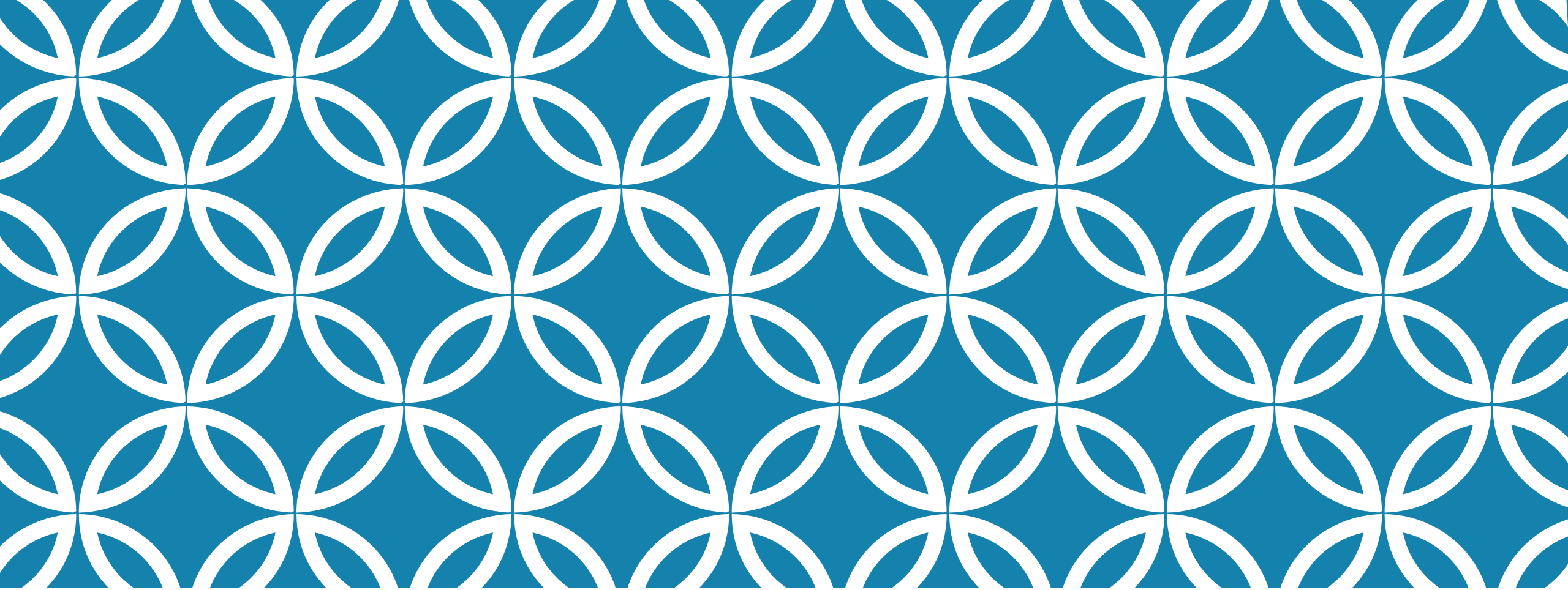


CSCI 15: AN INTRODUCTION TO THE MODERN INTERNET

Sam McCauley

WELCOME!

- Call me Sam (or, if you want, Professor McCauley or Professor Sam or something)

  - Email: sam@cs.williams.edu
  - Office: TCL 209 (one floor below here)
  - Office hours: Tuesday 1:00-2:50 PM

- Introductions

DAY TO DAY CLASS FORMAT

- Lecture for ~ 50 minutes
- 10 minute break
- Then short projects and/or group discussion and presentation

ABOUT THIS ROOM

- No food or drink (sorry!)
- Computers have Linux (Ubuntu)
- Try to sit where you can see and participate
- Please don't use computers during class other than at assigned times
- You can leave

