

Recitation 8: Encapsulation

MIT - 6.033

Spring 2021

Henry Corrigan-Gibbs 

Plan

- * What is encapsulation?
- * Pros/cons
- * Networking

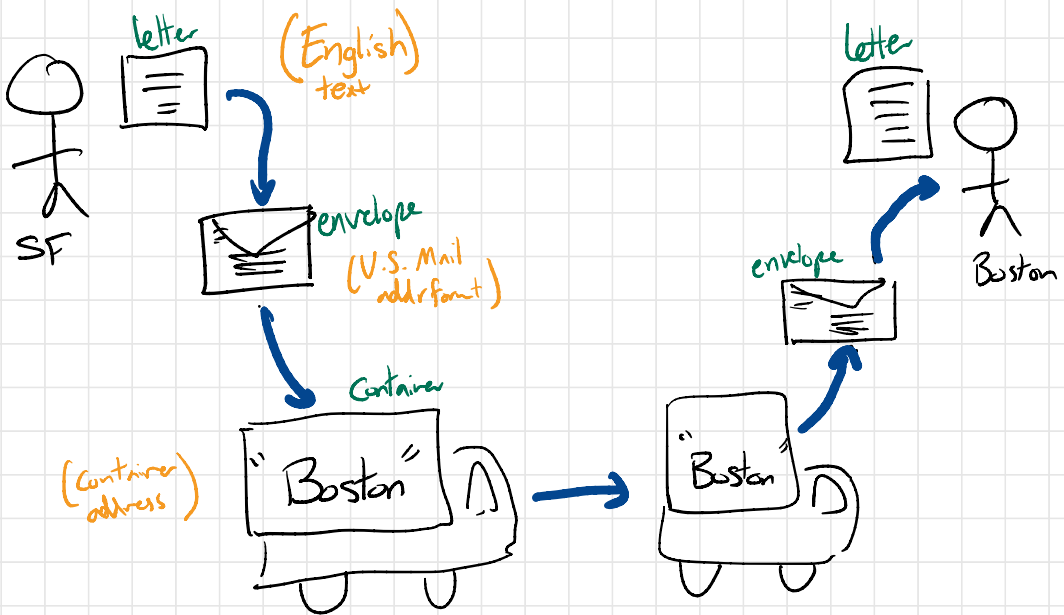
Logistics

- * DP Prep report assignment at due 3/30
- * Hands-on (net) due next Wednesday 3/24
- * Read for Thursday: ROW

Layering & Encapsulation

When we talk about layering in computer systems, it can seem a bit abstract.

Helpful to think about another comm system you may be more familiar with: U.S. Mail



Different "protocols" for boxes, live animals, etc.

Encapsulation

* Need to obey the **requirements** of layer below

- ↳ Maximum size + weight
- ↳ Address well formatted
- ↳ Return address
- ⋮

English Letter
U.S. mail 1st class
Container transport

* Need to account for **guarantees** of layer below

- ↳ Delivery time
- ↳ Reliability
- ↳ Security
- ⋮

Breakout Rooms

In context of U.S. Mail,
what are:

- 3 benefits of layering?
- 3 drawbacks of layering?

Benefits

- + Don't need to worry about implementation of layers below
 - ↳ What sorting machine used?
- + Economics of scale: are USPS for many use cases
- + Enables innovation
 - ↳ Can completely swap out layer
 - ↳ B/c structured around layers

Drawbacks

- Can't prioritize mail easily once it's in the system
- Can't filter junk
- Can't sort easily (all bills go to special addr)
- Can't enforce policy
- Inefficient — might like to batch letters for same recip
- “Dumb network”

