes	Ethernet RoE	30000	128	Ethernet RoE	51000	128	Pass
No	Ethernet RoE	50.5	1025	Ethernet RoE	52	1020	Fail
Yes	Ethernet IPv4 TCP	10	1025	Ethernet IPv4 TCP	10	966	Pass
Yes	Ethernet RoE	30000	1025	Ethernet IPv4 TCP	31000	1025	Pass

The following results are for pcap files generated given a packet-count, mean inter-packet gap and "inter-packet gap range". What this actually means is each inter-packet gap is pulled from a gaussian distribution about the given mean and the range equates to 6.5 standard deviations. In this test we will verify that the packet count is correct and that:
(expected meanIPG - ipgRange/13) <= actual meanIPG >= (expected meanIPG + ipgRange/13)
i.e the actual mean inter-packet gap is within half a standard deviation of the given one.

Expected protocol headers	Expected mean IPG	Given IPG range	Expected packet count	Actual protocol headers	Actual mean IPG	Actual packet count	Pass or Fail
Ethernet IPv4 TCP	1.3	0	1	Ethernet IPv4 TCP	NA	1	Pass
Ethernet IPv4 TCP	1.3	0	30	Ethernet IPv4 TCP	1.3	30	Pass
Ethernet IPv4 TCP	15.5	0	1000	Ethernet IPv4 TCP	15.5	1000	Pass
Ethernet IPv4 TCP	999999.01	499999.505	30	Ethernet IPv4 TCP	980889.4861	30	Pass
Ethernet VLAN IPv6 UDP	15.5	3.875	1000	Ethernet VLAN IPv6 UDP	15.4917	1000	Pass
Ethernet RoE	15.5	7.75	30	Ethernet RoE	14.9298	30	Pass
Ethernet VLAN IPv6 UDP	999999.01	249999.7525	1000	Ethernet VLAN IPv6 UDP	999340606.7	100015.4917	Pass
Ethernet RoE	1.3	0.65	30	Ethernet RoE	1.2355	30	Fail

The following results are for pcap files generated given a packet count and a packet rate. Unlike the previous results in this and the test assertion is exact equivalence of expectation and actual values.

Expected protocol headers	Expected packet rate	Expected packet count	Actual protocol headers	Actual packet rate	Actual packet count	Pass or Fail
Ethernet IPv4 TCP	0.01	1	Ethernet IPv4 TCP	NA	1	Pass
Ethernet IPv4 TCP	0.01	435	Ethernet IPv4 TCP	0.01	435	Pass
Ethernet RoE	7.72	1000	Ethernet RoE	7.72	1000	Pass
Ethernet IPv4 TCP	2000	435	Ethernet IPv4 TCP	2000	435	Pass
Ethernet IPv4 TCP	95.4	1000	Ethernet IPv4 TCP	95.39	1000	Pass
Ethernet VLAN IPv6 UDP	95.4	435	Ethernet VLAN IPv6 UDP	95.4	435	Pass
Ethernet VLAN IPv6 UDP	2000	1000	Ethernet VLAN IPv6 UDP	2000	1000	Pass
Ethernet VLAN IPv6 UDP	0.01	1000	Ethernet VLAN IPv6 UDP	0.01	1000	Pass

The following results are for pcap files generated given a byte rate and a timespan. Due to the fact that you can only include complete packets in a file the actual timespan will often be less than the expected one within the margin of error of one packet's worth of bytes at the expected byte rate. Further to this wireshark gives bytes/s as a whole number so we will accept if the byte rate is the expected rounded to the nearest whole number.

Expected protocol headers	Expected byte rate	Expected timespan	Actual protocol headers	Actual byte rate	Actual timespan	Pass or Fail
Ethernet IPv4 TCP	3	263	Ethernet IPv4 TCP	3	250	Pass
Ethernet IPv4 TCP	64.1	888	Ethernet IPv4 TCP	64	886.927	Pass
Ethernet IPv4 TCP	764.8	0.8	Ethernet IPv4 TCP	877	0.733525	Fail
Ethernet IPv4 TCP	64.1	263	Ethernet IPv4 TCP	64877	262.652	Pass
Ethernet RoE	3	888	Ethernet RoE	3	888.0	Pass
Ethernet IPv4 TCP	764.8	888	Ethernet IPv4 TCP	765	887.918	Pass
Ethernet IPv4 TCP	764.8	263	Ethernet IPv4 TCP	765	262.986	Pass
Ethernet RoE	64.1	0.8	Ethernet RoE	148	0.499	Fail

The following results are for pcap files generated by giving a timespan, mean inter-packet gap and inter-packet gap range. The same assessment criteria for IPG metrics which we used in the previous cases apply. Once again the timespan may fall below the expected by up to the expected mean IPG.