FIRST THINGS FIRST

- Log into computer using your CS ID and password

FIRST THINGS FIRST

- Open firefox, terminal, folder

PLAN FOR TODAY

- Syllabus and course plan
- Reading: Koans of bits
- Internet infrastructure

SYLLABUS

HOW THE SAUSAGE IS MADE

CSCI 102T

The Socio-Techno Web

Home | Calendar |

Upper-level Networking Course

CSCI 15 - Winter Study 2020

An Introduction to th

Home | Lec

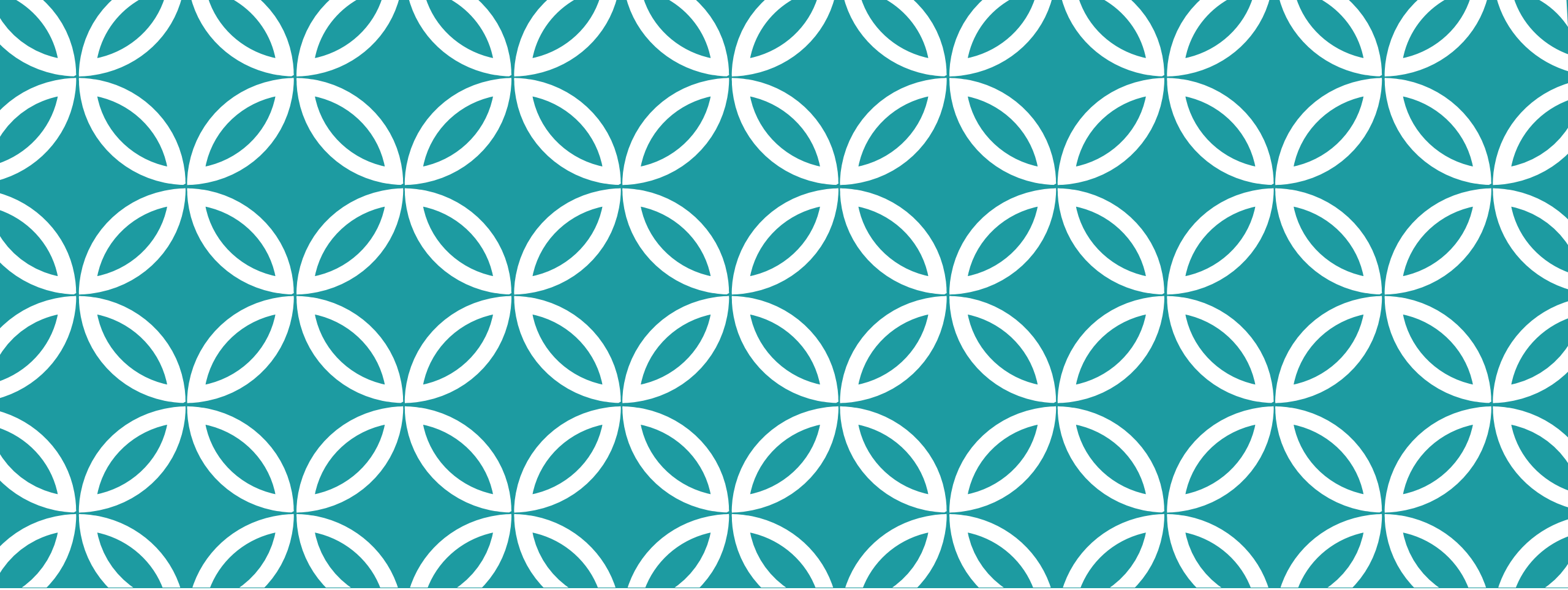
TAKEAWAYS

- Timing
  - Sometimes class may be a bit short/imbalanced
- Flexibility
- Participation!
  - Let me know if things are too fast or too slow, or assume knowledge you don't have
- Class should be hard sometimes!
  - Technical class (without technical expectations)

GOALS OF THE COURSE

- What happens when you send an email from one point to another? Who can see it?

