

BB-Gen: A Packet Crafter for Performance Evaluation of P4 Data Planes

Abstract

With the advent of flexible fast path packet processing research in Software Defined Networking (SDN) infrastructures, traffic generator tools witnessed many entrants with features ranging from varying lists of high-performance network traffic analysis to measuring traffic throughput and packet latency, supported protocols, and so on. The flexibility and protocol-independence of P4-based datapaths challenges the applicability of existing tools to carry rich performance evaluation experiments.

In this demo, we feature a packet crafter tool called BB-Gen in support of dataplane programmers to test the performance of P4-based (P4₁₄) software switch pipelines. With a major focus on simplicity, BB-Gen complements other traffic generators in lieu of trying to replace them. BB-Gen is a soft CLI-based packet crafter to generate packet flows formatted as PCAP files by taking user-defined parameters as inputs based on the headers defined in a P4 program. The tool supports different standard protocols (e.g., VXLAN, GRE, IPv6, etc.) and allows to set easily new and custom protocols with few template-based modifications. BB-Gen allows creating PCAPs for simple (best-case) and complex (worst-case) scenarios with all unique flows or following arbitrary flow (header value) distributions. It also allows the users to create a entire set of PCAPs for performance evaluation by specifying only a single flag in the command line. Under this performance setting, PCAPs generated comprises of all the standard packet sizes (i.e., 64, 128, 256, 512, 1024, 1280, 1518). In addition to the PCAPs, the second output from BB-Gen which is very useful for P4-based devices are test P4 Table Traces containing test entries with values derived from the PCAP packet contents. As shown in Figure 1, the generated PCAPs are fed into a performance analyzer tool (our main choice being NFPA)¹ to generate the actual workload traffic. The P4 table traces are used to populate the tables of the P4 device under test.

Altogether, BB-Gen complements other tools towards a complete tool-chain in support of P4 dataplane development. While p4pktgen² can be used to validate a P4 program by generating test input packets and table entries, p4app³ can perform functional tests for the P4 program using BMV2 simple_switch in a Mininet environment. BB-Gen allows the generation of traffic traces based on user-defined flow distributions that in turn can be used with a wide set of Traffic Generators (e.g., pktgen-dpdk, NFPA, TCPDUMP, etc.) for performance evaluation purposes. BB-Gen is released as open source, available to download from Github at <https://github.com/intrig-unicamp/BB-Gen>. In our strive to keep improving the tool, we plan to include more pre-defined standard protocols along with support of P4₁₆ as well as P4Runtime APIs in the near future.

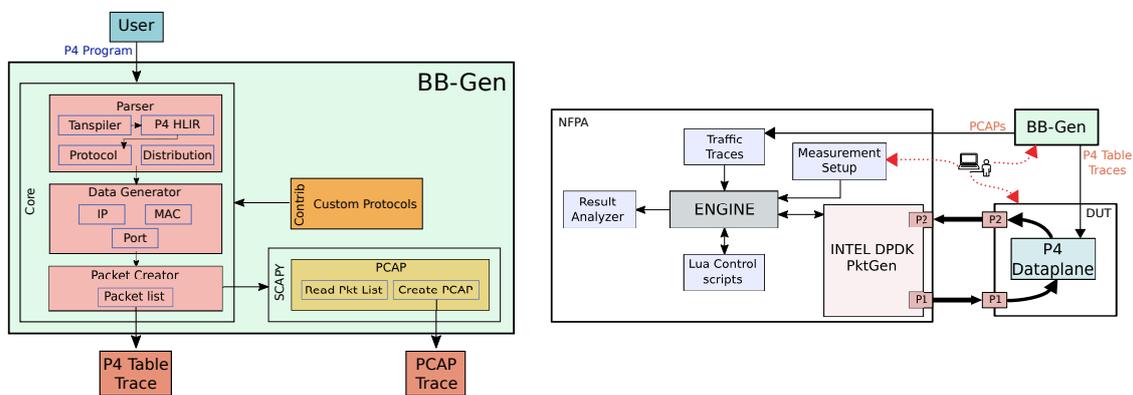


Figure 1: BB-Gen architecture (left) and demo workflow (right) featuring integration with NFPA and Intel DPDK.

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¹ <https://github.com/cslev/nfpa>

² <https://github.com/p4pktgen/p4pktgen>

³ <https://github.com/p4lang/p4app>