Continuous Measurements of Internet Path Transparency

Master / semester thesis

Background

Middleboxes in the Internet are network devices that perform functions other than just forwarding. These function are usually things like access control of firewalls, traffic classification 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] as proposed by Google. While these new proposals aim to improve network performance, middlebox blocking or interfering with this kind of traffic makes it hard to deploy them on a large scale or might even decrease performance at the end.

Several measurement studies have already been performed to detect middleboxes and the impairments they impose to specific extensions. E.g. measurements on Explicit Congestion Notification [4,5,6] as well as TFO support [7]. Both of these campaigns where one-time measurement using a tool for A/B-testing, called PATHSpider [8] that measures connectivity to a target point for both without (A) and with (B) the extension enabled and observe the differences.

Thesis Goals

This thesis will extend the measurement setup to perform continuous measurements to not only detect middlebox impairments that break path transparency but also monitor changes over time.

This leads to the following tasks:

1. Extension of the existing Python-based PathSpider tool with a management and scheduling interface based on the mPlane protocol [9]
2. Design and setup of a measurement campaign for continuous measurements: How often to measure? Which vantage points, which targets to use?
3. Data export to a central repository
4. Analysis of Path Transparency based on measurement data collected from different vantage points

Contact: Brian Trammell, trammell@tik.ee.ethz.ch, ETZ H93
Mirja Kühlewind, mirja.kuehlewind@tik.ee.ethz.ch , ETZ H93

Professor: Prof. Laurent Vanbever

References:

1. RFC 7413 - TCP Fast Open, https://tools.ietf.org/html/rfc7413
2. RFC 6824 - TCP Extensions for Multipath Operation with Multiple Addresses, https://tools.ietf.org/html/rfc6824
3. https://www.chromium.org/quic
4. RFC 3168 - The Addition of Explicit Congestion Notification (ECN) to IP, https://tools.ietf.org/html/rfc3168
5. Kühlewind, M., Neuner, S., Trammell, B.: On the State of ECN and TCP Options in the Internet. In: Proc. Passive and Active Measurement 2013, Hong Kong (March 2013)
6. http://ecn.ethz.ch
7. ftp://ftp.tik.ee.ethz.ch/pub/students/2016-FS/SA-2016-49.pdf
8. https://github.com/mami-project/pathspider
9. draft-trammell-mplane-protocol-00 - mPlane Protocol, https://tools.ietf.org/html/draft-trammell-mplane-protocol-00