



Report of One-way Throughput Test

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1 Introduction

The tests provided estimates of one-way throughput of the NetFlow probes on Ethernet at a rate of a gigabit per second according to RFC 2544 [1]. The test results discovered throughput dependency on packet size and compared SW and HW solutions. The representative of SW solution was a nProbe [2], which uses a classical Intel network card. The representative of HW solution was a FlowMon [3], which is based on the COMBO [4] technology, developed in the frame of Liberouter [5] project.

2 Goal

The goal of the proceeded test was to show the performance of specialized HW and SW NetFlow probes.

3 Measurement Description

The test was performed by sending 500000 packets of specified length and by measuring throughput of the probe. The packets were sent by the Tcl script `flowmon_test1.tcl` which was developed to send packets with increasing length using Spirent AX/4000 test device. The starting length of packet was set to 46 B and the final length was set to 1500 B (the length of TCP/IP packets on L3). The increment of length was set to 20 B. The number of flows for each packet length was set to 5 (there were sent 72 different packet lengths). The probes were set to generate NetFlow version 5 data [6]. The Fig. 1 and the Fig. 2 describe setup and progress of the whole test process. The detailed description of used hardware configuration is show in section B.

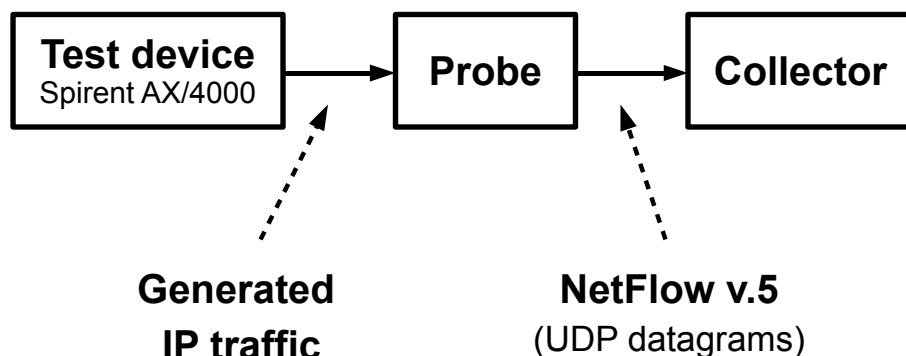


Figure 1: Test setup

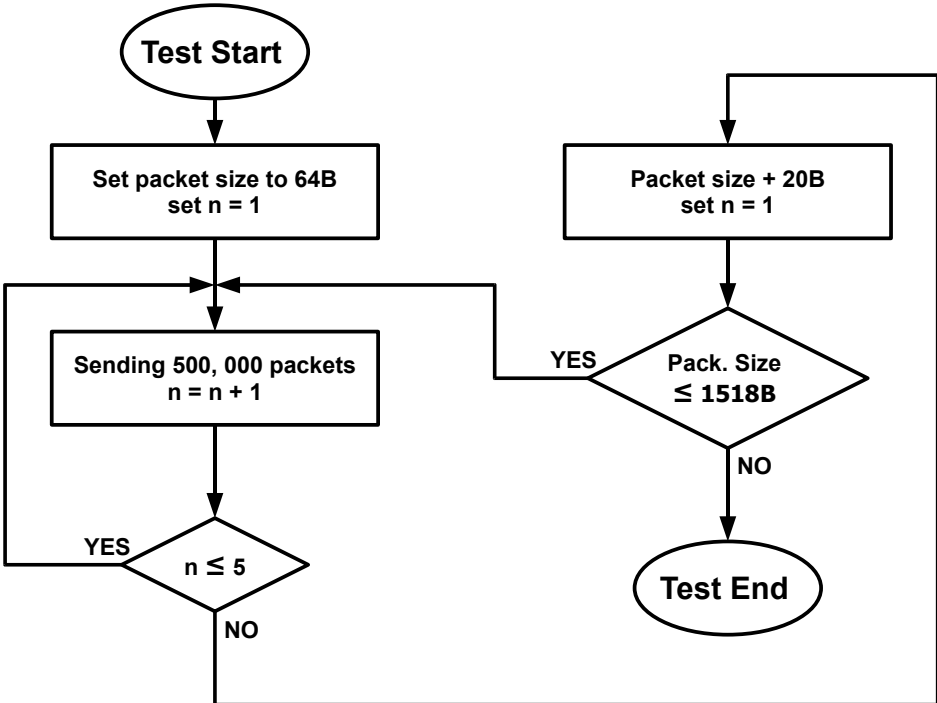


Figure 2: Progress of testing

4 One-way Throughput Test of nProbe

The section shows how the IP traffic generator, nProbe probe and collector were started. The nProbe probe run with default parameters on standard Linux kernel. The Fig. 3 shows connection of devices and Fig. 4, 5 show results for nProbe.