- Able to read news about the internet from an educated standpoint



KOANS OF BITS

KOAN 1: IT'S ALL JUST BITS

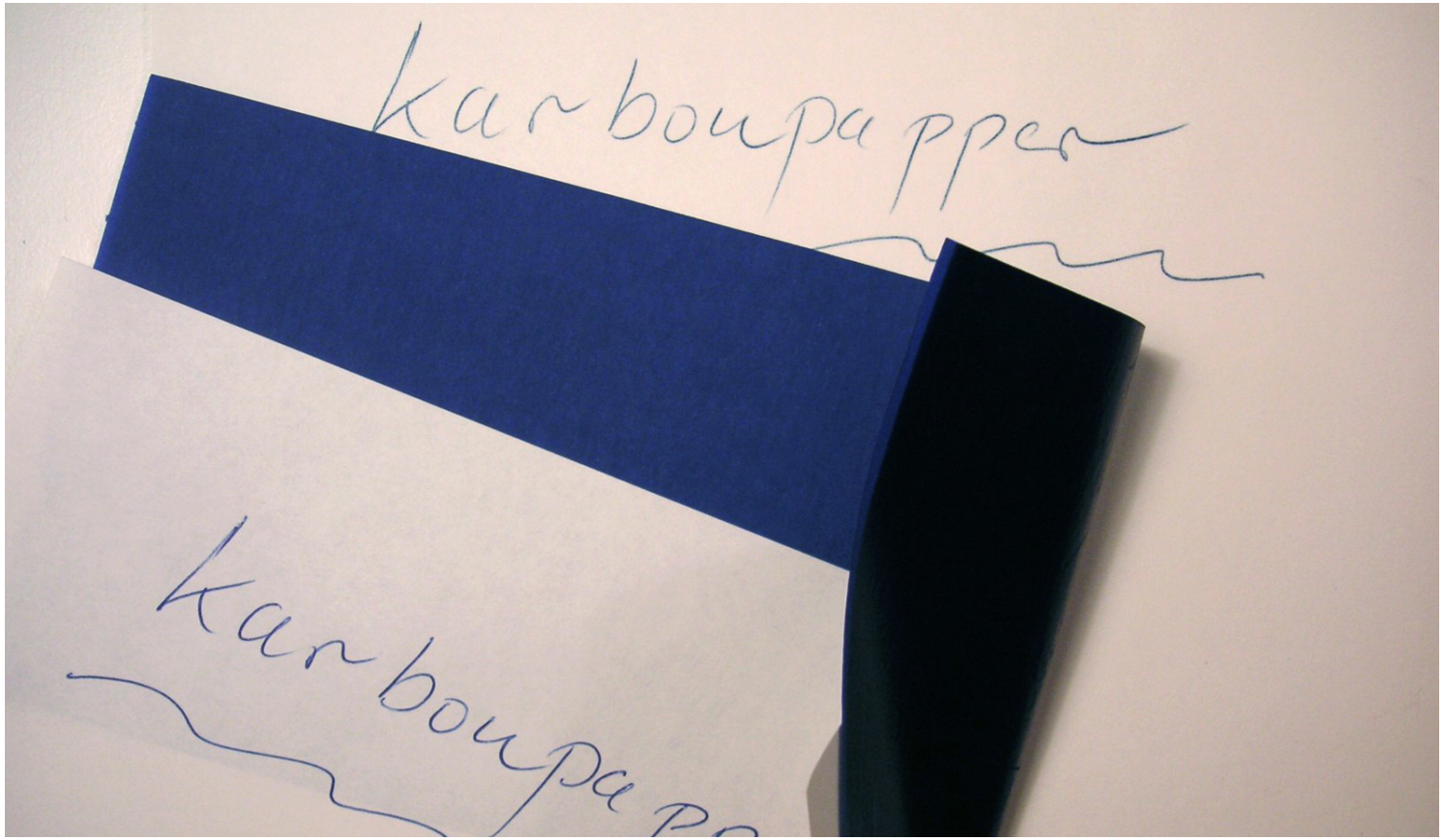
DISCUSSION

- How can you represent text using bits? A picture?
- Is there anything on a computer that doesn't use bits?
- What are some media that don't use bits in general?

ANALOG MEDIA

DISCUSSION

- Why bits?
  - Easy to store (just need two states: “on” or “off”)
  - Why not? Can store anything anyway



KOAN 2: PERFECTION IS NORMAL

DISCUSSION

- I have some problems with this---it's not true at all
  - We'll learn a bit about why when we get to TCP
- Why does it seem true?
  - Cheap copying means consistent copying
- What lessons can we learn from this?

KOAN 3: THERE IS WANT IN THE MIDST OF PLENTY

DISCUSSION

- The wide availability of information and media means that things not on the Internet may be harder to find

