Green Routing

Graduate

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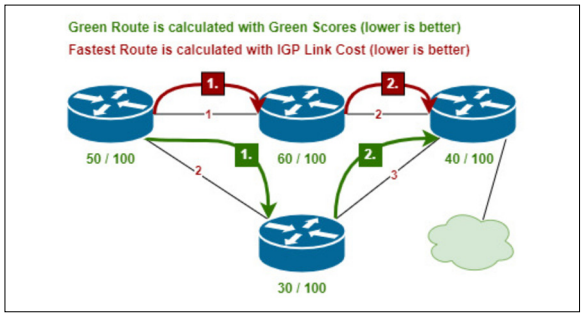
Introduction: Traditional routing protocols and techniques are often used in today's networks, and their basics were generally established before the millennium. In recent years, the network area has not experienced the same level of fast transformation as other IT industries. With the development of the digital world and the introduction of new industries and technologies like 5G and cloud computing, the volume of data transferred through networks today is massive and will continue to expand in the future. Modern networks must not only deal with an unprecedented amount of data transmissions, but many new requirements have emerged in order to meet client demands. In our time with climate change a new requirement on the energy efficiency of routing has emerged.

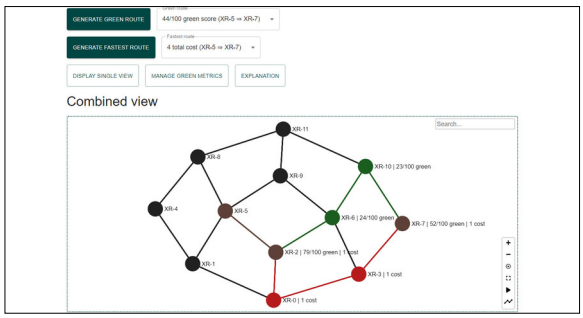
Problem: The latest estimates for the ICT sector indicate emissions of around 1.4Gt of CO_2 per year. Internet backbone networks are responsible for six percent of this ecological footprint. The growing bandwidth creates new opportunities to consider other metrics and aspects in addition to the traditional ones which mostly only tend to prefer path with the highest throughput.
This thesis is looking for a solution to implement a green routing approach, where in a network the most ecological paths are to be computed. The solution should be able to compute paths efficiently underlying a defined green index based on sensor data from routers as well as external factors like the source of electricity or the cooling used in the datacenter.
It should be possible to view the network over a simple web interface and compare different scenarios. Additionally, it should be possible to deploy the calculated green route on the network.

Result: The application can be accessed over a frontend where the synchronized network is displayed, and the calculation of a green route can be executed. It is possible to select the metrics used for the green index beforehand. The underlying calculation of the best paths based on the green index has been implemented by a Green SR-App software in form of a REST-API. This backend API, which is written in modern GoLang, can synchronize all network data via the Jalapeño API Gateway. It can react on topology changes, process and store the received data for future statistical analysis and then calculate the best paths over a predefined period of sensor data based on Yen's k-shortest paths algorithm. If desired, the generated green route can then be deployed on the network.
The software is designed to be very performant in very large networks of up to 1000 routers and links. It also displays the fastest route over the network that can be used to compare the greenest path to the fastest path and their metrics.

Green route instead of fastest route
Own presentment



Green SR-App Frontend
Own presentment



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Subject Area
Internet Technologies and Applications

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