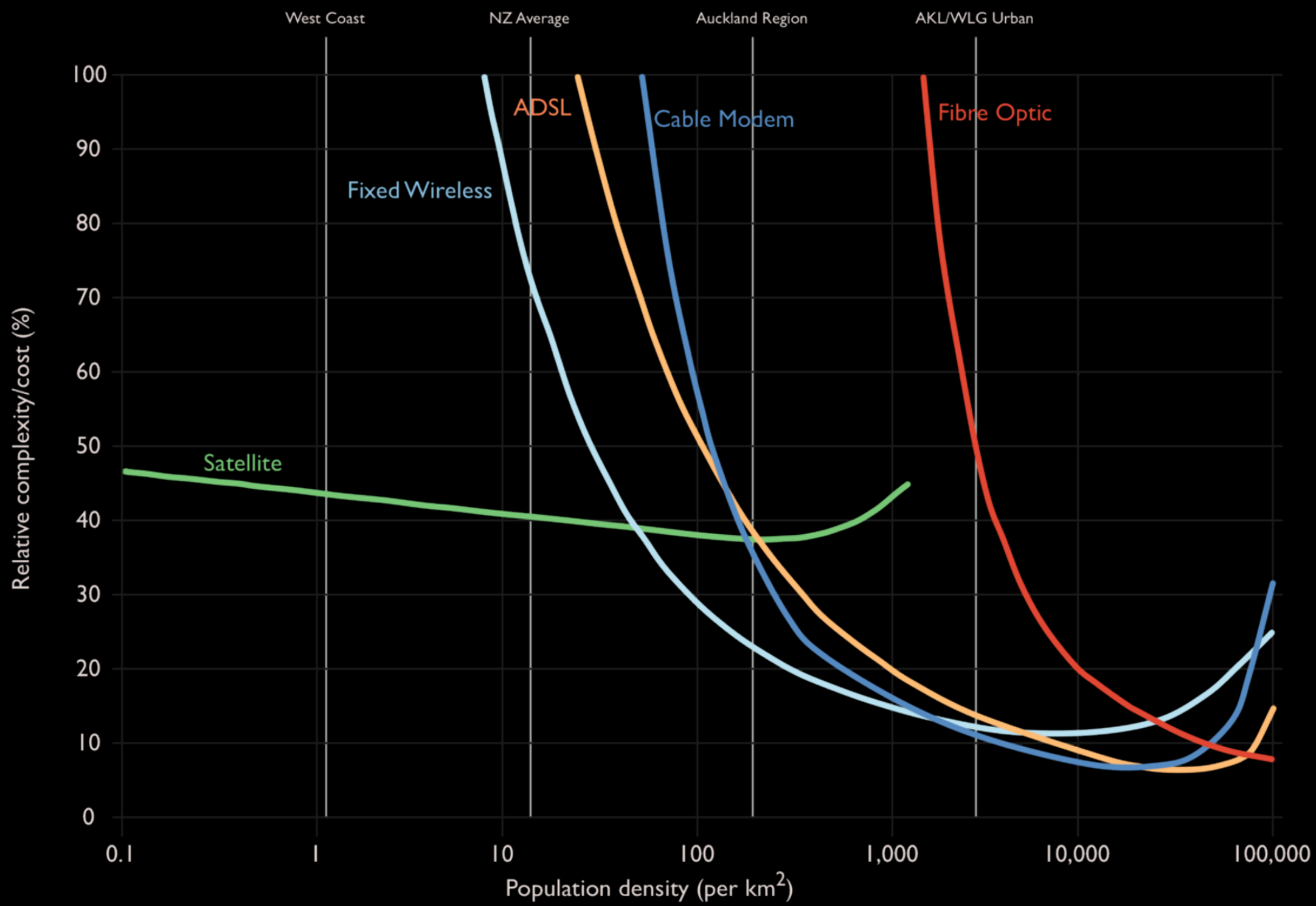
UP IN THE SKY

- The future is

LETS TALK ABOUT THE FUTURE

- Why do we need satellite?
- Common Orbits & Latencies
- Radio Spectrum Matters
- Satellite Architectures
- Commercial Ventures