- Google books

KOAN 4: PROCESSING IS POWER

Google TPU 3.0 >

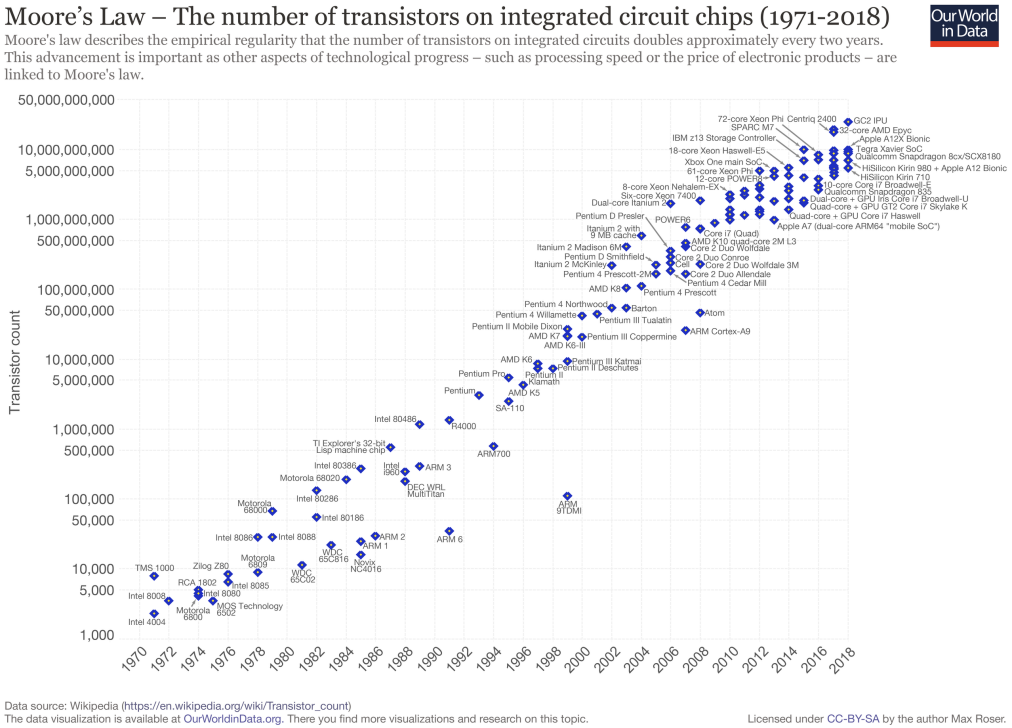
DISCUSSION

- Machine learning strengthens this point considerably

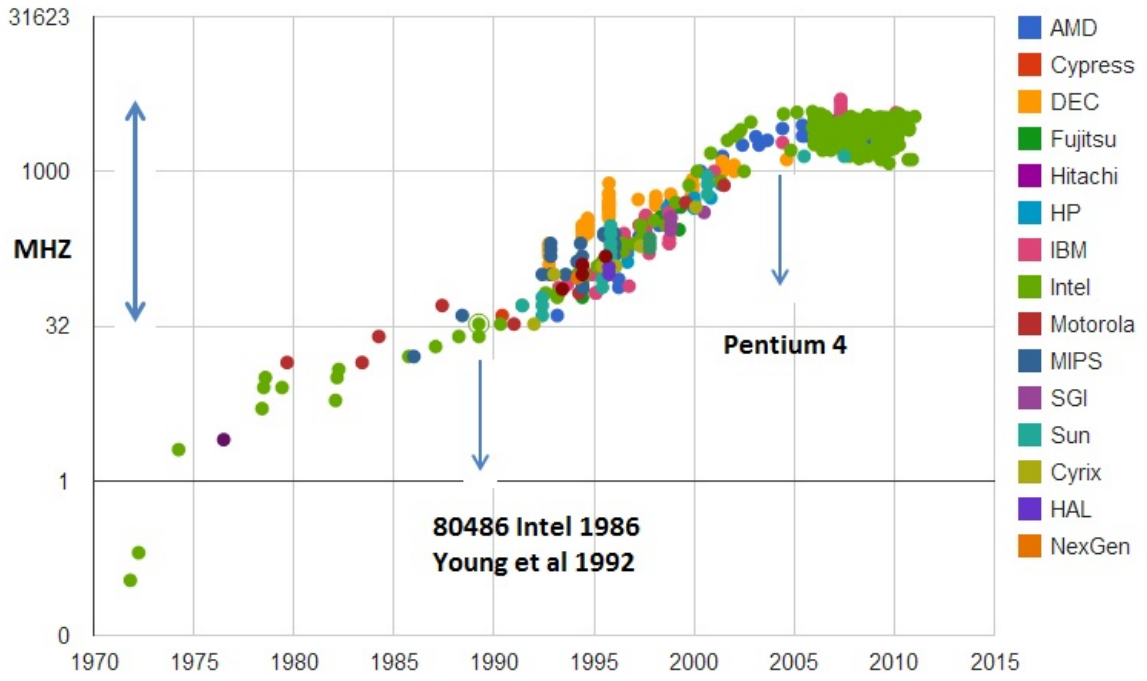
- Moore's law

MOORE'S LAW

Density is still growing!

