Master Thesis Project Description

Joar Heimonen

November 28, 2025

Temporary Title

DNS-Based Traffic Steering for IPv6 Enabled Edge Microservices

Temporary Thesis Statement

This thesis investigates whether DNS-based traffic steering combined with direct IPv6 addressing of microservices can function as a viable alternative to traditional Layer 7 ingress proxies and service meshes. This work includes both a systematization of existing solutions to proxy scalability, and an experimental evaluation comparing the Layer 7 based traffic steering with different configurations of DNS-based traffic steering.

Methodology

We will analyze the problem of proxy scalability and look at the principal approaches to proxy based traffic steering. This includes Layer 7 proxies, service meshes and client-side load balancing. The goal is to identify common design patterns and tradeoffs in these systems. This will allow us to identify the criteria best suited to comparing these systems with each other and with our DNS-based approach. This systematization of knowledge will assist in choosing paradigms to test.

We will design and implement a minimal DNS-server tailored to function as a kubernetes ingress controller. The DNS-server will be tailored for efficient traffic steering based on pod metrics. We will create dummy microservices and client simulators. Implement best practice configurations for our selected baseline paradigms. The number of pods will remain constant while the number of simulated clients will vary. Metrics like RTT, throughput, CPU utilization and failover behavior after simulated node and pod crashes will be analyzed and compared between the different paradigms.

Progress Plan and Milestones

Spring 2026

- Systematization of knowledge
- Start development of DNS server

Autumn 2026

- Finish development of DNS server
- Implement client simulator and dummy microservices

- Select baseline paradigms
- Start developing the experiments

Spring 2027

- Finish developing the experiments
- Perform the experiments
- Write the master thesis and related articles

Relevant Curriculum

AUTUMN25 - IN4070 - Logic - 10 ECTS
AUTUMN25 - IN5020 - Distributed Systems - 10 ECTS
AUTUMN25 - IN5060 - Quantitative Performance Analysis - 10 ECTS
AUTUMN25 - IN5060 - Recent Advancements in Internet Protocols - 10 ECTS
SPRING26 - IN4000 – Operating Systems - 20 ECTS
AUTUMN26 - IN5031 - Protocols and AI for Future Internet - 10 ECTS