WHY WE NEED SATELLITE



ORBITS & LATENCIES

LEO

1K

12MS

MEO

10K

120MS

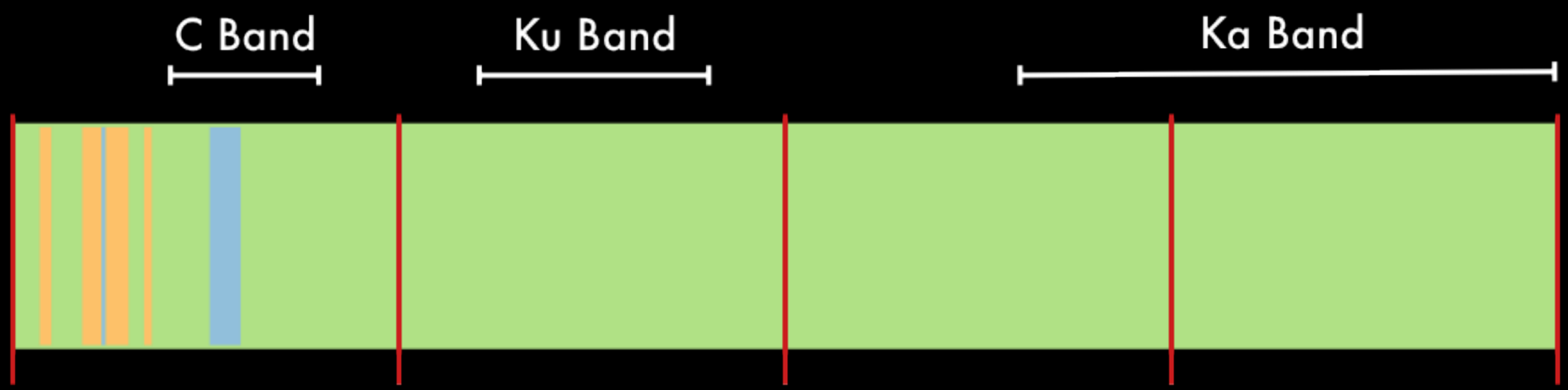
GEO

36K

480MS

AT LEAST FOUR ONE-WAY TRIPS TO LOAD A WEB PAGE
IN ADDITION TO INTERNET LATENCY

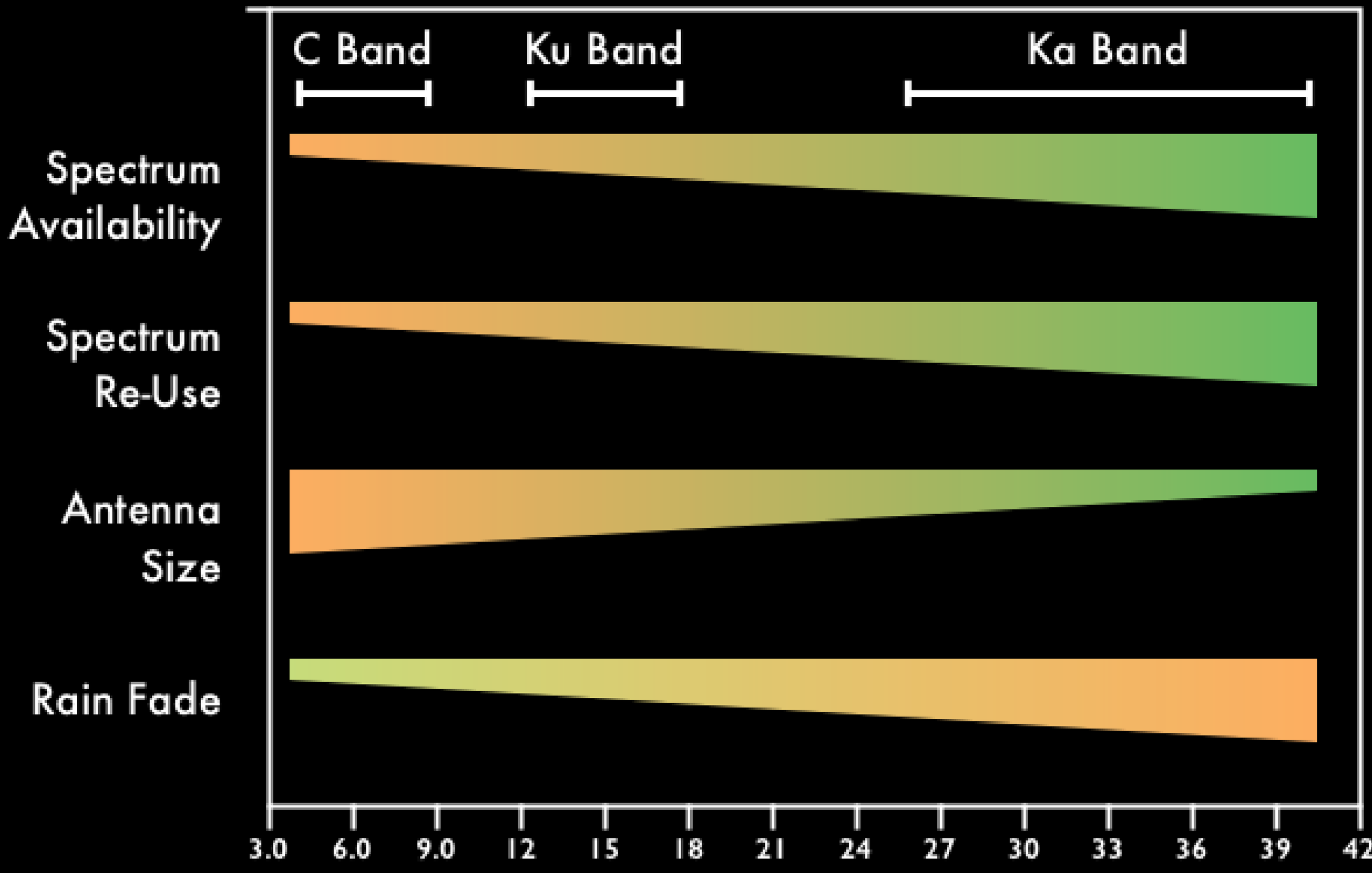
BROADBAND SATELLITE SPECTRUM



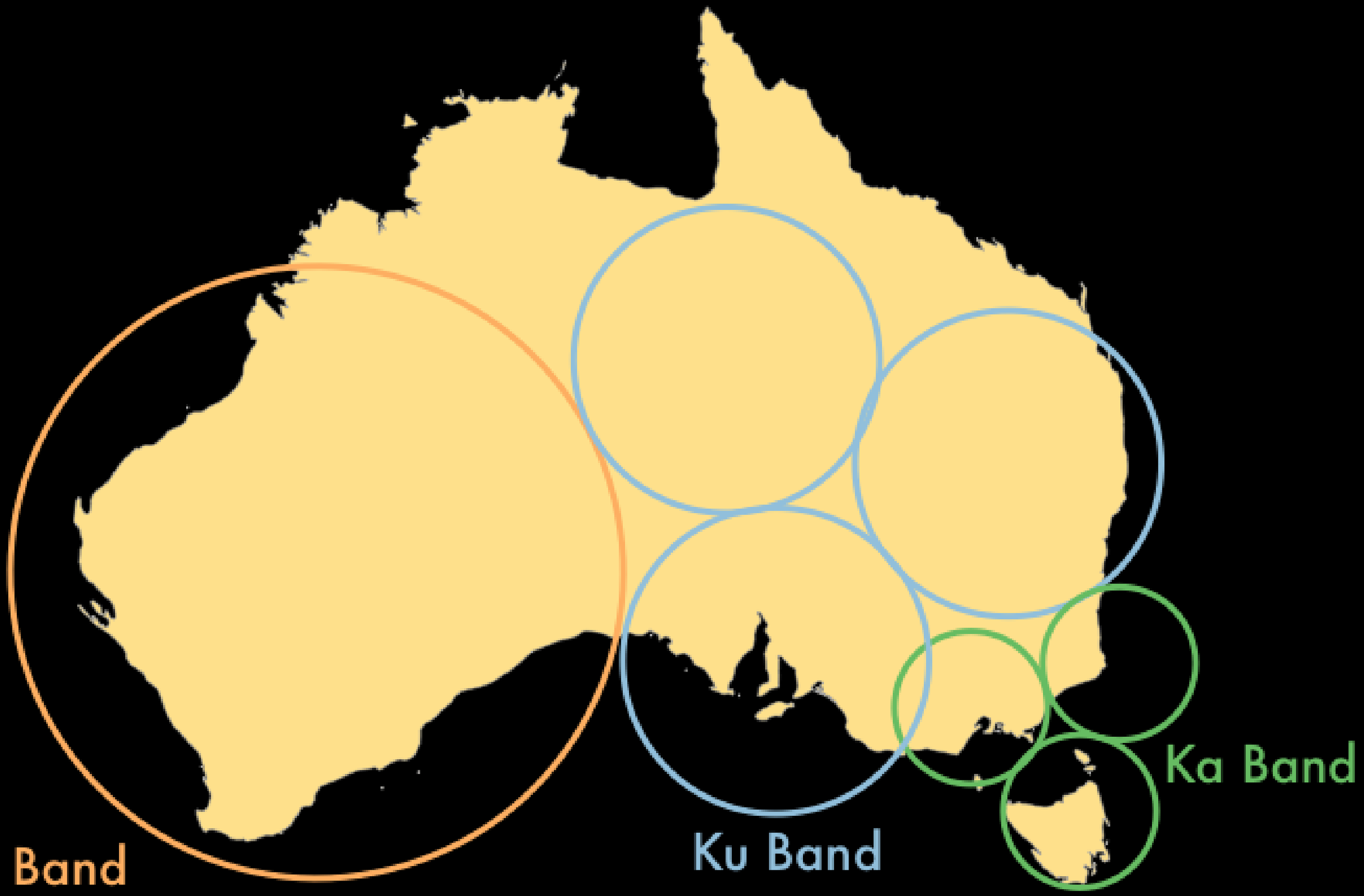
C Band — Ku Band — Ka Band

L-BAND & V-BAND ARE NOT FOR BROADBAND ACCESS

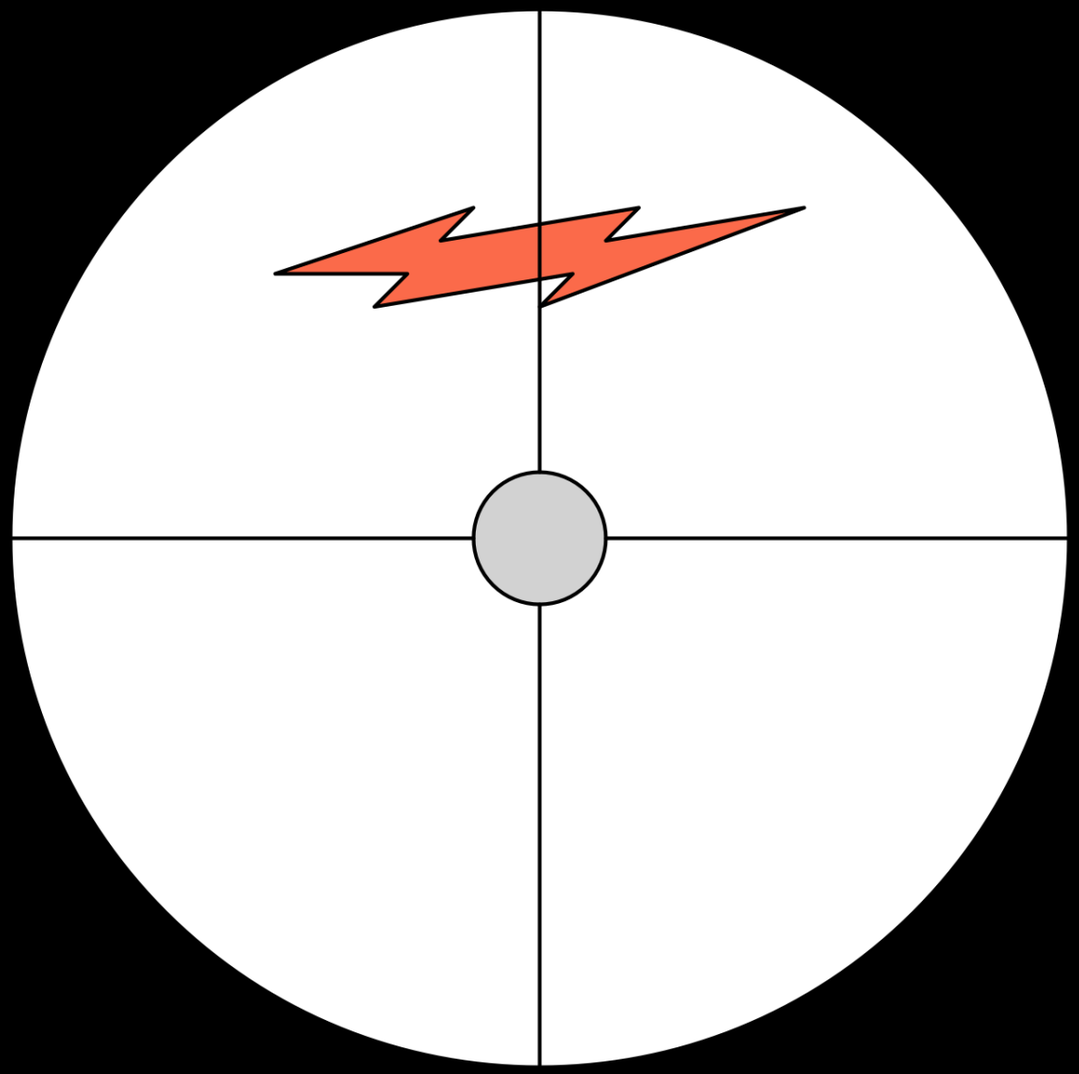