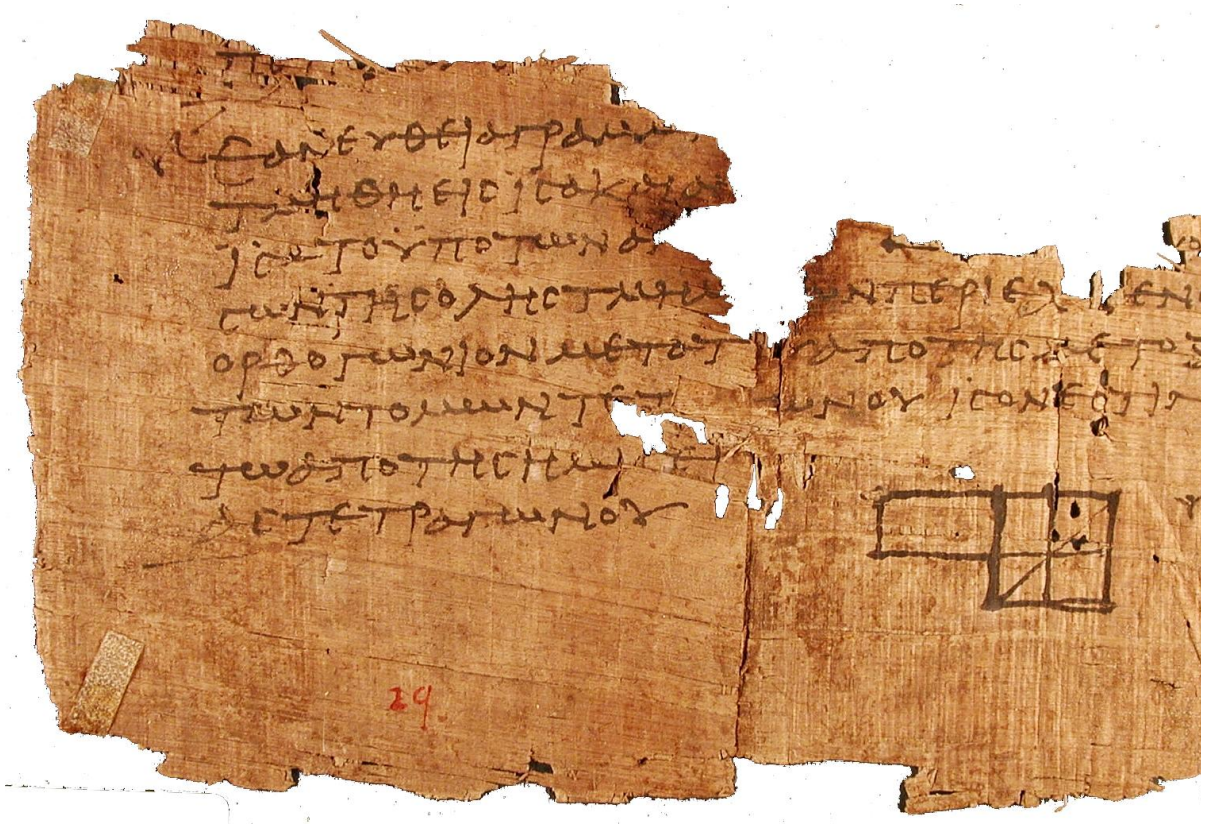


Processor speeds are not!



KOAN 5: MORE OF THE SAME CAN BE A WHOLE NEW THING

- Meaning exponential growth is fast
  - It really is



KOAN 6: NOTHING GOES AWAY

DISCUSSION

- Again I don't agree with this necessarily
- Entropy
  - You will *always* lose bits over time

- How can you minimize this?
- Upkeep

DISCUSSION

- In what sense is this true?

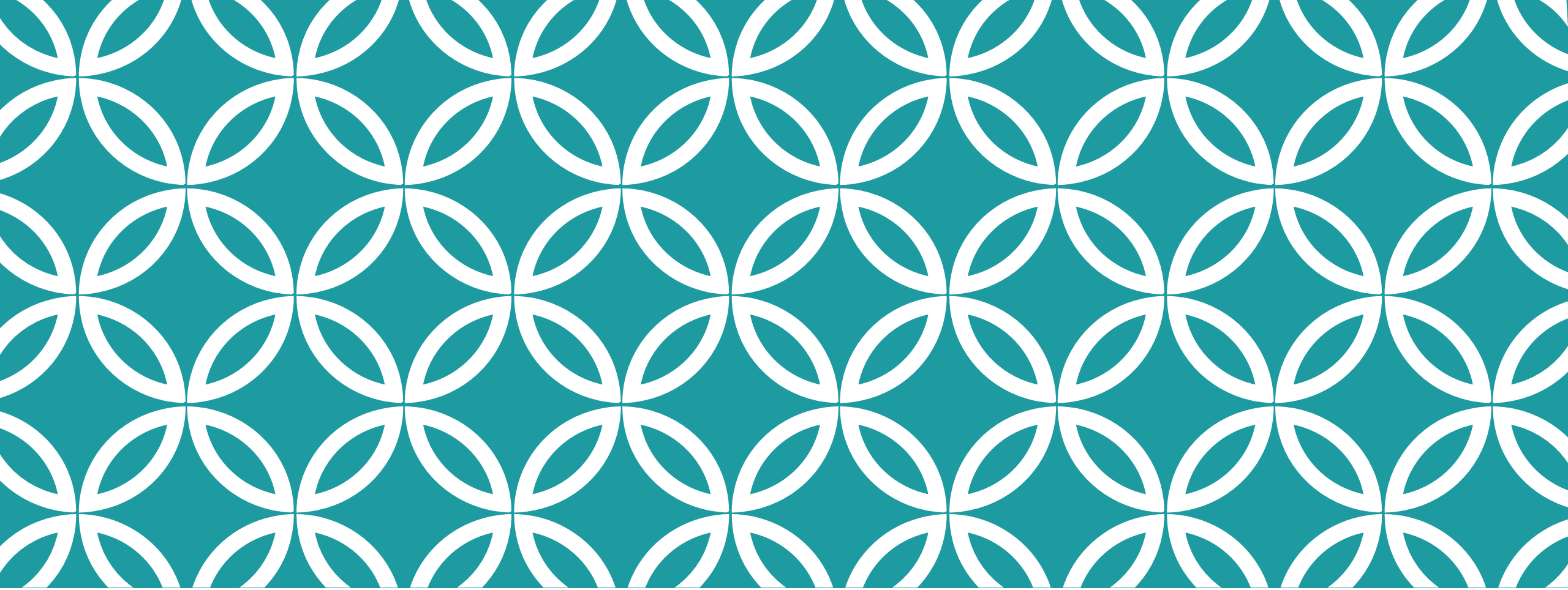
- What is kept on the web and what is lost?
  - Internet Wayback machine (web.archive.org)

- What is lost then?

