Tracing Internet Path Transparency

Semester thesis

Background

Middleboxes in the Internet are network devices that perform functions other than just forwarding packets. These functions include access control of firewalls, traffic classification to for differential treatment to enhance performance, or other adaptations to align the traffic with the network conditions. Unfortunately this kind of middlebox mangling can also lead to dropping or blocking of unknown and new protocol extensions or completely new protocols. Examples are TCP options such as needed for TCP Fast Open (TFO) [1] or to support Multipath TCP (MPTCP) [2] as well as new UDP-based protocols such as QUIC [3]. While these new proposals aim to improve network performance, blocking or interference of unknown traffic at middleboxes makes it hard to deploy these protocols and enhancements at Internet scale.

We have already performed several measurement studies to detect middlebox-related impairments to specific protocol extensions, e.g. measurements on Explicit Congestion Notification [4,5,6] as well as TFO support [7]. These campaigns were performed with a tool for controlled experimentation with A/B-testing called PATHspider [8]. PATHspider measures connectivity to a target point for both without (A) and with (B) the extension enabled and observe the differences. Running PATHspider from multiple vantage points allows problems close to the target to be distinguished from those occurring closer to the Internet core. However, if a problem is detected PATHspider cannot determine where exactly the problem occurred. To gather further information a traceroute has to be performed that aims to detect traffic modifications along a given path with the known problem. tracebox [9] is a tool for isolating packet header changes along a traced route.

Thesis Goals

This thesis will integrate tracebox with PATHspider to enable more detailed analysis of detected path impairments. This leads to the following tasks:

1. Extension of the existing Python-based PathSpider tool with the ability to run tracebox if an impairment was detected
2. Data export to a central repository and analysis of integrated measurement data
3. Design and setup of a measurement campaign for existing test features in PATHspider, such as ECN, TFO, and DSCP

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