

# A World of Pure Approximation

Rules of Thumb and other Fun Facts

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# “How the #%\$\*@# did you know that?”

- Network Planning is the intersection of technology, geography, and arithmetic.
- Also, a lot of educated guesses based on incomplete information.
- Cached information is important, but the cache isn't that big, and most information changes.
- Here are some rules of thumb (and other fun facts) that are not likely to change all that much, that I use to make better decisions about planning networks, understanding network costs, and generally reasoning about the world.
- Ready? Here we go.

# Distance and Time

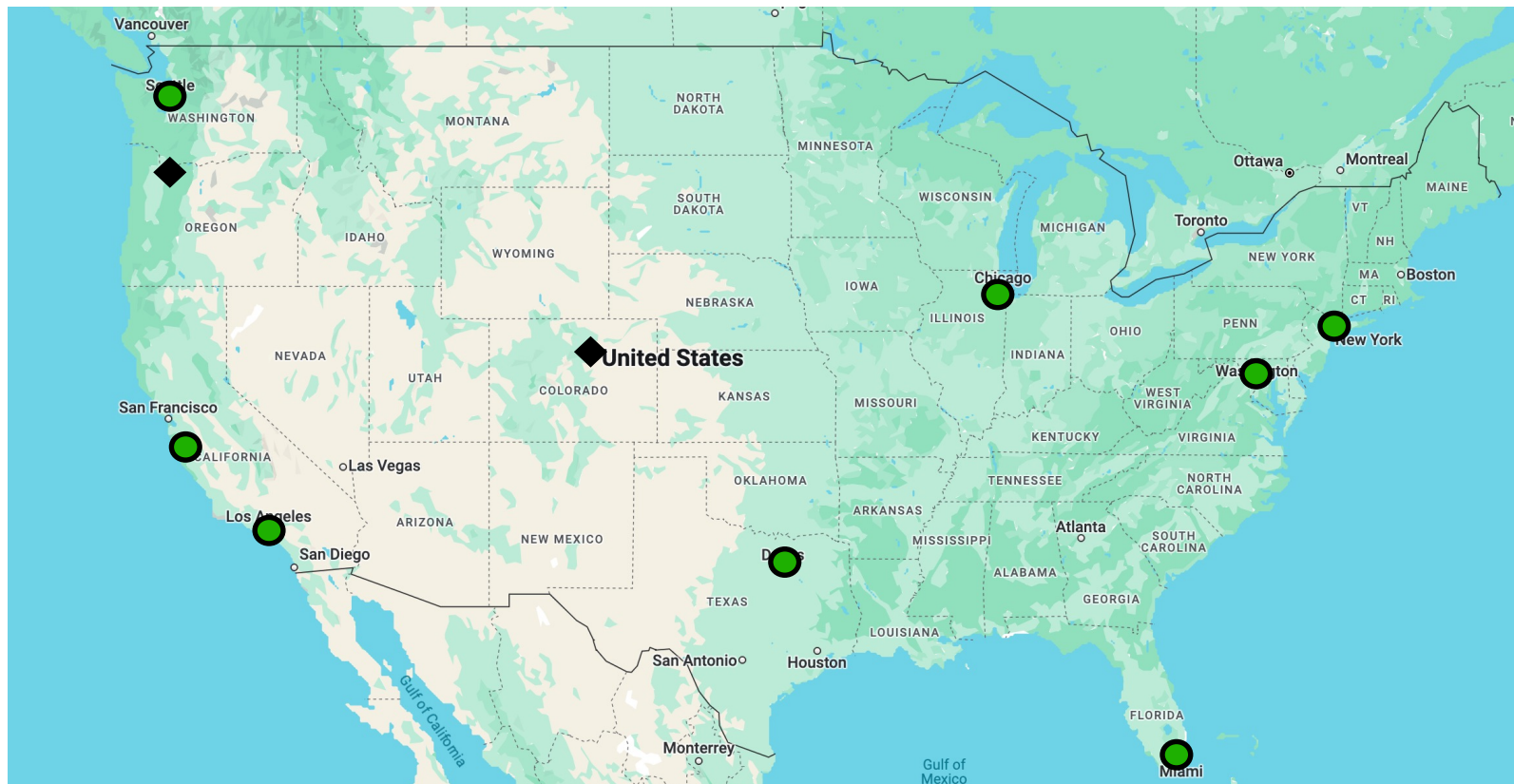
- **1ms RTT = 100km in fiber**
  - The speed of light hates us all equally.
- **Use driving distances to approximate fiber length btw. 2 points on land.**
  - Great Circle is OK for water, but on land fiber goes where the roads go.
- **NYC to LA = 80 ms RTT**
- **NYC to London, UK = 90ms RTT**
- **MIA to São Paulo, BR = 120ms RTT** (this is a really important one)
- **Geosync orbit = ~250ms RTT**

# Speed and Size

- **7 Mbit/sec = 1080p video streaming (w/ compression)**
- **632 GB = 1 Mbit/sec/month**
  - e.g.  $632 \text{ GB}/(\text{Mbit/sec/month}) * \$0.09/\text{GB} = \$56.88 \text{ Mbit/sec/month}$
- **The TCP Delay Equation**
  - At higher bandwidth, bits don't get faster; they just get smaller.