KOAN 7: BITS MOVE FASTER THAN THOUGHT

DISCUSSION

- How has this speed affected information accessibility?
- Academics
  - Wikipedia
  - MOOCs
- Personal communication
  - Free emails, calls over What'sApp
- "Long distance calls"



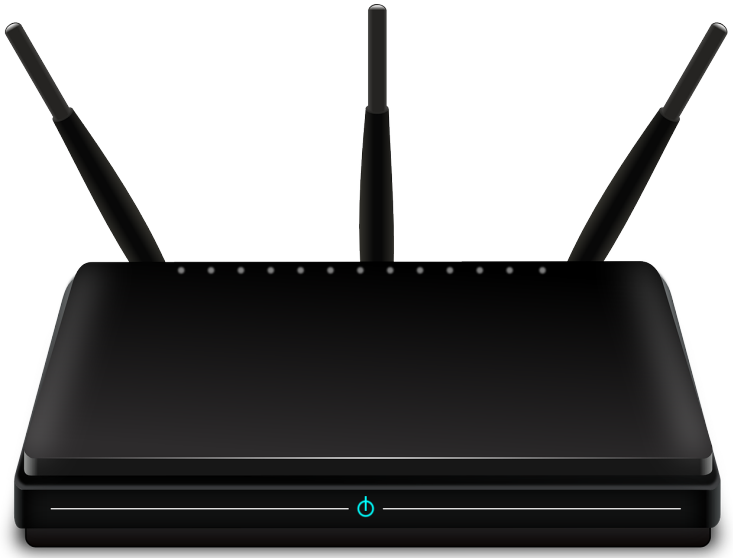
INTERNET INFRASTRUCTURE

VOCABULARY

- Network
  - Multiple devices connected to allow communication between them
- Internet
  - Infrastructure that connects multiple networks
- Web
  - Information system to exchange documents, etc (web pages)