SATELLITE SPECTRUM PRIMER



SATELLITE SPECTRUM REUSABILITY

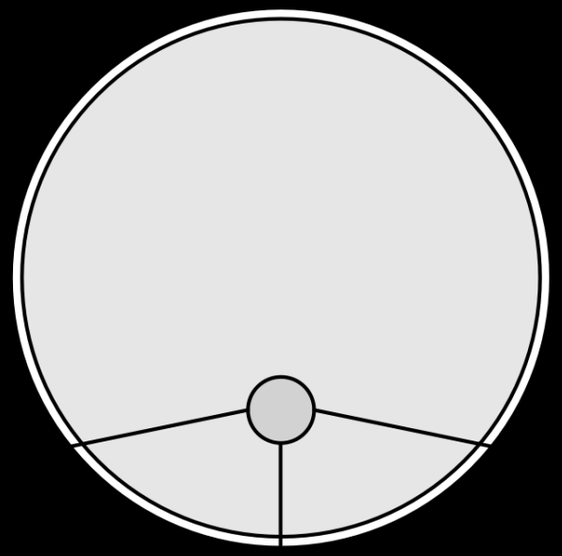


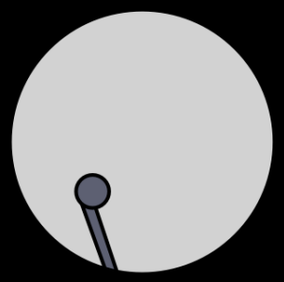
HIGHER BANDS = SMALLER ANTENNAS



C Band 30 dBi

Ku Band 30 dBi



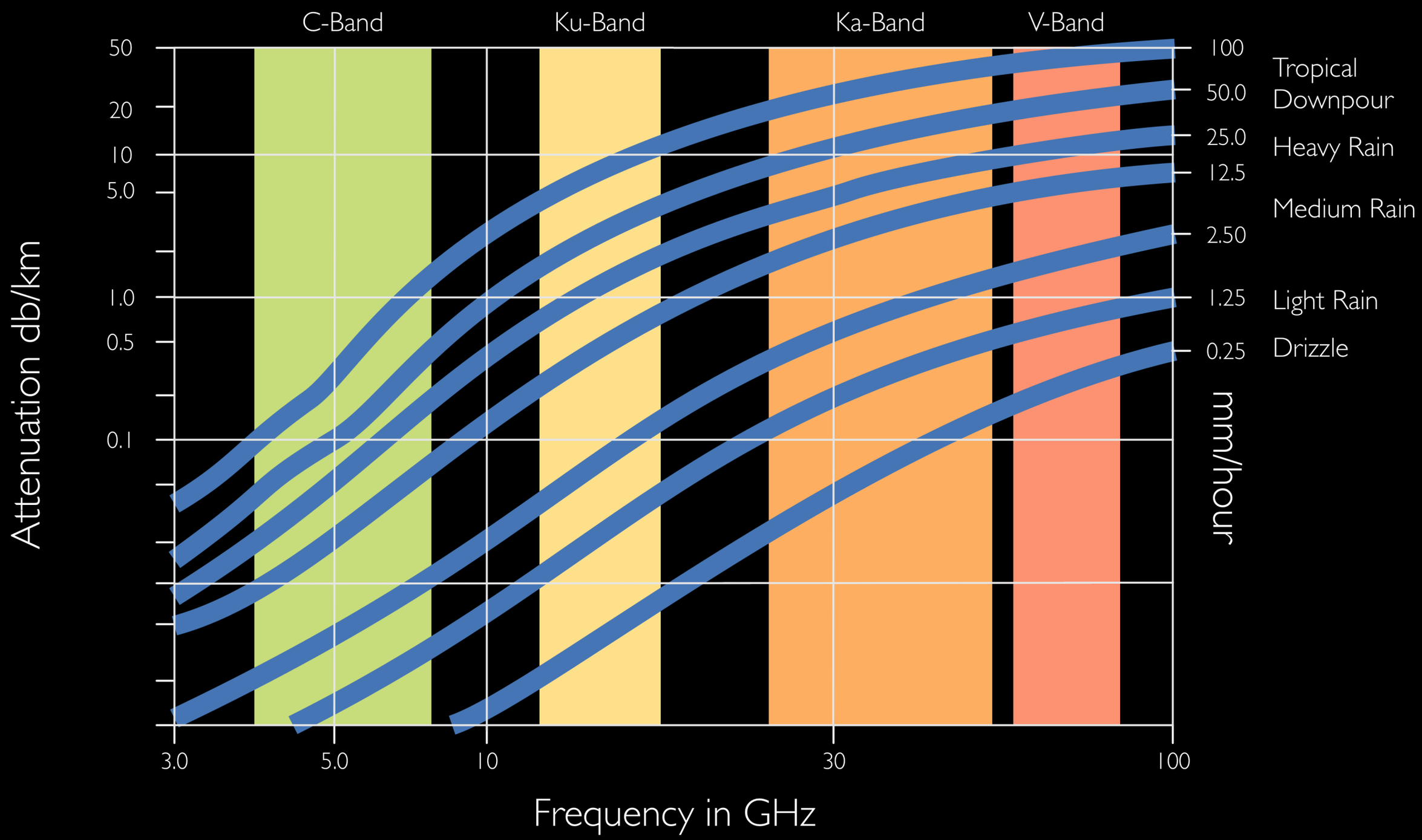


Ka Band 30 dBi

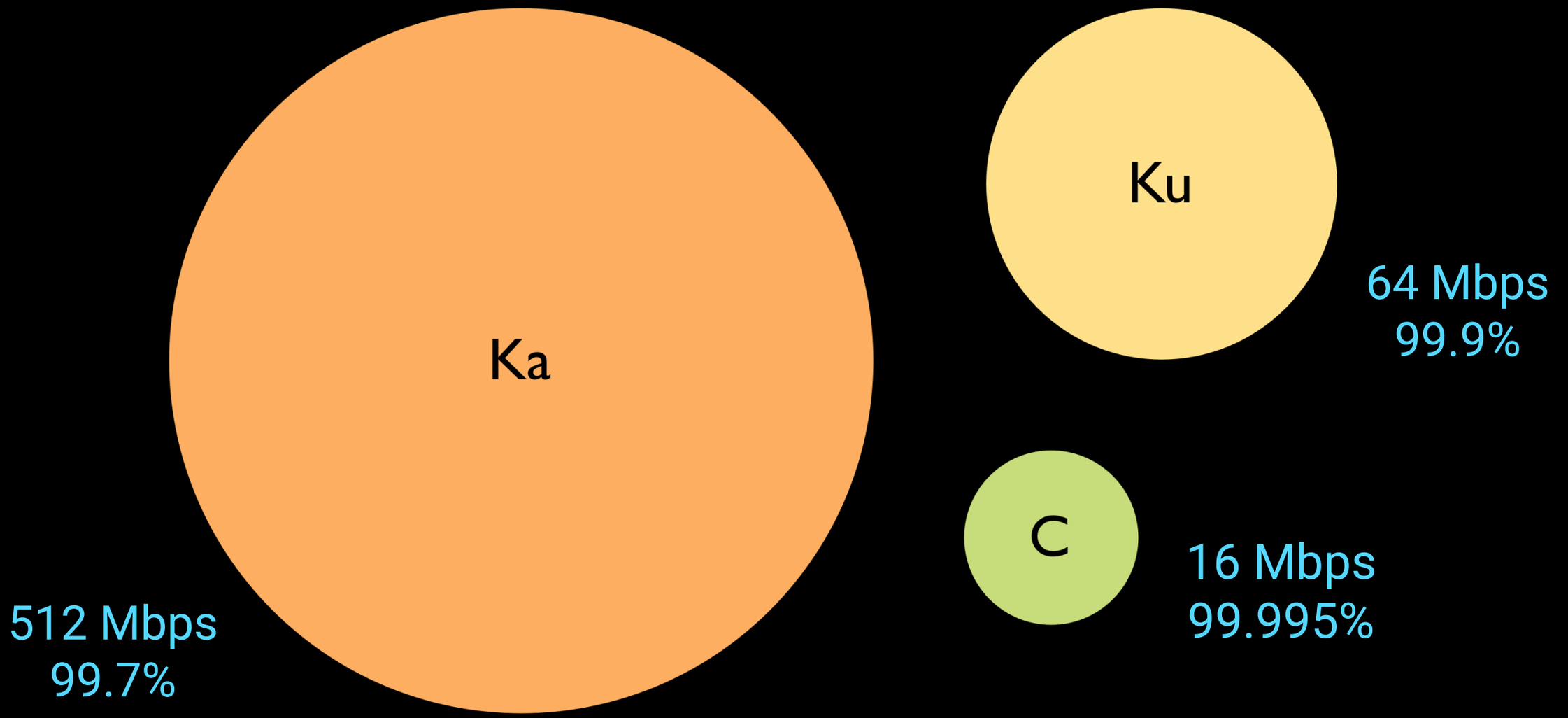
C BAND NEEDS 16X AREA OF KA BAND
FOR THE SAME AMOUNT OF GAIN

HIGHER BANDS = MORE RAIN FADE

