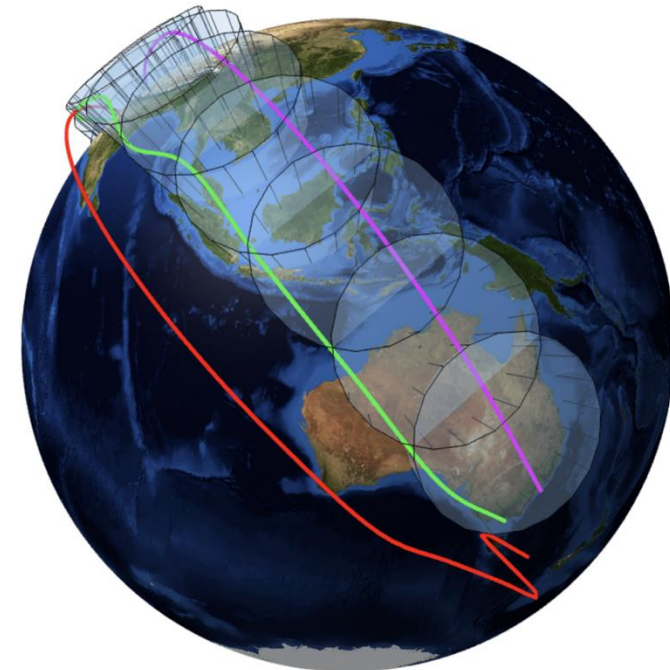


Optimizing Geographic-Based Routing in LEO Constellations

Motivation

LEO Constellations (e.g., Starlink) rely (at least in-part) on Inter-Satellite Links to enable end-to-end connectivity between any two places on Earth. This communication requires robust routing protocols which can establish an end-to-end path over the ever-changing network. To address this challenge, we proposed the Geographic Checkpoint Routing (GCR) protocol [1], which defines the end-to-end path between any two points on the Earth through geographically defined checkpoints, thus decoupling the routing decisions from the constellation's topology. This approach was also recently extended to handle specific edge cases [2], thus optimizing the achievable end-to-end latency and paths traversed through the constellation.



Thus far, GCR was validated only in specific scenarios and mostly with latency and hop-count optimization in mind. The goal of this thesis would be to continue this evaluation, extending it to distinct scenarios spanning various geographically distributed communication endpoints and different constellation characteristics. The aim of this investigation would be to assess the feasibility of the algorithm for real-world deployments, looking not at specific optimizations, but the performance of the algorithm in general. This will also enable identification of remaining challenges, allowing for further improvements for the protocol, also being this thesis's goal.

Your Tasks

- Verification of the applicability and usability of the used simulation software (OMNeT++ [3] with FLoRaSat [4])
- Verification of functionality of GCR and its extensions in complex scenarios
- Identification of challenges and their causes within GCR
- Preparation and validation of enhancements, improving the protocol's performance

Requirements

- Excellent knowledge and understanding of computer networking
- Good programming skills in C++ and Python (or other language enabling result processing)
- Understanding of communication over LEO Constellations is desirable
- Prior knowledge of simulation software, e.g., OMNeT++ with FLoRaSat, is a plus

References

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