ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

SCION Endhost Path Selection Algorithm

Project Proposal

Introduction

This project is suited for students with an interest in inter-domain networking, algorithm design, computer networks and optimization problems in general.

You will learn about endhost routing optimization in path-aware networks, traffic engineering from the endhost perspective, and optimzation problems in computer networks.

The project leverages the path-aware property of the SCION network architecture [1].

Project description

Design of an application aware and network property aware path selection algorithm in SCION. SCION is a path-aware inter-domain network architecture deployed across multiple ISPs worldwide. Endhosts are provided with a sets of paths by their ISP from which they can select according to their requirements. The path selection algorithm takes into account the meta-data propagated by the SCION path construction beacons, and contained in the path segments, as well as other path specific information and the application specific performance goals to perform an optimal or close to optimal path selection. Some of the metrics are independent and orthogonal, while other are dependent or co-dependent of each other or even conflicting with path policy restrictions such as geo-fencing or device path policies. The work should expand on the capabilities of the existing path selection algorithm and provide more advanced optimization strategies, in both static and dynamic network environments.

Work packages

The following tasks have to be completed in this thesis; optional tasks are marked by a star symbol.

Phase 0: Register project and setup environment, familiarize yourself with the SCION architecture, and write the “Background” chapter of the thesis, literature review.

Phase 1: Design basic algorithm

Phase 2: Incorporate co-dependent metrics and weights

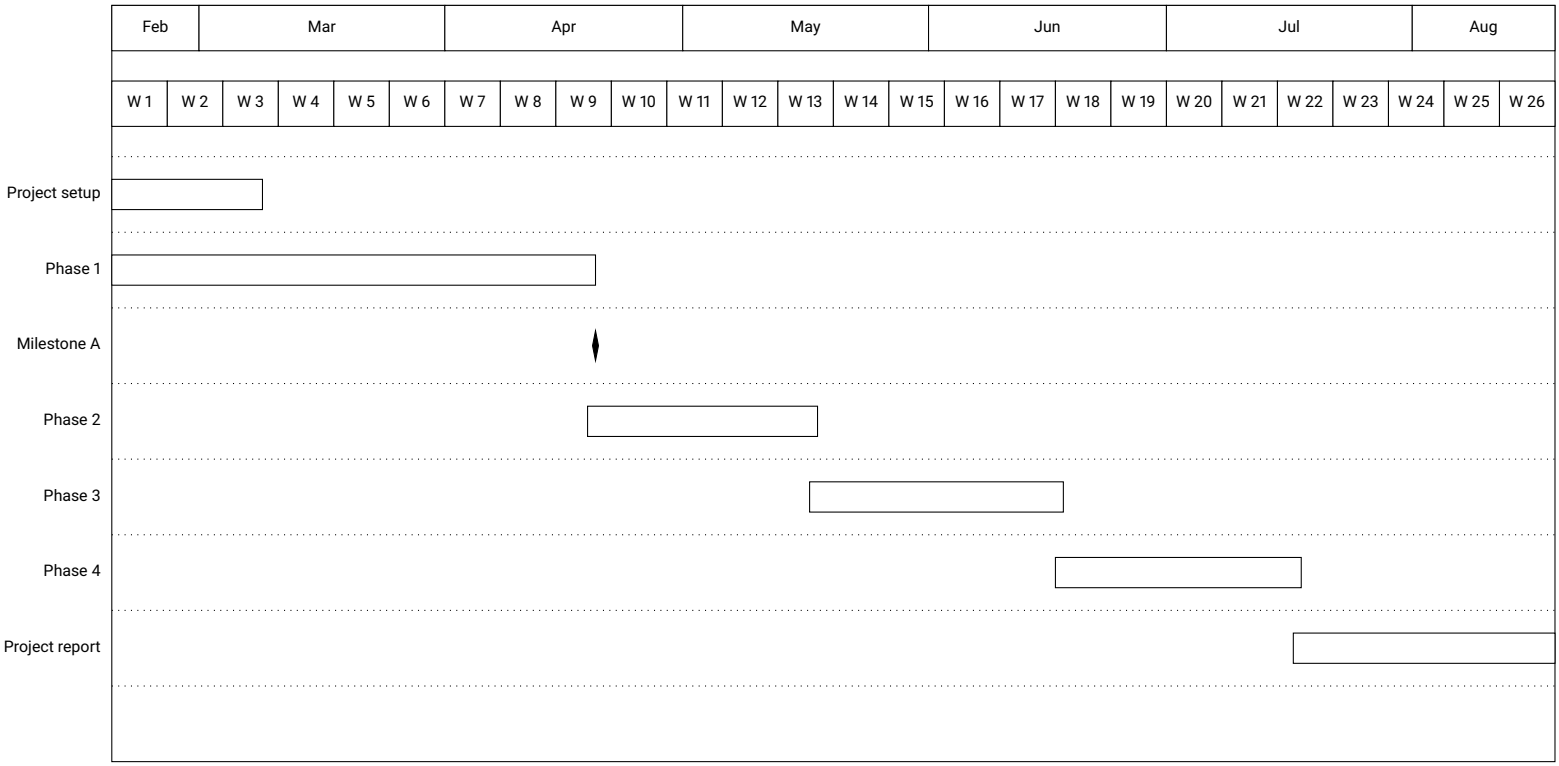
Phase 3: Tune parameter weights and validate algorithm stability, define NOR

Phase 4: Evaluate the algorithm in different (simulated) network environments

Phase 4b*: Explore path selection in a concurrent multipath setting

Phase 5: Finalize and hand in project report

Timeline



Requirements

- Foundations algorithms and optimization problems
- Foundations in networking
- Java programming is helpful but not required

Contact

Advisor Name: François Wirz (wirzf@inf.ethz.ch), Jordi Subirà Nieto (jonieto@inf.ethz.ch)

Organization

The student and the advisor will hold weekly meetings. During each weekly meeting, the student will briefly describe the work completed during the week and outline the work to be completed during the next week. The advisor will, if necessary, assist the student in identifying potential future issues and discuss current issues. Pressing complications arising between two meetings will be promptly discussed. The advisor will assist the student towards completing any agreed-upon milestones.

Grading Scheme

Grade	Description
6.0	Design and implementation, as well as thesis are candidates for submission to an academic conference or workshop.
5.5	Project quality significantly exceeds expectations.
5.0	Project meets expectations.
4.5	Project partially meets expectations and has minor deficits.
4.0	Project meets minimum quality requirements but has major deficits and is clearly below expectations.

References

[1] L. Chuat, M. Legner, D. Basin, D. Hausheer, S. Hitz, P. Müller, and A. Perrig. *The Complete Guide to SCION. From Design Principles to Formal Verification*. Springer International Publishing AG, 2022.