Expected protocol headers	Expected mean IPG	Given IPG range	Expected timespan	Actual protocol headers	Actual mean IPG	Actual timespan	Pass or Fail
Ethernet IPv4 TCP	1.4	0	2.1	Ethernet IPv4 TCP	1.4	1.4	Pass
Ethernet IPv4 TCP	1.4	0.35	34.77	Ethernet IPv4 TCP	1.34	33.644	Pass
Ethernet IPv4 TCP	921.82	230.455	1369.3	Ethernet IPv4 TCP	915.743	915.743	Pass
Ethernet RoE	921.82	0	1369.3	Ethernet RoE	921.82	915.743	Pass
Ethernet VLAN IPv6 UDP	213.44	53.36	1369.3	Ethernet VLAN IPv6 UDP	178.006	1246.04	Fail
Ethernet RoE	1.4	0.7	34.77	Ethernet RoE	1.347	33.674	Pass
Ethernet VLAN IPv6 UDP	213.44	106.72	1369.3	Ethernet VLAN IPv6 UDP	184.235	1289.647	Fail

The following results are for pcap files generated by giving a timespan and a packet rate. We will accept timespans that fall below the accepted timespan by up to 1/(expected packet rate) seconds.

Expected protocol headers	Expected packet rate	Expected timespan	Actual protocol headers	Actual packet rate	Actual timespan	Pass or Fail
Ethernet IPv4 TCP	0.5	15.5	Ethernet IPv4 TCP	0.5	14	Pass
Ethernet IPv4 TCP	9.9	15.5	Ethernet IPv4 TCP	9.9	15.4545	Pass
Ethernet VLAN IPv6 UDP	123	0.8	Ethernet VLAN IPv6 UDP	123	0.793	Pass
Ethernet RoE	0.5	222.11	Ethernet RoE	0.5	222.0	Pass
Ethernet VLAN IPv6 UDP	9.9	600	Ethernet VLAN IPv6 UDP	9.9	600	Pass
Ethernet IPv4 TCP	123	15.5	Ethernet IPv4 TCP	123	15.496	Pass
Ethernet RoE	0.5	600	Ethernet RoE	0.5	600	Pass
Ethernet VLAN IPv6 UDP	9.9	222.11	Ethernet VLAN IPv6 UDP	9.9	222.02	Pass

Pcap analysis tests

Test result info shown in tests/pcap_analysis_tests/test_files/AnalysisTest.log

Many test failures are shown in the log file but after careful review, I have concluded that these are due to the fact that the test expectation values are pulled from the generation configuration values. As can be seen above there are many ambiguities in assessing these values as compared to the actual outcomes and even after these ambiguities are considered there are still a few failures. From this we can conclude that this test was insufficient due to its coupling with the correctness of the generation configuration values.

CLI interface tests

Results of the CLI interface tests can be seen in tests/cli_ui_tests/test_files/cliTest.log
The test case numbers recorded in the log file correlate to one of the cases described in the spreadsheet tests/cli_ui_tests/test_files/cli test cases.xlsx

Initially most invalid CLI argument combinations test cases produced errors as expected and asserted in the test instrumentation code except for test cases 18, 19 and 20 which were meant to but didn’t. After checking the code I found there were some missing error conditions, I corrected them so the tests now pass.

Initially all valid test cases passed, producing correctly named and located pcaps except for test case 28 which failed. I found the error responsible for this (an overly strict defined error case) and now the tests all pass.

Performance test

The performance test passed -> A full generation and analysis of the largest pcap which falls under the systems intended use completed in under 60 seconds.
View the test log in tests/performance_tests/test_files/performanceTest.log to see exact runtimes.

User acceptance test

After deploying an early version of the tool to Calnex test engineer Lorcan Roddy, he commented the following:

“This PCAP tool is extremely useful for testing, we have been able to use this to test filtering operations on the SNE that would otherwise require expensive hardware, which is of limited availability due to other tasks that would not be testable by this program, this has helped speed up test as it requires less hardware, having the option of command line interface or direct interfacing with the code means we can do quick verification test or automated test with this tool, which helps with the production and verification of each test release and nightly builds of our the SNE software.”