DUT (device under test) settings for nProbe tests

```

Generator (Spirent AX/4000):      $ tcslsh
                                  flowmon_test1 -s 64 -f 1518 -i 20 -n 5 -d 0

nProbe probe:                     # ./nprobe -i eth1 -n chianti.liberouter.org:5000

Collector (flowmoncol on chianti): $ flowmoncol -m4 > file.txt

Generating outputs:               $ ./flowscript file.txt

```

Connection of devices during tests of nProbe probe

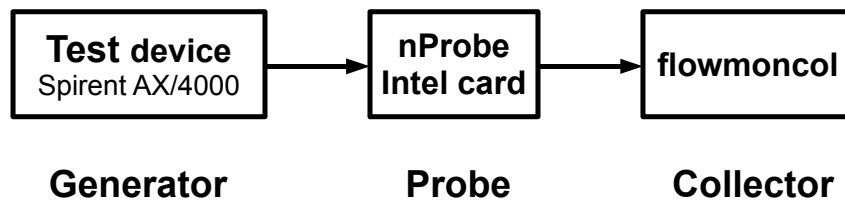


Figure 3: Connection for nProbe testing

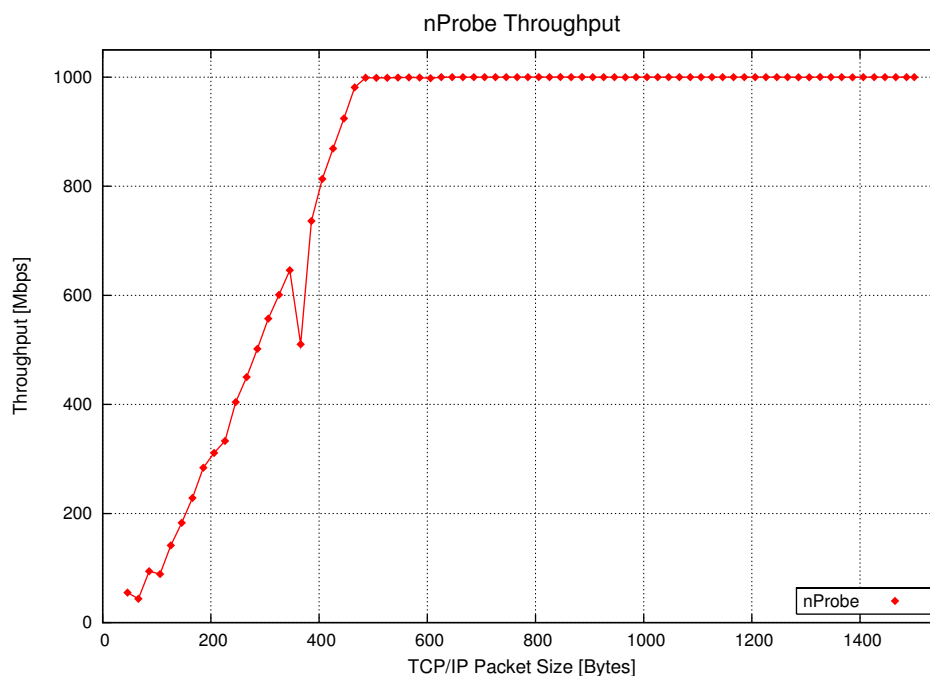


Figure 4: nProbe throughput

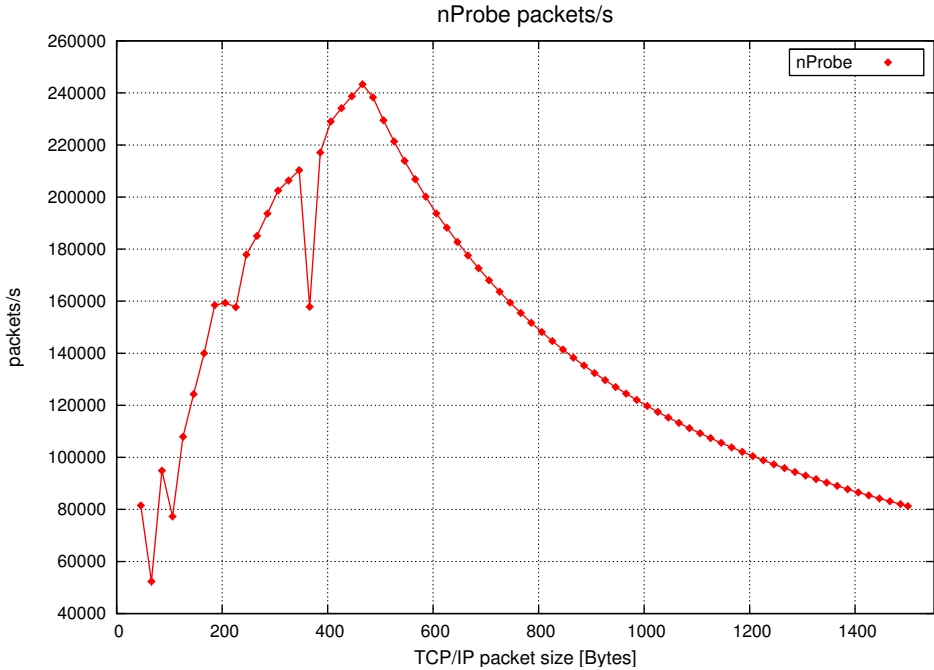


Figure 5: nProbe packets per second

5 One-way Throughput Test of FlowMon

The section 5 shows performed FlowMon test. As you can see below, the collector `flowmoncol` run at the same computer as FlowMon probe and exporter. The processing power of computer is not so critical when we use HW probe, so we were able to use only one computer. The FlowMon probe run with default parameters on standard Linux kernel. The Fig. 6 shows connection of devices and Fig. 7, 8 show test results for FlowMon probe.

DUT (device under test) settings for FlowMon tests

```
Generator (Spirent AX/4000):  $ tclsh
                             flowmon_test1 -s 64 -f 1518 -i 20 -n 5 -d 0

FlowMon probe:                # flowmonlkm -l
                             $ flowmon -a 7 -e -v NF5 -c localhost:5000

Collector (flowmoncol):       $ flowmoncol -m4 > file.txt

Generating outputs:           $ ./flowscript file.txt
```

