Networks, Communication, & Distributed Applications

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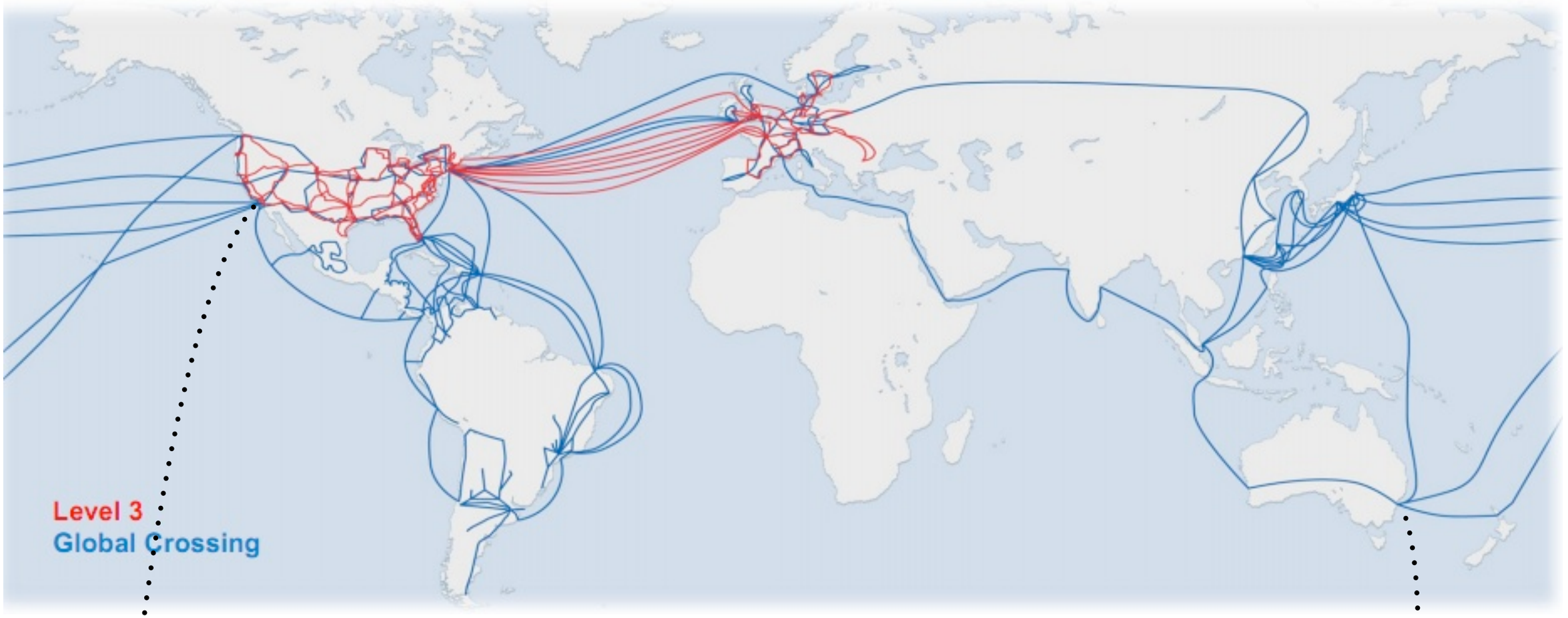
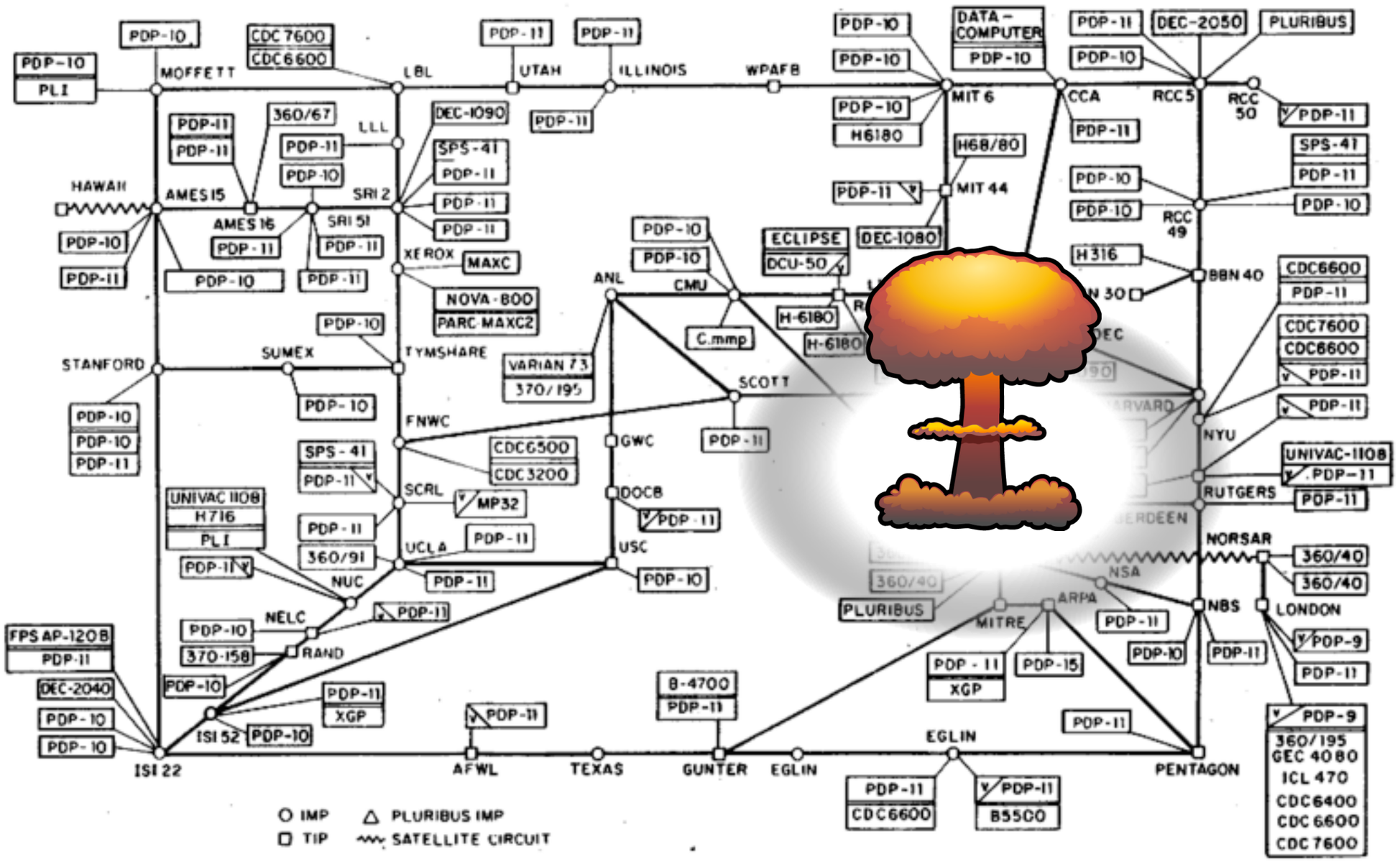
Networking

