

Bachelor’s Thesis: Performance-Analysis of VPP

Intermediate Talk

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VPP: a fast software router

VPP (Vector Packet Processing) is a user-space software router. It’s approach combines many advantages:

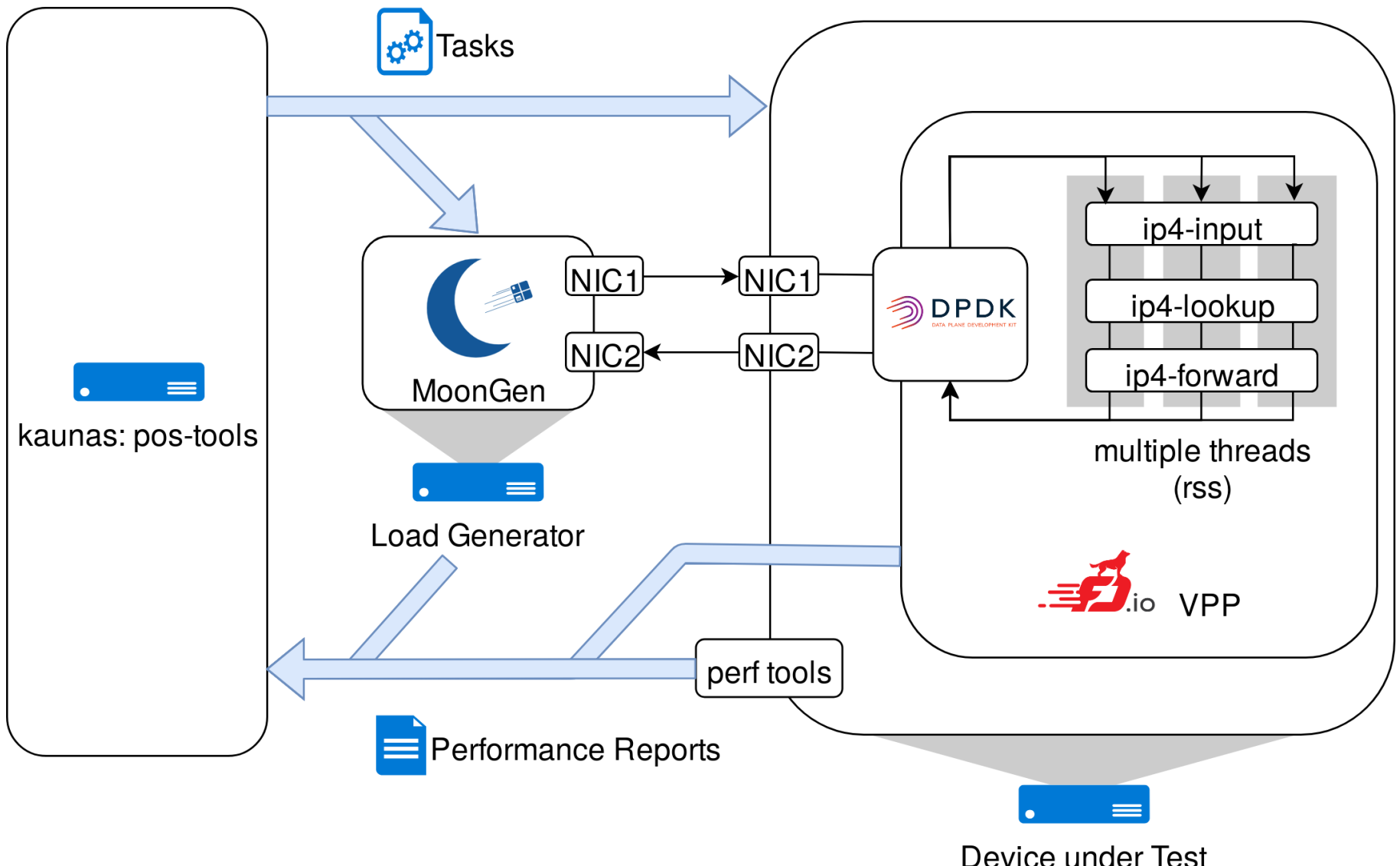
- ▶ deployable to mainstream architectures
- ▶ fast, user-space NIC drivers
- ▶ can run in virtualized containers

"It is the open source version of Cisco’s Vector Packet Processing (VPP) technology" [1] and is now beeing developed by FD.io ("The Fast Data Project") which belongs to the Linux Foundation.

Feature Highlights:

- ▶ vecorized processing of packets in badges
- ▶ utilizes high-speed dpdk drivers
- ▶ modular and extendable packet-processing graph [4]
- ▶ cpu-scalability

Benchmarking Setup



Testing Methodology

For tests to return meaningful latency results, the optimum of throughput to latency is beeing found by a script. This packet rate is then used for further tests. Otherwise a worst case of latency is triggered, because because packet queues fill up. [3]

VPP properties to test:

- ▶ raw forwarding throughput
- ▶ latency: cache and memory impact
- ▶ packet processing graphs utilizing multiple cpu cores
- ▶ testing specific processing nodes / router features
- ▶ TODO

Testing Parameters

MoonGen [2] scripts can generate testing load according to the following testing parameters:

- ▶ packet rate
- ▶ packet size
- ▶ traffic type (generic Ethernet, UDP)
- ▶ traffic pattern (inter packet gaps)

Gathered testing results:

