I’m glad you’re here!

Brief introductions

- Your name
- 1 sentence background
- Why are you interested in internet infrastructure?
WHAT IS INTERNET INFRASTRUCTURE?

• The pipes that carry the bits from across oceans, between cities, down your street, and into your hands.
  • **Wires** (fiberoptic cables/coaxial cable/twisted pair cables)
  • **Waves** (LTE/5G/Long-distance microwave)

• **Why is this infrastructure important?**
  • Without it, there is no Internet.
    • Protocols don’t do much if there is no where to carry the bits!
  • Building and operating Internet infrastructure is *extremely resource intensive* and *hard to change*
    • People, Pipes, Permits, Power, Ships, Submarines, Satellites, Towers
THIS INFRASTRUCTURE IS ALL AROUND US

Middle-of-Nowhere
Arizona

Genesee Ave.
Arizona
BUT WAIT, IS THAT STUFF EVEN COMPUTER SCIENCE?

- In CS networking courses and research we often focus on protocols and policy. Why?
- Doing research on infrastructure is hard.

*You need to interact with the physical world*
Researchers have realized we can’t ignore it anymore

- Infrastructure imposes fundamental limitations
  - Reliability (Nashville bombing takes down entire state)
  - Performance (latency for AR and bandwidth for 4k)
  - Scalability (reaching the next billion people)
BUT WAIT, INFRASTRUCTURE IS OLD NEWS

• First telegraph line was used in 1844 (Morse)
• First wireless message sent in 1898 (Marconi)

There isn’t much work left to do, right?
WHAT WILL WE COVER IN THIS COURSE?

Wires and Waves

- Backbone links (Transcontinental and undersea)
- Internet Points-of-Presence (Internet Exchange Points)
- Regional Access Networks (Metro fiber, p2p Microwave)
- Last-mile links (“Broadband”)
  - Wired: Fiber-to-the-home, CableTV.
  - Wireless: LTE, 5G, Satellite (to home, in flight), Rural WISPs
PRE-REQUISITES

• Undergraduate networking
  
  • E.g., CSE 123

• You will need a strong foundation in undergrad networking

• We’re going to be reading research papers that assume you remember those concepts (e.g., Routing)

• To brush up:


  • (Free online!)
A LITTLE ABOUT ME

- I am *obsessed* with Internet Infrastructure
- I have been that way for a while (my dissertation)

> Introduction

The Internet links that connect to homes and mobile devices are called *last-mile links*. When last-mile links are not available, the effectiveness of government services is undermined, the profits of businesses are diminished, and the flexibility of the workforce is lost. However, unlike links in the core of the Internet, last-mile links are typically not redundant. As a result, the reliability of any single link is of paramount concern: when last-mile links fail, people can be completely disconnected from the Internet.

- ...the pandemic shows this wasn’t just dissertation fodder

The Internet was critical to keeping society’s lights on.
GOAL OF CSE 291

- Bring you **up to the state of the art in Internet Infrastructure design and operation**
  - [Mon] review of concept then [Wed]/[Fri] Papers
- Give you the skills needed to **stay at the state of the art for your entire career**
- Project: Work on a (small) research project of your own to study your own Internet infrastructure, culminating in a ~6 page research paper.
- Deadlines on schedule, seed ideas posted soon
READING FOR MONDAY

Lecture: Origins of Internet Infrastructure

1. Distributed Communication (1964) Chapter IV
2. Attracting Capital for Railway Development in China Pg. 161 - 173