Network traffic monitoring and analysis are critical for managing large scale networks. However, as link speeds scale to 100Gbps and beyond, capturing complete packet traces becomes challenging.

In recent work, we built a dataplane profiler called Patchwork and used it on the FABRIC testbed to profile its network traffic.

We relied on software-only traffic processing solutions, but that does not scale. We need hardware support for Patchwork to handle high volumes of traffic.

Introduction

1. Boost Patchwork’s traffic monitoring capabilities by handling high volumes of traffic without packet loss, filtering traffic at full line-rate, and exporting traffic statistics.
2. Use FABRIC’s AMD-Xilinx Alveo U280s to process traffic in the data plane.

Motivation

1. Demonstrate line-rate packet filtering while handling mirrored uplink traffic up to 100 Gbps without any packet loss.
2. Accelerate Patchwork’s packet processing using P4 leveraging FABRIC Alveos.

Approach

1. Design and implement advanced packet filtering logic in P4, targeting FABRIC’s Alveo SmartNICs, with features including configurable sampling rates, variable header packet truncation and address pseudonymization for enhanced privacy.
2. Compile P4 code and integrate with FABRIC testbed using Patchwork by leveraging existing dataplane monitoring capabilities.
3. Validate the line-rate of the implemented solution by generating standardized traffic profiles, conducting thorough testing for packet loss at various speeds (10 Gbps ... 100 Gbps), and profiling the achieved sampling rates to ensure optimal performance.

Current State

- Integrated our optimized P4 pipeline with the Patchwork system on FABRIC, enabling hardware-accelerated packet processing.
- Implemented mid-square PRNG for packet sampling in P4 and truncation, allowing control over data volume and retention of metadata.
- Developed pseudonymization functionality in P4 to ensure privacy by masking IPv4 &IPv6 addresses in the captured network traffic.