



Master thesis No. 1009  
Queuing Delay Avoidance with Multipath Routing



**Methods**

Programming in Java  
Simulation

**Topics**

Queuing Delay  
IP Networks

**Background**

Research in queuing systems is a mature topic that has started in the 20th century and still remains very relevant for modern communication systems. Since queuing delay is considered to be a difficult topic to take into consideration in research of core networks, it is often completely ignored even if this can potentially lead to misleading results. Nowadays, given the explosive increase of low-latency demanding applications, it is important to take into account all possible delays as well as find ways to contribute to a lower end-to-end latency.

This master thesis considers the problem of queuing delay in IP networks and investigates ways of reducing the overall end-to-end latency through clever routing. In a meshed network environment there are a lot of paths connecting each node pair and one FIFO queue per output port in an IP router. This gives us the possibility of choosing different paths for the same end-to-end demand, what is commonly known as multipath routing. It is expected, that this flow segregation will overall decrease queuing delay, but at the same time increase the propagation delay. The topic of this thesis is to investigate this phenomenon and come up with a heuristic to accomplish a lower average of end-to-end latency.

**Problem Description**

In the context of this master thesis, you are asked to develop a heuristic algorithm that will make use of multipath routing and will result in a statistically lower end-to-end latency compared to a conventional shortest path routing algorithm. More specifically you are asked to:

- investigate relevant literature for queuing models and routing algorithms
- select from literature an appropriate traffic model for core networks
- develop a heuristic to reduce end-to-end latency in an IP network
- integrate your heuristic and model in the simulation tool provided by IKR
- evaluate the performance of your heuristic method via simulation

**Acquired Knowledge and Skills**

Through this work you will deepen your knowledge of queuing systems. You will also have the possibility to work with SimLib, a big scale discrete event simulation library from our institut. Moreover you will get a good insight in modern problems of IP computer networks and challenge yourself to come up with creative solutions.

**Requirements**

Communication Networks Architecture and Design  
Programming Experience in Java

**Desirable knowledge**

Kommunikationsnetze I

**Contact**

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