Old Phones

New Phones



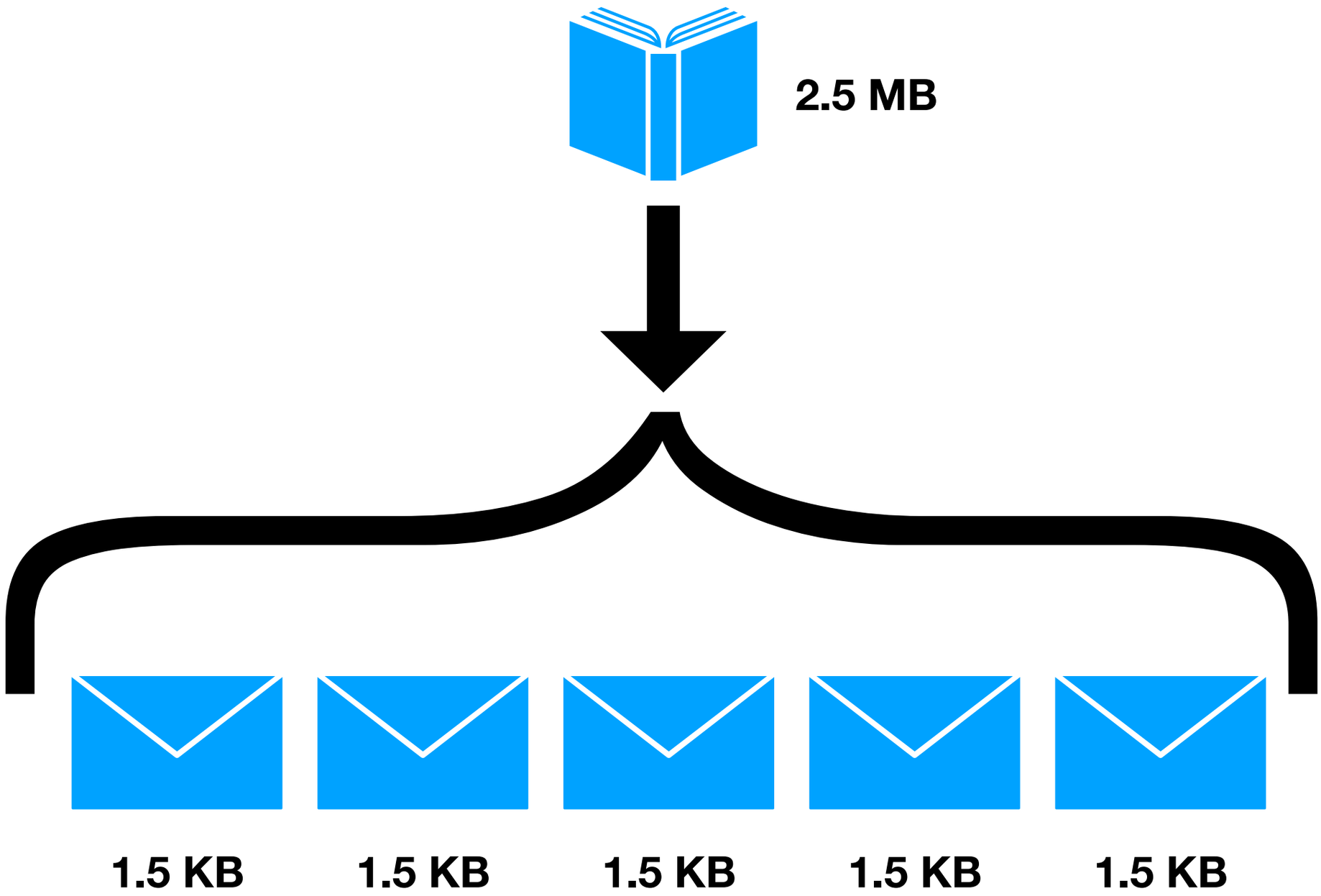
Packet-Switched Network



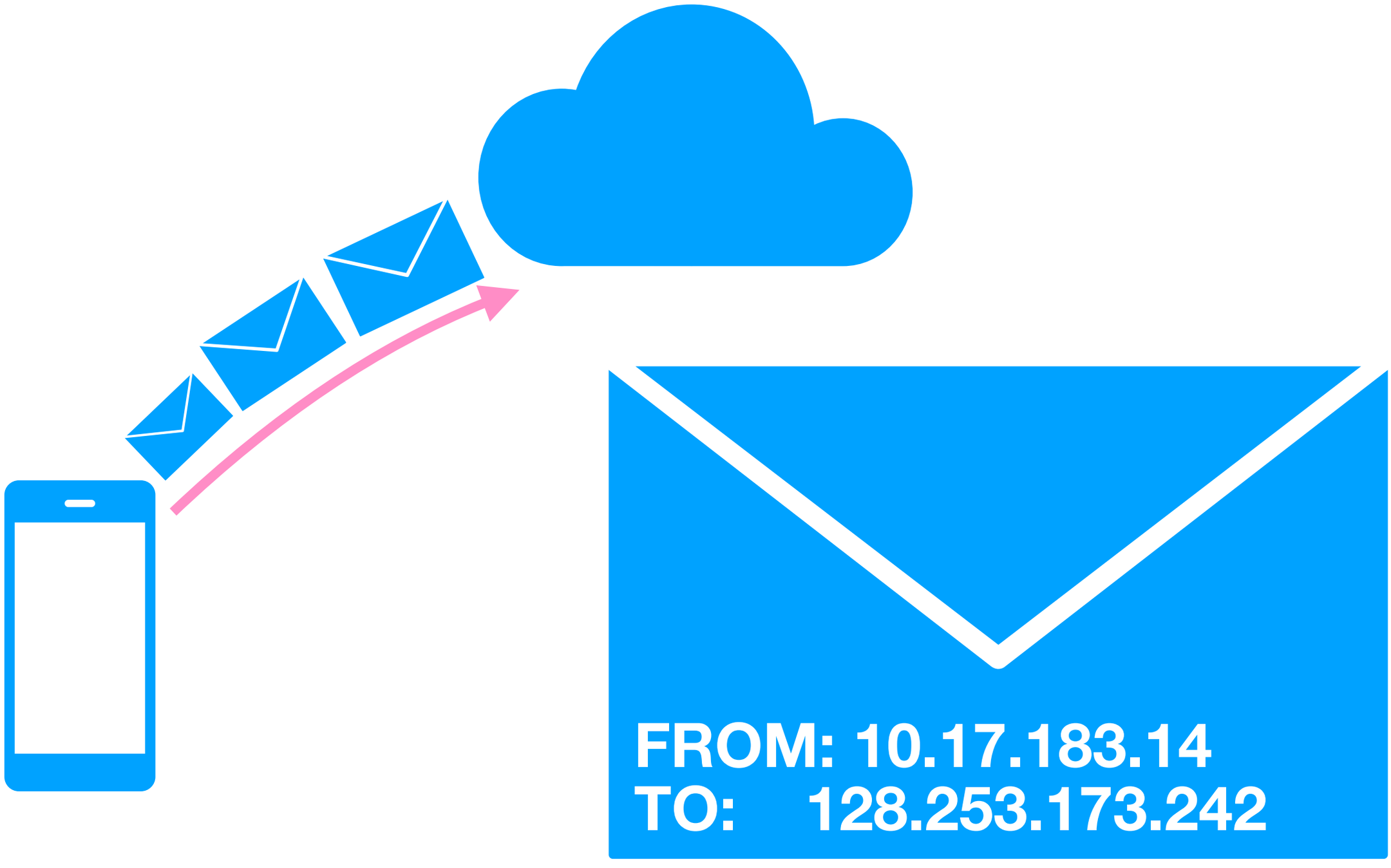
(PLEASE NOTE THAT WHILE THIS MAP SHOWS THE HOST POPULATION OF THE NETWORK ACCORDING TO THE BEST INFORMATION OBTAINABLE, NO CLAIM CAN BE MADE FOR ITS ACCURACY)

NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

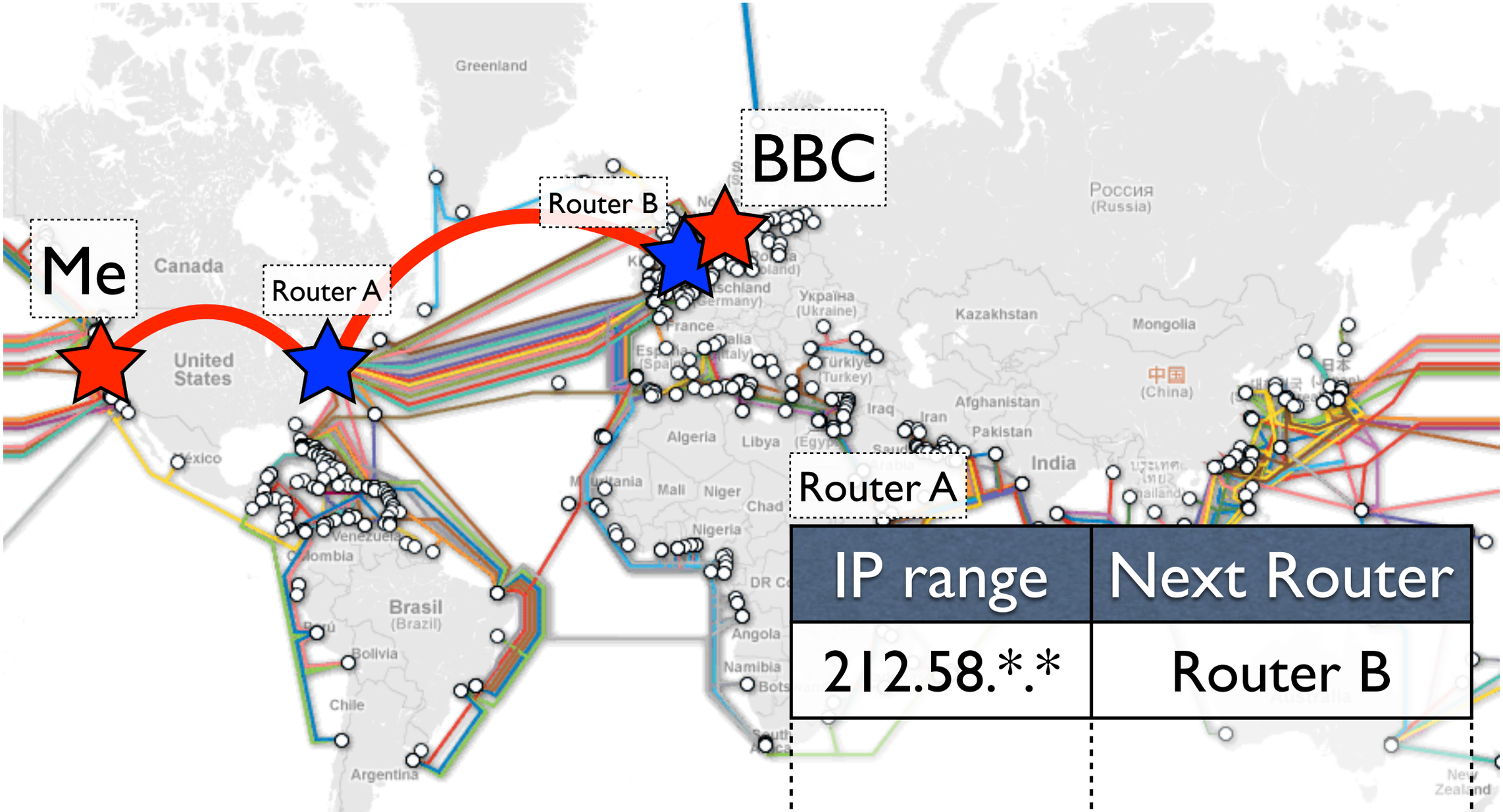
Packets