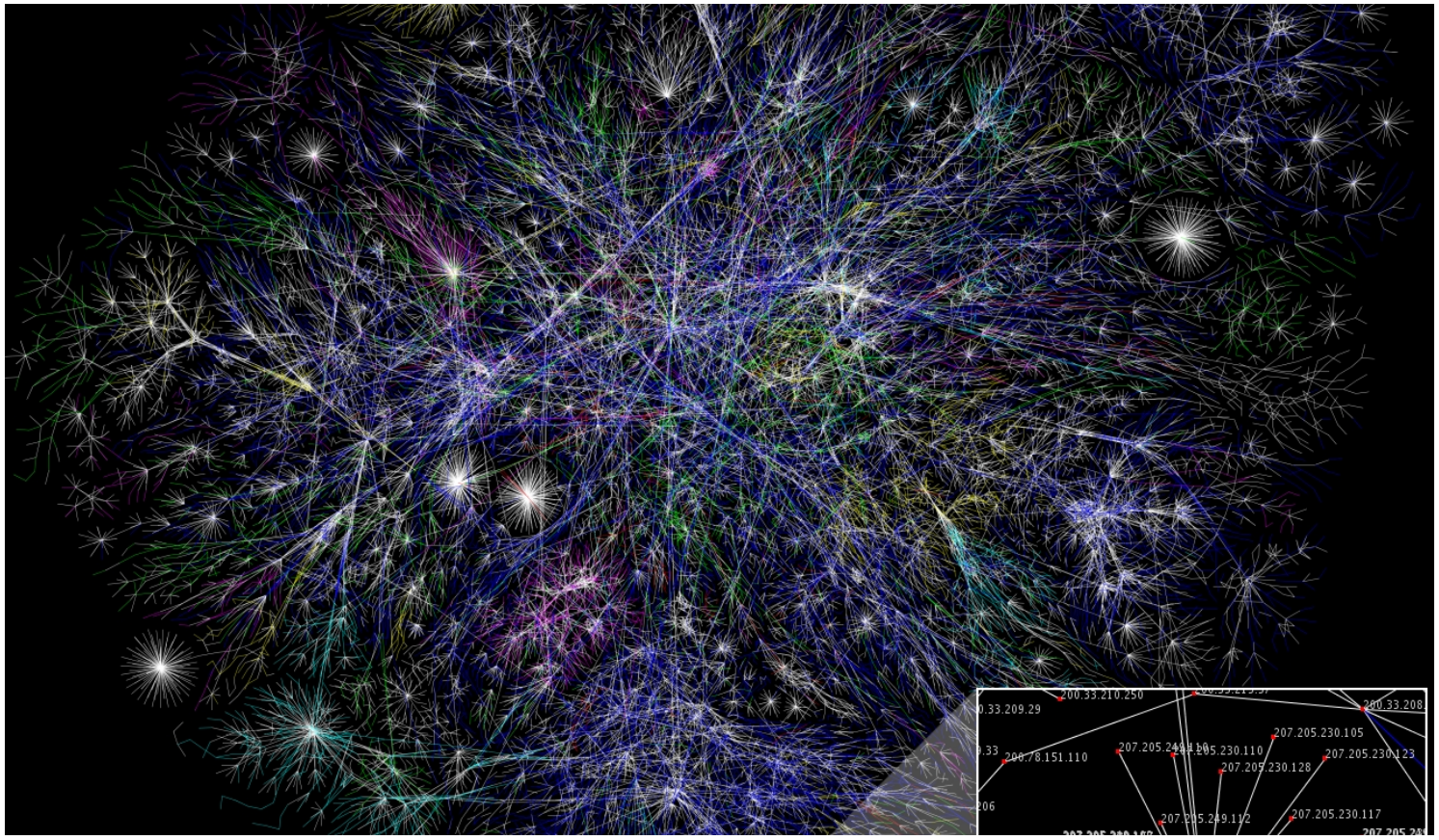
NETWORKS

- Local area network
- Connect with wifi or wired connections
- This is how PurpleAir works (etc)



NETWORKS

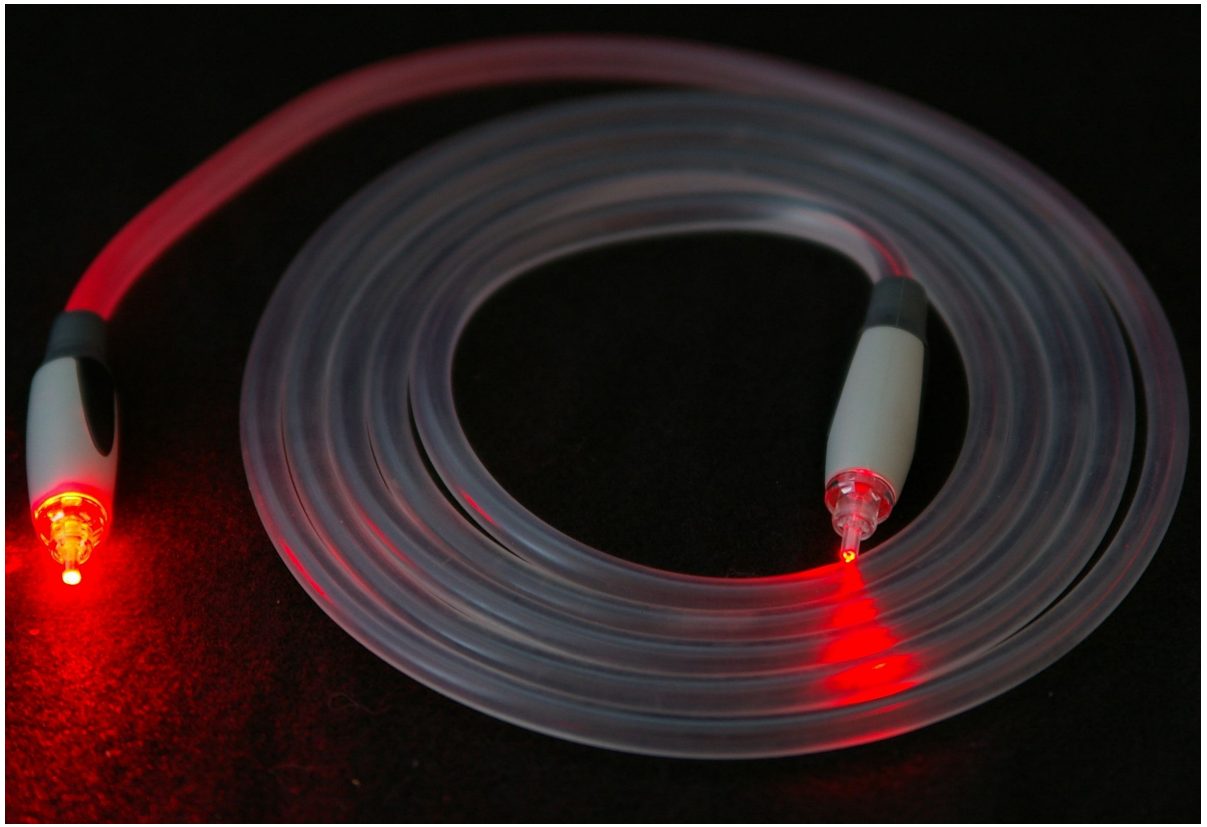
- Lots of other kinds, i.e. cell phones, older types of cables
- Bluetooth



THE INTERNET

INTERNET

- Infrastructure to connect multiple networks
- (Hence inter – net)
- Made up of many pieces
- “Backbone” that much of traffic goes through
  - We’ll talk about this more later



INTERNET BACKBONE

- Mostly fiber-optic cable
- If you hit one end with a laser, the other end lights up
- Low error, bundled, long distances
- Your Internet Service Provider deals with this

INTERNET: LAST MILE

- Cable/DSL/dialup

- New: Fiber optic (hence FiOS)
- Old: Copper coaxial cables
- Can also use satellite, cellular network, etc.

BITS TO….LIGHT? ELECTRICITY?

- How do the bits in your computer get translated to these physical forms for transmission?
- This is the job of your modem

INTERNET: CONNECTING CONTINENTS

- Big cables under the sea
- No satellites involved!