HIGHER BANDS = MORE RAIN FADE

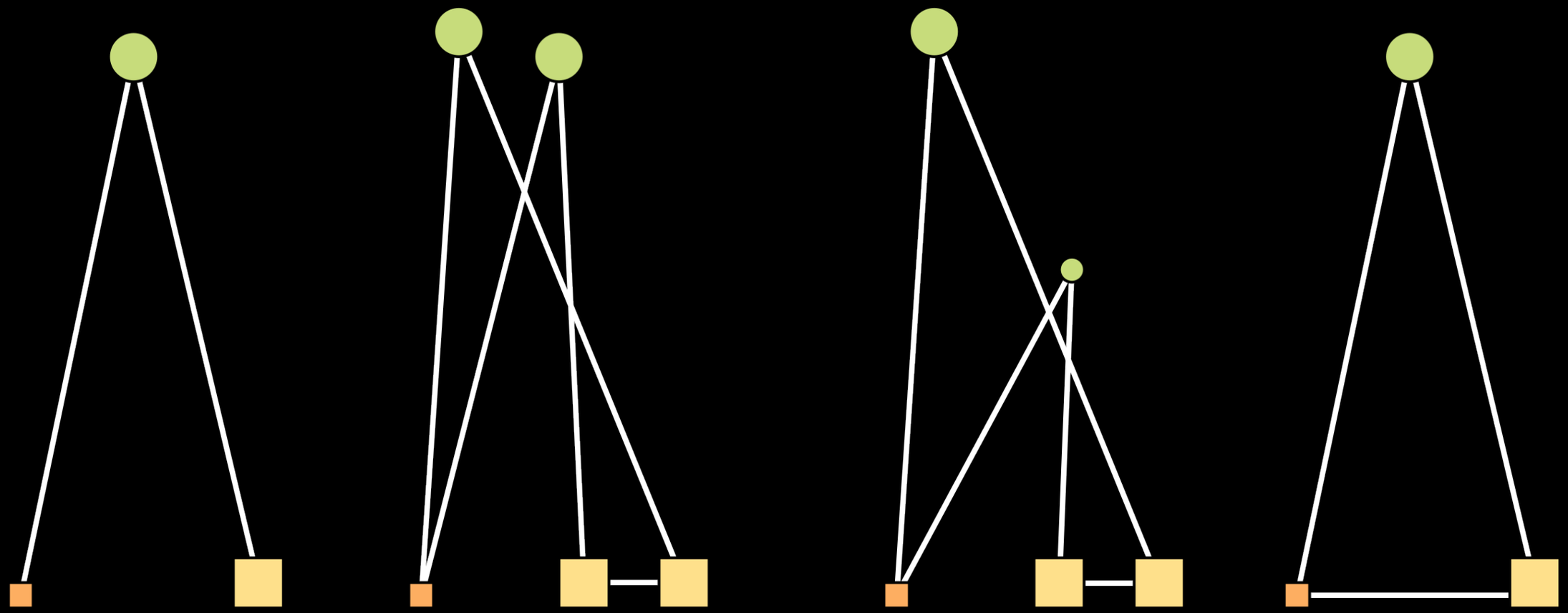


SATELLITE BANDS STRAW MAN
TEMPERATE CLIMATE



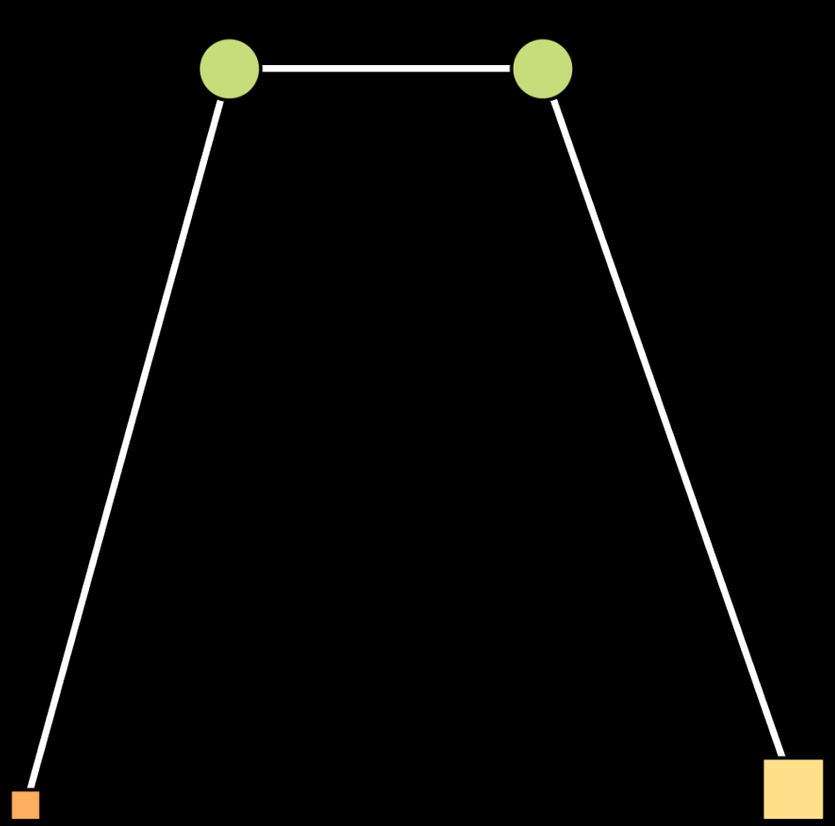
ASSUME A 1.2M DISH ON THE GROUND

NETWORK ARCHITECTURE

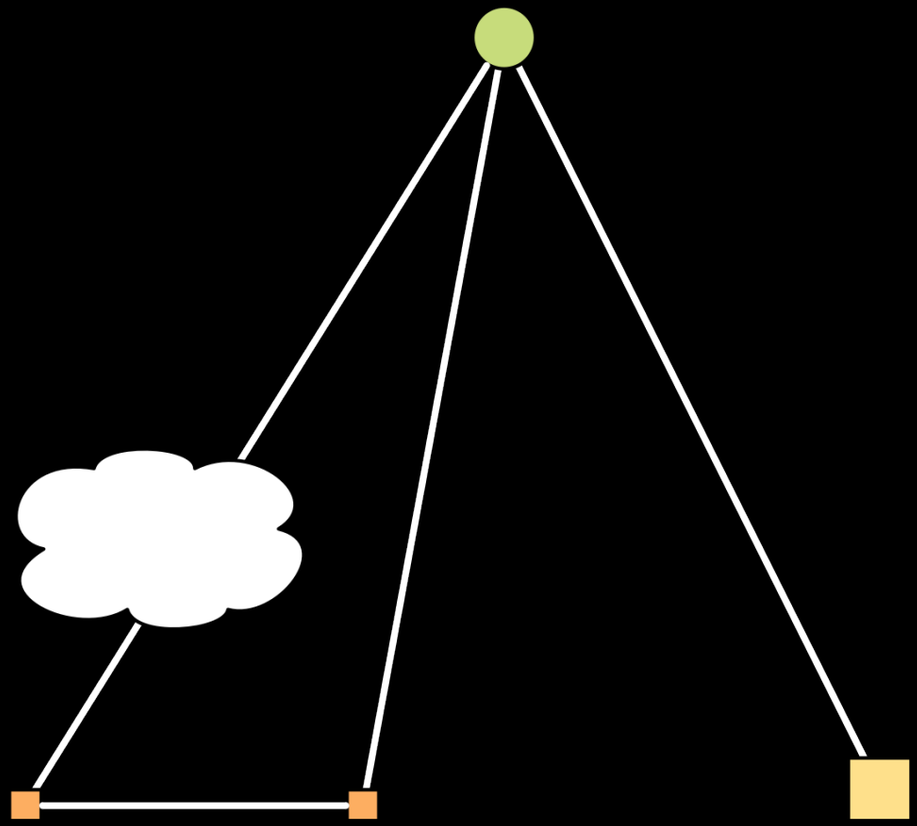


Up & Down | Redundant VSAT | Multi-Modal | Multi-Modal

ADVANCED NETWORK ARCHITECTURE



Sat X Link



Cloud Avoidance

CONSIDER ARCHITECTURE

- Blended Satellite Services
