CSE 291: INTERNET INFRASTRUCTURE

Infrastructure History

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Entire Internet (ARPANET) in 1973

LOGISTICS

- Canvas
  - https://canvas.ucsd.edu
  - Course homepage has schedule
  - Online Q&A
  - Quizes, gradebook, some materials
- Each other!

GRADING

- Class project: 50%
- In-class participation: 25%
- After-class Quizzes (once a week on Fri): 25%
- **Total: 100%**

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

CLASS PROJECT (DETAILS COMING NEXT WEEK)

- Study Internet Infrastructure in San Diego
  - Deploy your own Internet measurement system
    - Quite a bit of Internet infrastructure in San Diego:
    - Cox, Spectrum, AT&T (fiber), Verizon, AT&T (mobile), T-Mobile Campus (CENIC)
  - Observe the topology, performance, and reliability
  - Write a 6-page report
- Or reproduce research we discuss in this class…

PRIMARY ACTIVITY: READING NETWORKING PAPERS

- Why? Primary source information about infrastructure is buried in jargon-filled technical documents (specs, internal docs)
- Researchers do a good job of telling you what you need to know:

  We will spend lots of time talking about the background sections of research papers

- Researchers dig into *why* infrastructure works or does not work as expected.

WAYS OF READING

- There are many ways to read something
  - To get a broad overview of the main idea
  - To determine the main “takeaway points”
  - To find something specific (e.g. what is the repair protocol for the Pastry protocol again?)
  - “Close” readings
- We’re going to be doing close readings of 1 paper per class discussion

WHAT IS "CLOSE READING"?

- Not just "what", but *WHY*
  - Why did they design the infrastructure in this way?
  - Why were alternatives were ruled out?
  - Why does the system behave the way it does?
  - Could we make it better?
- What can you learn from their experiments? From the workloads used in the evaluation?

INTERNET INFRASTRUCTURE VS. TELECOM & TELEGRAPH (BARAN)

- **“All-Digital” Communication Links**
  - Receive, check if its correct (same bits as intended)
  - Store and Forward “relay” (can repeat msgs. over many hops)
- **Packet Switching**
  - Messages separated into “blocks” (packets) that contain their own addressing information

BARAN'S VISION OF INTERNET INFRASTRUCTURE (IN THE 1960'S)