# Places

## The United States: The “Big 9” (and a couple of others)

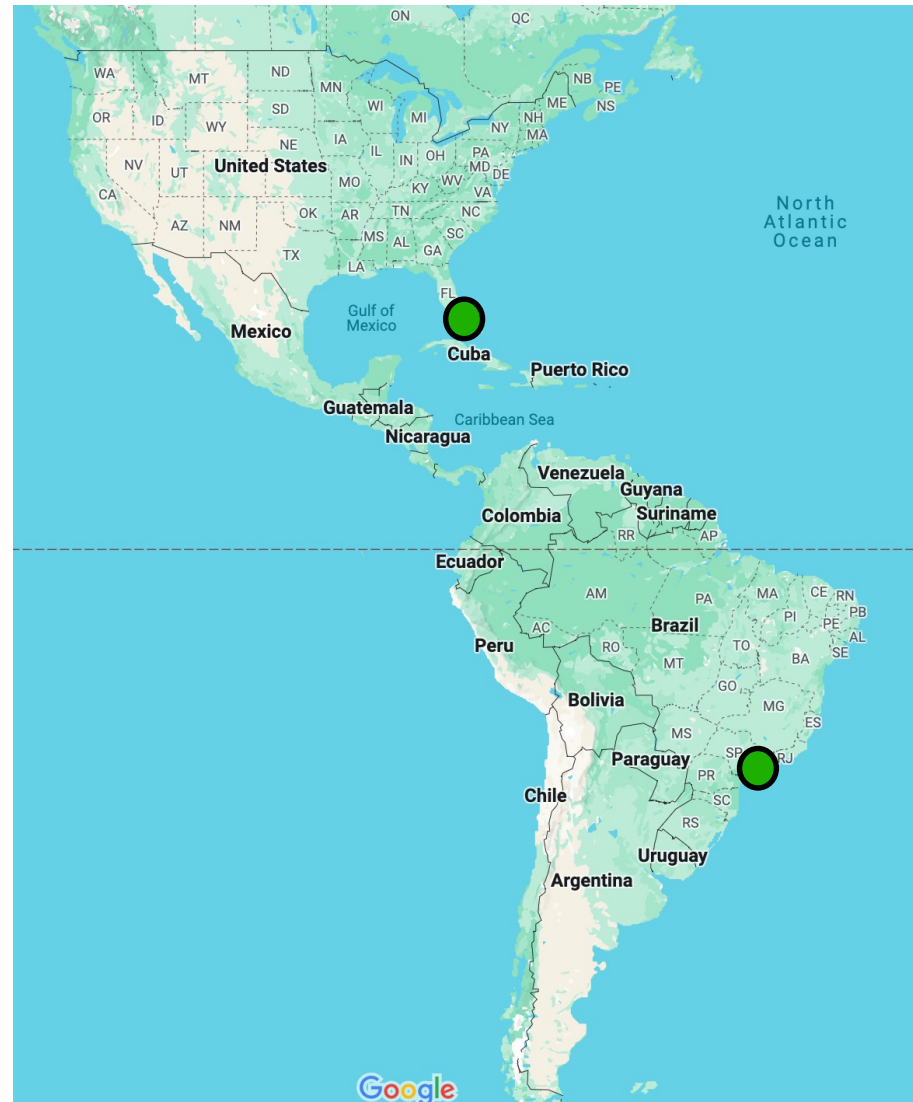


# Places

**South America is only kind of South of North America**

**São Paulo is 2 timezones east of US EST.**

**This is also why fiber from MIA to RIO/GRU is such a shlep.**



# Putting It Together

- **Sanity checks on point-to-point fiber connections**
  - 1200km = 12ms as a theoretical lower limit.
  - Getting quoted 30ms is bad. Getting quoted 7ms is impossible.
- **You can't get a 7 Mbit/sec live stream from MIA to GRU over TCP**
  - The most you can hope for is 4-5 Mbit/sec, because physics.
- **Bogotá, Colombia is due south of Miami (through Cuba)**
- **Cloud egress can be incredibly expensive.**
  - “Logs in, toothpicks out.”

# Any Questions?

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