Layering in Networks

When you send a packet,

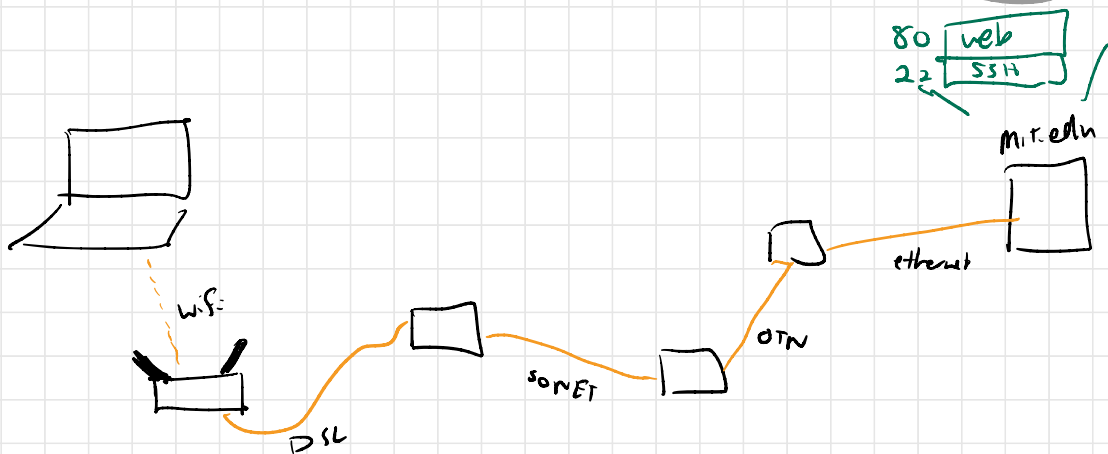
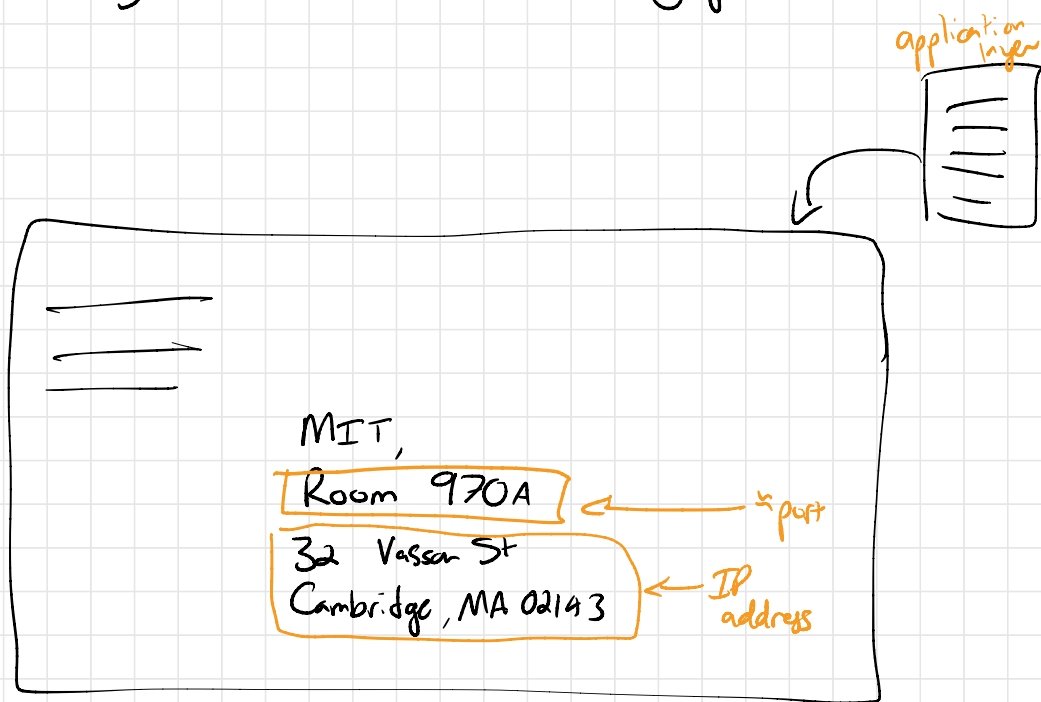
Application data — What do you want?
HTTP, DNS, SSH, FTP, ...

Transport layer — How do you want it?
TCP = stream of bytes
UDP = individual packets
port # (mitchell: 80)
↳ On one computer, many processes running.
Which one gets your packet?

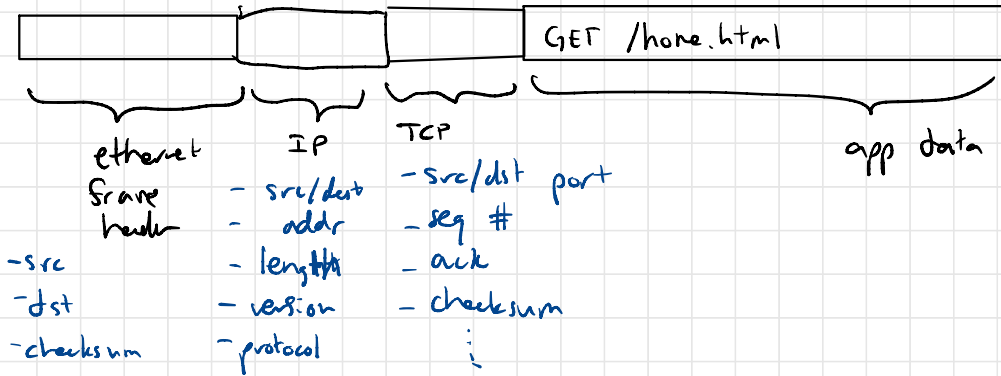
Network layer — Where is it?
IP = address on internet
IP (128.52.129.126)

Link layer — How am I going to get there?
Ethernet, Wi-Fi, DSL, PPP, ...
Ethernet (aa:bb:cc:dd:ee:ff)

If you want an analogy



When you send data over internet...

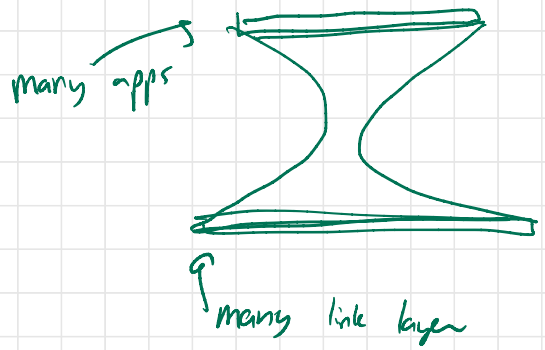


- Each layer has its own addresser!
 - ↳ Often own checksums / techniques for detecting corruption / loss

⇒ "Hourglass shape" of protocol popularity.

→ Whole internet uses IP ... common language.

Link layer & app layer have many protocols.



Things to know about IP:

- "Best effort" packet transit

 - ↳ Good idea?

- Global addresses

 - ↳ Good idea?

- Routing is a big part

 - ↳ How to get packet from here to there?

Discussion

↳ Where does security belong in this layering picture?