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

AT LEAST FOUR ONE-WAY TRIPS TO LOAD A WEB PAGE IN ADDITION TO INTERNET LATENCY
C Band    —    Ku Band    —    Ka Band

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

![Graph showing the relationship between frequency and attenuation in different bands.](image)

- **C-Band**
- **Ku-Band**
- **Ka-Band**
- **V-Band**

**Attenuation** dB/km vs. **Frequency in GHz**

- Tropical Downpour
- Heavy Rain
- Medium Rain
- Light Rain
- Drizzle

**mm/hour**
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
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