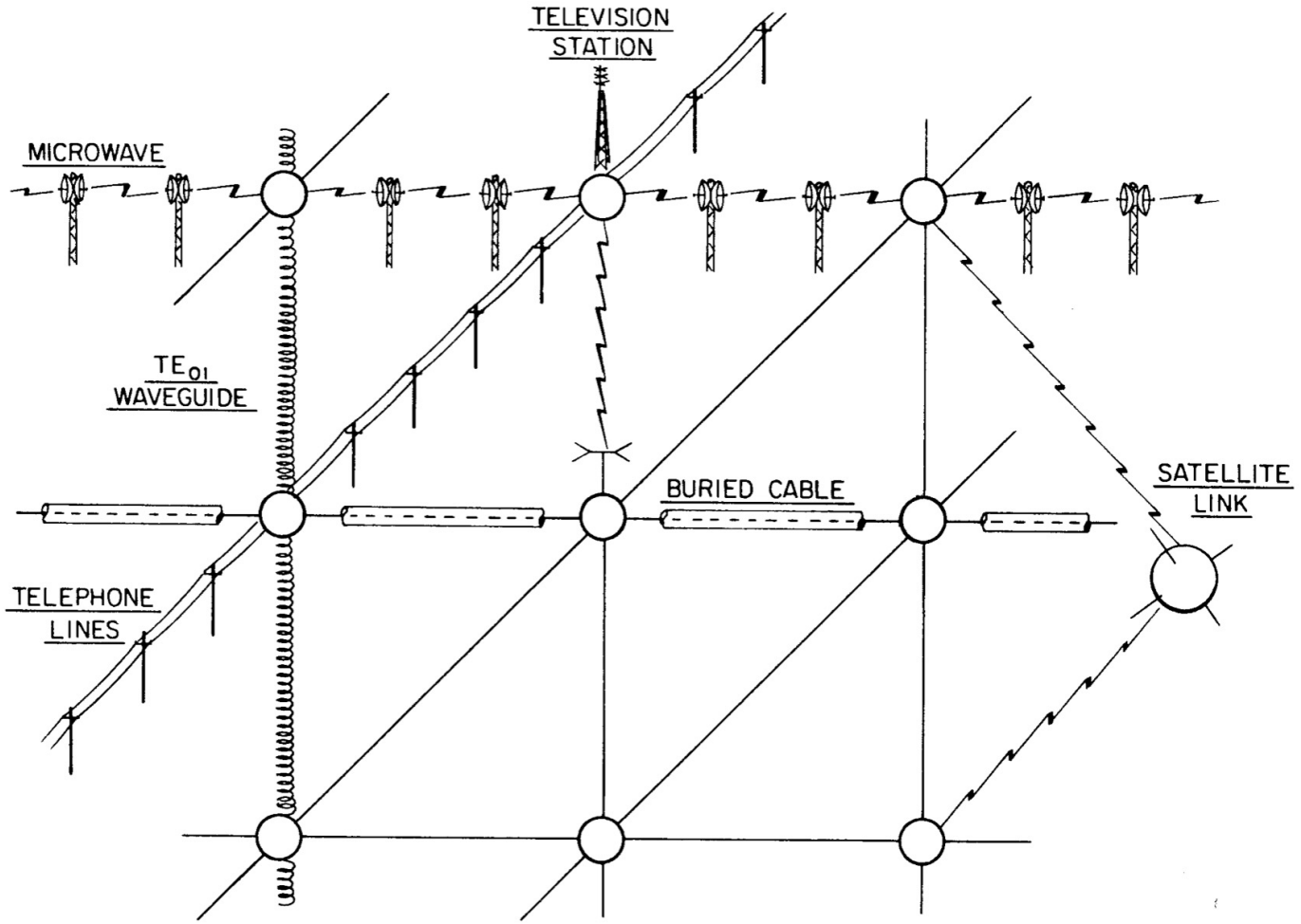
