

# Modelling Low Earth Orbit Constellations for Networking

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## 1 Introduction

SpaceX are planning to launch a constellation of 4,425 low Earth orbit communication satellites in the next few years. The objective of this constellation, called Starlink, is to provide low-latency internet connection across the world.

The satellites in this network will be in constant motion, not just relative to the ground, but relative to one another, creating a network with a constantly changing topology and associated latencies. The question of how to route signals across such a network has not been thoroughly explored, but it will become increasingly relevant as more and more companies build similar constellations.

My goals are:

1. To develop multiple routing algorithms for this network.
2. To compare these algorithms on latency, fault tolerance, and response to high demand.
3. To create visualisations of these routing algorithms at work.

This network, and networks like it, are the future of the internet.

## 2 What is Starlink?

As of 21/11/18, there are two companies offering satellite internet services, Excede[?], and Hughes, whose 9202 BGAN Land Portable Satellite Terminal

offers connection speeds up to 464kbps[2]. These companies largely target domestic use in rural areas which don't have a faster coverage, and corporations, providing internet connections to airplanes and cargo ships. Currently, Satellite Internet connection is a last resort, something turned to when conventional means of connection are not available, Starlink intends to invert this, turning satellite internet into the premium option,

SpaceX have already sent up two test satellites, and according to Elon Musk, they are working very well, providing a latency of only 25ms[3].

## 2.1 The Structure of Starlink

There is a lot we do not know about Starlink, but this is what we can infer from SpaceX's application to the FCC[4], and their technical attachment[5].

## References

- [1] <https://www.exede.com>
- [2] <https://www.hughes.com>
- [3] <https://twitter.com/elonmusk/status/1000453321121923072>
- [4] [licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/related\\_filing.htm?f\\_key=-289550&f\\_number=SATLOA2016111500118](https://licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/related_filing.htm?f_key=-289550&f_number=SATLOA2016111500118)
- [5] [https://licensing.fcc.gov/myibfs/download.do?attachment\\_key=1158350](https://licensing.fcc.gov/myibfs/download.do?attachment_key=1158350)