Connection of devices during tests of FlowMon probe

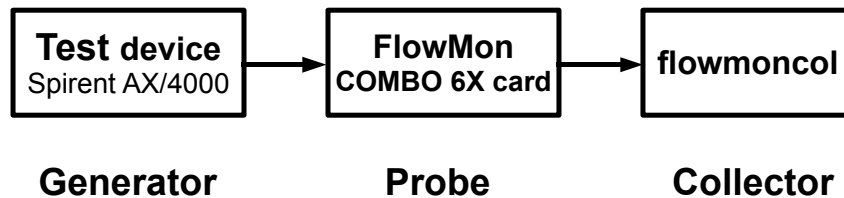


Figure 6: Connection for FlowMon testing

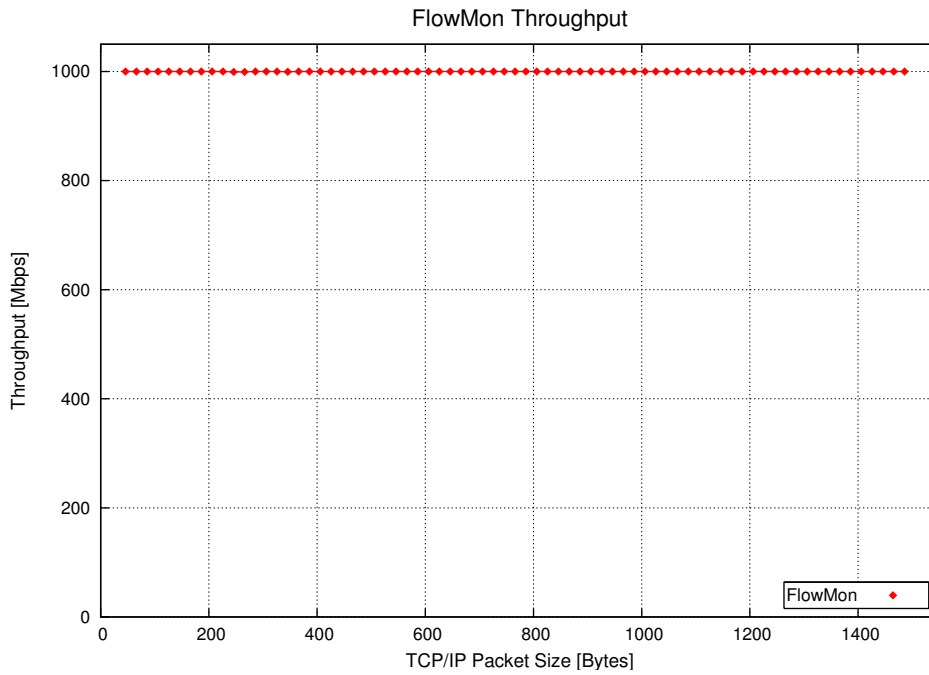


Figure 7: FlowMon throughput

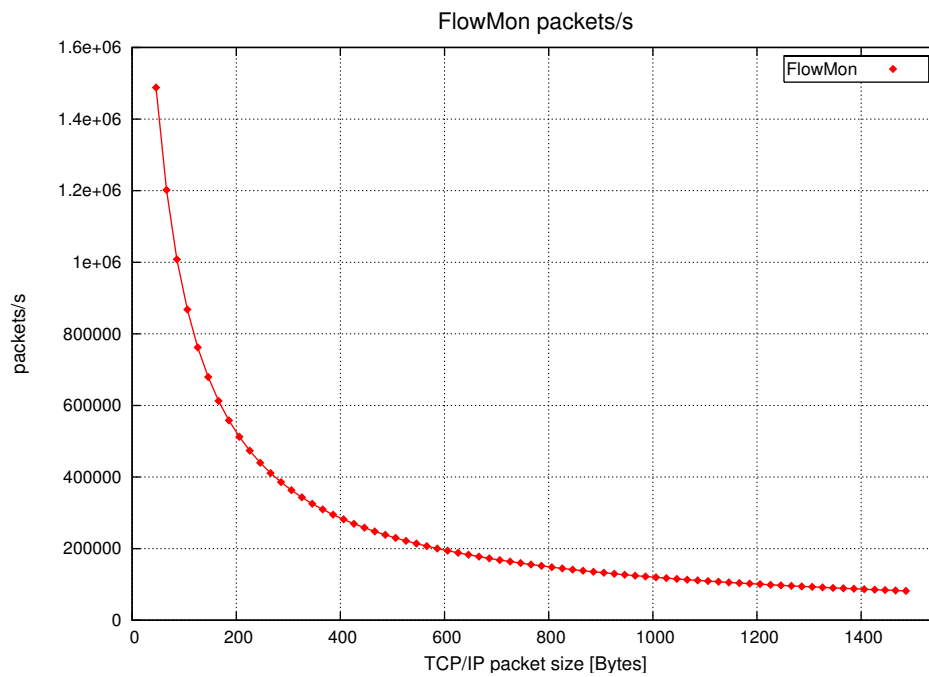


Figure 8: FlowMon packets per second

6 Comparison Between FlowMon and nProbe

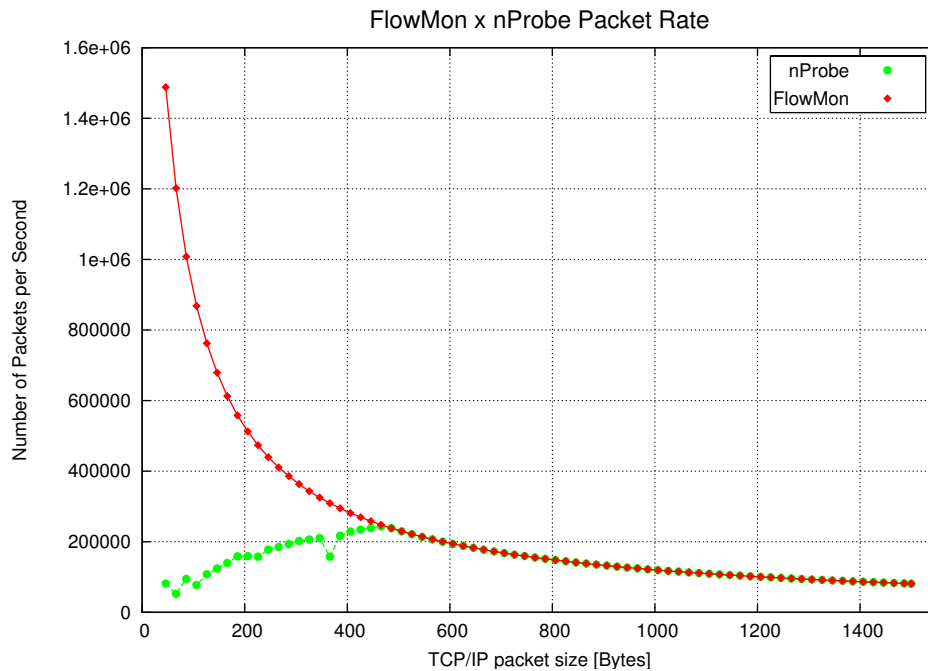


Figure 9: Packets per second rate of tested probes

7 Conclusion

The results in Fig. 9 and Tab. A in appendices indicate that the FlowMon probe is able to process 1 Gbps traffic at line rate without any packet losses, regardless of the packet size. In comparison, the nProbe software suffers from massive losses for packet sizes below approximately 400 B. To improve nProbe performance (generally SW like NetFlow probes) special kernel and user space tuning is required. This requires advanced knowledge of operating system internals, non-standard source code patches and fixes. Such activities were out of our scope during performed tests.

References

- [1] S. Bradner and J. McQuaid. RFC 2544 - Benchmarking Methodology for Network Interconnect Devices. 1999.
