Technische Universität Berlin

Internet of Things for Smart Buildings
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Distributed Security Infrastructures

EINSTEIN CENTER Digital Future

Master's Thesis:
Predictive Congestion Control of the Tor Network

Context

The Tor network enables anonymous communication on the Internet. It anonymizes Internet users by relaying their traffic over a series of intermediate nodes, instead of exchanging data directly with the recipient. Its ability to provide a reasonably high degree of anonymity has led to broad adoption amongst a variety of users who are in need of private online communication. However, efficiently transferring user data over multiple intermediate hops constitutes a networking challenge. Due to the use of multiple relays, bottlenecks that appear in the network can only indirectly be observed by the sender. Tor's current inability to effectively avoid congestion in the network, leading to such bottlenecks, is one of the main problems of current implementations of the Tor network, because the resulting impact on performance (data rate and latency) is significant.

Description

The main goal of this master thesis is to develop an optimization-based framework for the congestion control of the Tor network that improves the overall performance of current control techniques. The work will be divided in the following steps

- Development of a simple mathematical model based on current literature. This model should be used to obtain predictions of congestion at different parts of the network.
- Design of an optimization-based control strategy to reduce the overall congestion in the network. Based on the predictive capabilities of the previously developed model, inputs to the system will be defined and adapted dynamically, to ensure a smooth operation of the network.
- The designed controller will be tested in a realistic network simulator

Requirements

- Knowledge about mathematical modeling and/or numerical optimization
- Knowledge about predictive control and control theory is a plus
- Interest in computer networks
- Good Python or Matlab programming skills

Prof. Sergio Lucia
Internet of Things for Smart Buildings
sergio.lucia@tu-berlin.de
iot.tu-berlin.de

Prof. Florian Tschorsch
Distributed Security Infrastructures
florian.tschorsch@tu-berlin.de
dsi.tu-berlin.de