- Different Capacities
- Different Availabilities
- Different Latencies
- Rapid Latency Changes
- How do we make this work?

REPRESENTATIVE COMMERCIAL VENTURES

TELCO2 IETF 101 LONDON MARCH 2018

NBN CO SKY MUSTER

- GEO orbit, Ka band
- 2016-2030 (est.)
- 400+ ms latency
- 2x 67.5 gbps SSL 1300
- 25/5 mbps to users
- Ten Earth Stations

03B NETWORKS

- MEO Orbit, Ka band
- Carrier Focussed since 2014
- Up/down only (no sat-sat)
- 1.2gbps 700 km beams
- 144 gbps online, 96 ordered
- 2x Tracking antennas req
- Rain fade even w/ 4m dish

ONEWEB

- 700+ Ku Band LEO Satellites
- Imperceptible Latency
- Consumer Focus from 2019
- Big-Name Investors
- Global Coverage
- 6 gbps per sat, 4.2T network
- Intelsat Plan Blended Offerings

Image ©OneWeb

Expanded versions of this talk are available

- APNIC 2017: https://youtu.be/YDedVZ04aqk?t=8s
- NZNOG 2017: https://youtu.be/7i8Yn-qCa-M?t=25m3s

QUESTION & ANSWER

- How many new satellites will we see in ten years?
- Expect at least an order of magnitude increase from today's 1,500 active communication satellites.

- Does latency matter to all traffic?
- No. streaming media works well over high latency.

- Will the leo networks provide global coverage?
- Not necessarily. They may sleep to conserve power over sparsely populated areas.

- Will leo provide broadband to mobile phones?
- No. mobile Broadband service requires antennas far larger than phones.

- What's the orbital period of a LEO satellite?
- Between 90-120 minutes.

- How big is a communications satellite?
- Between 300kg and 6,500 KG

- Why will these new ventures succeed?
- Smaller, lower cost electronics. Advances in power systems. Competition in orbital launch capacity