- [2] Luca Deri. nProbe an extensible Netflow v5/v9/IPFIX GPL probe for IPv4/v6.
<http://www.ntop.org/nProbe.html>.
- [3] FlowMon Probe. <http://www.liberouter.org/flowmon/>.
- [4] COMBO6X card. http://www.liberouter.org/card_combo6x.php.
- [5] Liberouter project. <http://www.liberouter.org/>.
- [6] Netflow Technology.
http://www.cisco.com/en/US/tech/tk812/tsd_technology_support_protocol_home.html.
- [7] AX/4000 Broadband Test System.
<http://www.spirentcom.com/analysis/technology.cfm?media=7&ws=325&ss=101>.

Appendices

A Table of Selected Values

Frame size	Packet size	Theoretical max. pps	nProbe pps	FlowMon pps
64	46	1488095	81525	1488095
84	66	1201923	52362	1201923
104	86	1008064	94908	1008064
124	106	868055	77292	868055
144	126	762195	107910	762195
164	146	679347	124287	679347
184	166	612745	139978	612745
364	346	325520	210324	325520
384	366	309405	157829	309405
404	386	294811	217067	294811
424	406	281531	229022	281531
444	426	269396	234119	269396
464	446	258264	238721	258264
784	766	155472	155472	155472
804	786	151699	151681	151699
824	806	148104	148133	148104
844	826	144675	144675	144675
1004	986	122070	122070	122070
1024	1006	119731	119731	119731
1044	1026	117481	117490	117481
1064	1046	115313	115295	115313
1484	1466	83111	83111	83111
1504	1486	82020	82020	82020
1518	1500	81274	81274	81274

B Used HW/SW Equipment

Test device

Testing device: Spirent AX/4000 [7]

Testing software: Tcl library AX/4000 4.72

Host computer for testing of FlowMon

Host computer: cabernet.liberouter.org

OS: RedHat Linux 2.6.9-11.EL

MB: Intel SE7501CW2

CPU: Intel(R) Xeon(TM) 2.4 GHz (1 core)
8 KB L1 + 512 KB L2 cache

Memory: 512 MB DIMM DDR Synchronous 266 MHz

Cards: Combo6X / COMBO-4SFPRO/1G

PCI Bridge: c610.04.04

Host computer for testing of nProbe

Host computer: irsai.liberouter.org

OS: RedHat Linux 2.6.9-11.EL

MB: Intel SE7520BD2D

CPU: Intel(R) Xeon(TM) 3.00 GHz (2 cores)
2x(16 KB L1 + 2 MB L2 cache)

Memory: 1 GB DIMM DDR Synchronous 266 MHz

Cards: Intel Corporation 82546GB Gigabit Ethernet Controller

PCI Bridge: width 64 bit; clock 66 MHz

SW: nprobe v.4.1 for i686-redhat-linux-gnu [2]