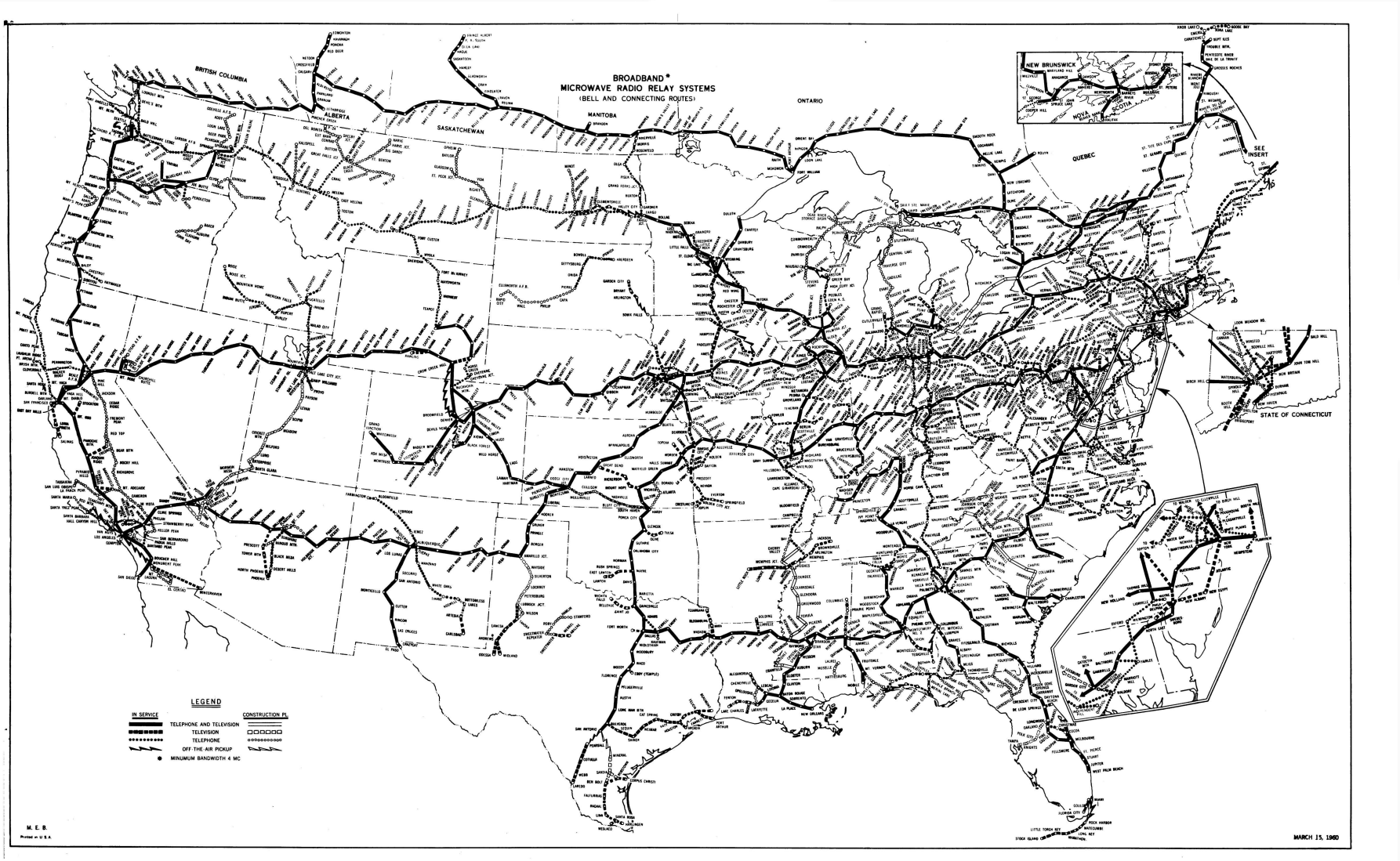