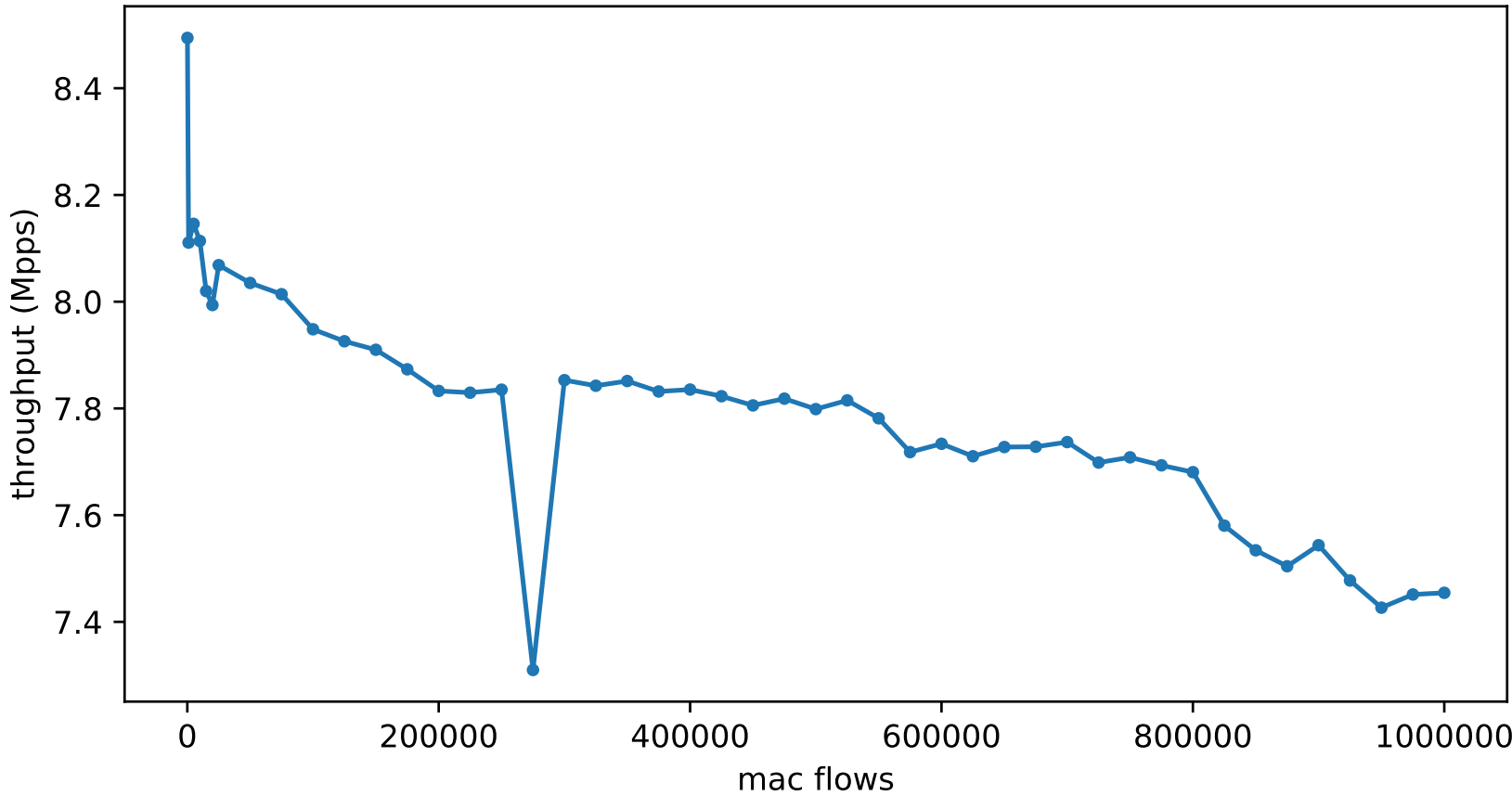
- ▶ latency histogram
- ▶ throughput
- ▶ linux perf stats (cache misses...)
- ▶ linux perf record (cpu-time spent per symbol)
- ▶ internal vpp state information

I2 Throughput

The following results are produced by sending non-ip ethernet packets to a single destination. VPP ran on an Intel E5-2640 @ 2.0GHz (cesis) with 10G networking results in the following numbers:

| VPP config                    | max Mpps | stable Mpps | Relative |
|-------------------------------|----------|-------------|----------|
| packet gen speed              | 14.86    | 14.86       | 100%     |
| I2 xconnect                   | 10.4     | 10.1        | 68%      |
| I2 bridge: no features        | 9.35     | 9.2         | 62%      |
| I2 bridge: mac-age            | 8.62     | 8.6         | 58%      |
| I2 bridge: mac-learn          | 8.51     | 8.3         | 56%      |
| I2 bridge: mac-learn, mac-age | 8.50     | 8.3         | 56%      |

I2 Latencies per Flow



[1] What is vpp? [https://wiki.fd.io/view/VPP/What\\_is\\_VPP%3F](https://wiki.fd.io/view/VPP/What_is_VPP%3F). Accessed on 2019-01-16.

[2] P. Emmerich, S. Gallenmüller, D. Raumer, F. Wohlfart, and G. Carle. MoonGen: A Scriptable High-Speed Packet Generator. In *Internet Measurement Conference 2015 (IMC'15)*, Tokyo, Japan, Oct. 2015.

[3] S. Gallenmüller, P. Emmerich, F. Wohlfart, D. Raumer, and G. Carle. Comparison of frameworks for high-performance packet io. In *Proceedings of the Eleventh ACM/IEEE Symposium on Architectures for networking and communications systems*, pages 29–38. IEEE Computer Society, 2015.

[4] L. Linguaglossa, D. Rossi, S. Pontarelli, D. Barach, D. Marjon, and P. Pfister. High-speed software data plane via vectorized packet processing (extended version). *Tech. Rep.*, 2017.