INTERNET: CONNECTING CONTINENTS

- https://qz.com/657898/this-map-shows-the-explosive-growth-of-underwater-cables-the-power-the-global-internet/

- https://www.submarinecablemap.com/

WEB INFRASTRUCTURE

- What infrastructure do we need for websites?

- One answer: a way to translate website names into how to find the site on the web (i.e. into an address)

WEB INFRASTRUCTURE

- nslookup : terminal command to translate website names (host names) into an address
- Try it out! (Address won't work sometimes)

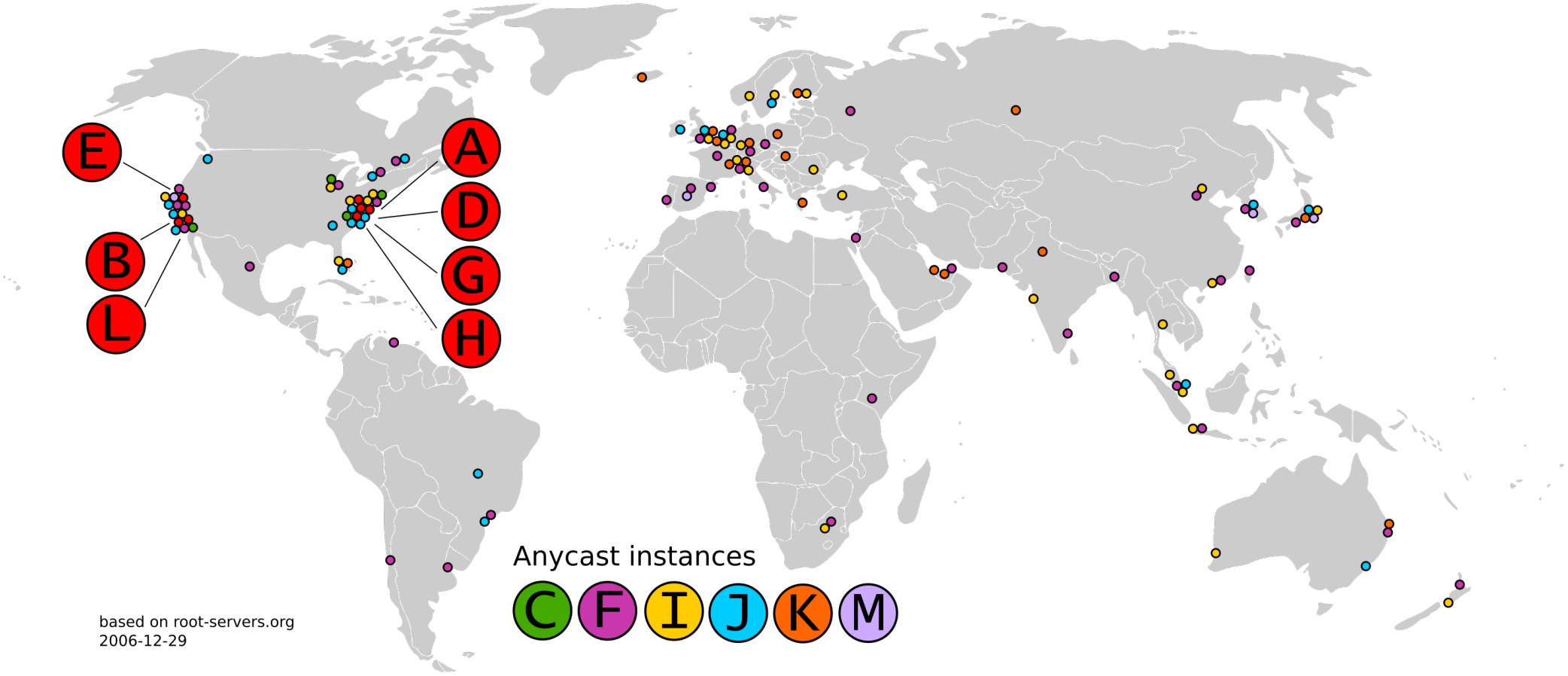
WHAT DO WE NEED?

- "Phone book" of who owns what host name
- In the 1970s, everyone kept track of the full list
- To get a new name you would call Elizabeth Feinler and she would add it to the list
  - you would have to update your list periodically
- Who keeps track of it now?

DNS

- Domain name server
- Distributed across the world (so people can quickly access)
- Each domain (.com .edu .uk .cn) kept track of by a different entity; this entity lets the people running the servers know about changes

MAP OF ROOT NAME SERVERS (2006)



DNS

- Updated map at root-servers.org
- Only 13!
  - For technical reasons
- Distributed over many machines around the world
- For security and easy access

GROUP PRESENTATIONS

- Read 1-2 assigned articles
- Look up other resources! The articles may not be self-contained. (Often they aren't.)
- ~5 minute presentation
- Who, what, when, where, why, how?
  - 1 minute on each?