FIG. 9 – All Digital Network Composed of Mixture of Links

AT&T LONG LINES (1960'S) [LONG-HAUL MICROWAVE]



Circuit switching (not packet), but a perfect starter infrastructure for the Internet

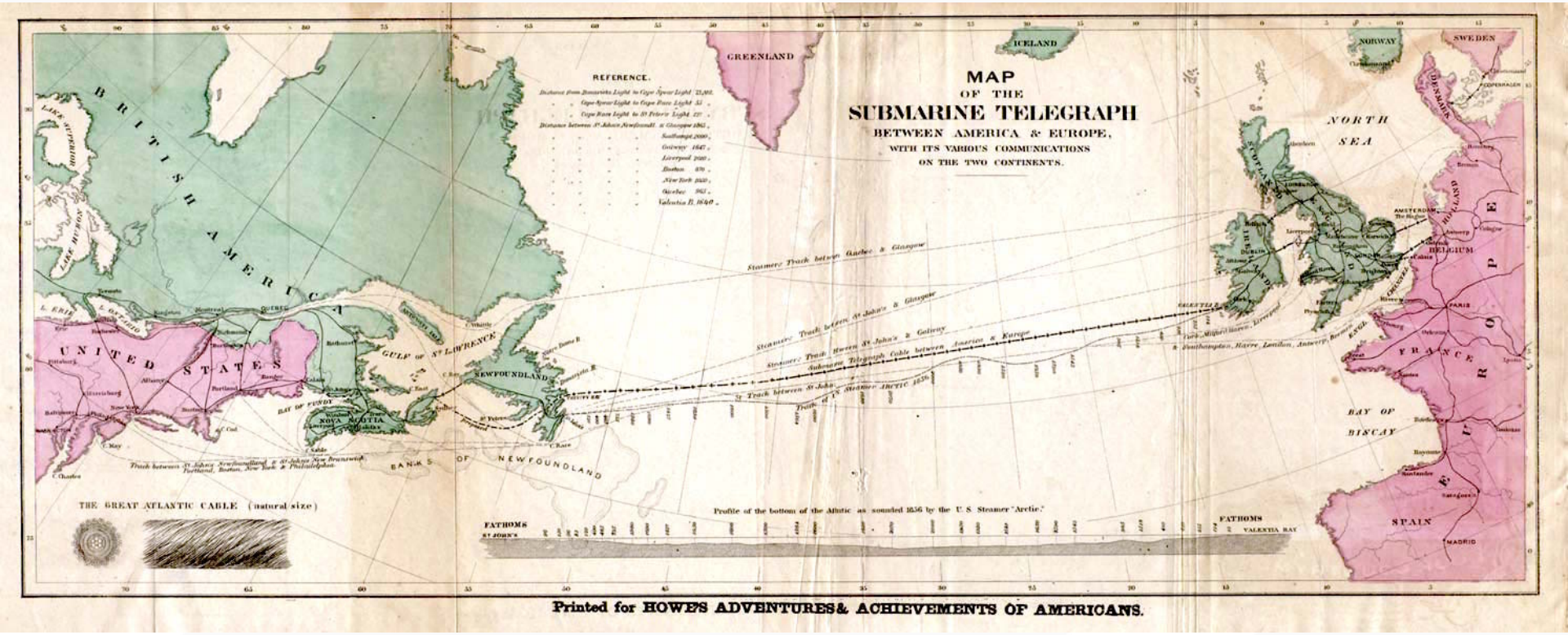
LONG LINES IS STILL HERE…

AT&T WANTED NOTHING TO DO WITH THE INTERNET

- The Internet architects couldn’t convince AT&T to make their infra packet switched.
- Possibly delayed the adoption of the Internet!

Why?

UNDERSEA CABLES WERE ALSO ALREADY POPULAR

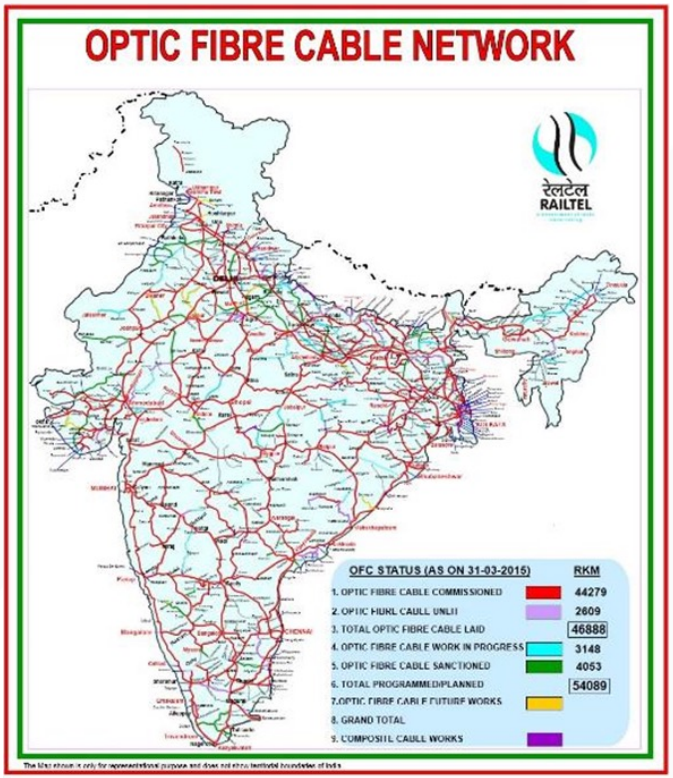


Became standard for overseas telephone and telegraph

FIRST COMMUNICATION SATELLITE (TELSTAR 1) 1962

GAME CHANGER: FIBER ALONGSIDE RAILROADS

Railroads had right-of-way permits across continents in 80s (and needed comms)



Fiber brought a massive growth in capacity and performance (**way more than needed**)

READING FOR WEDNESDAY

W Sep 29	Long-Haul Terrestrial Internet Links	InterTubes: A Study of the US Long-haul Fiber-optic Infrastructure

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