Internet Protocol

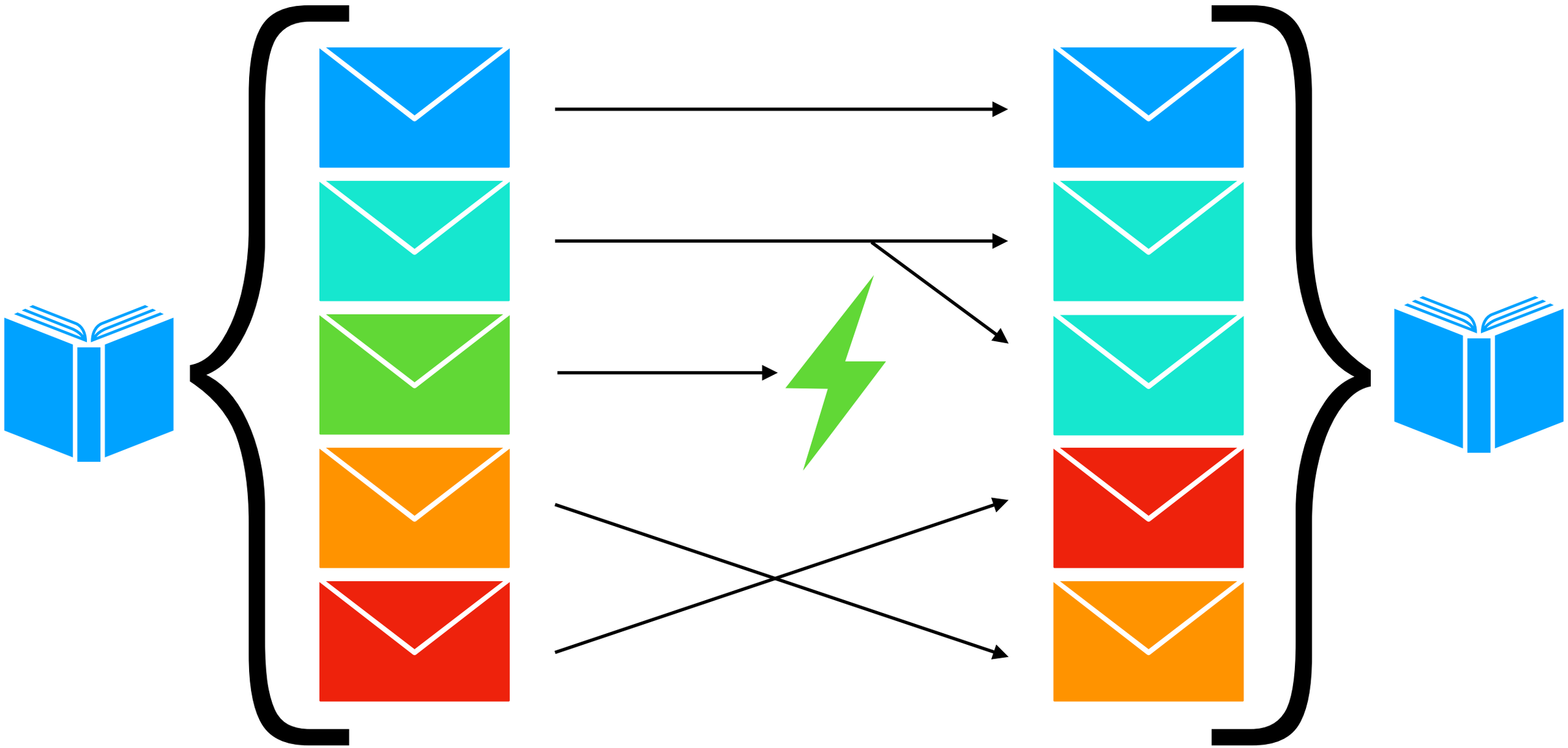


Global IP Network



Tools: ping, traceroute

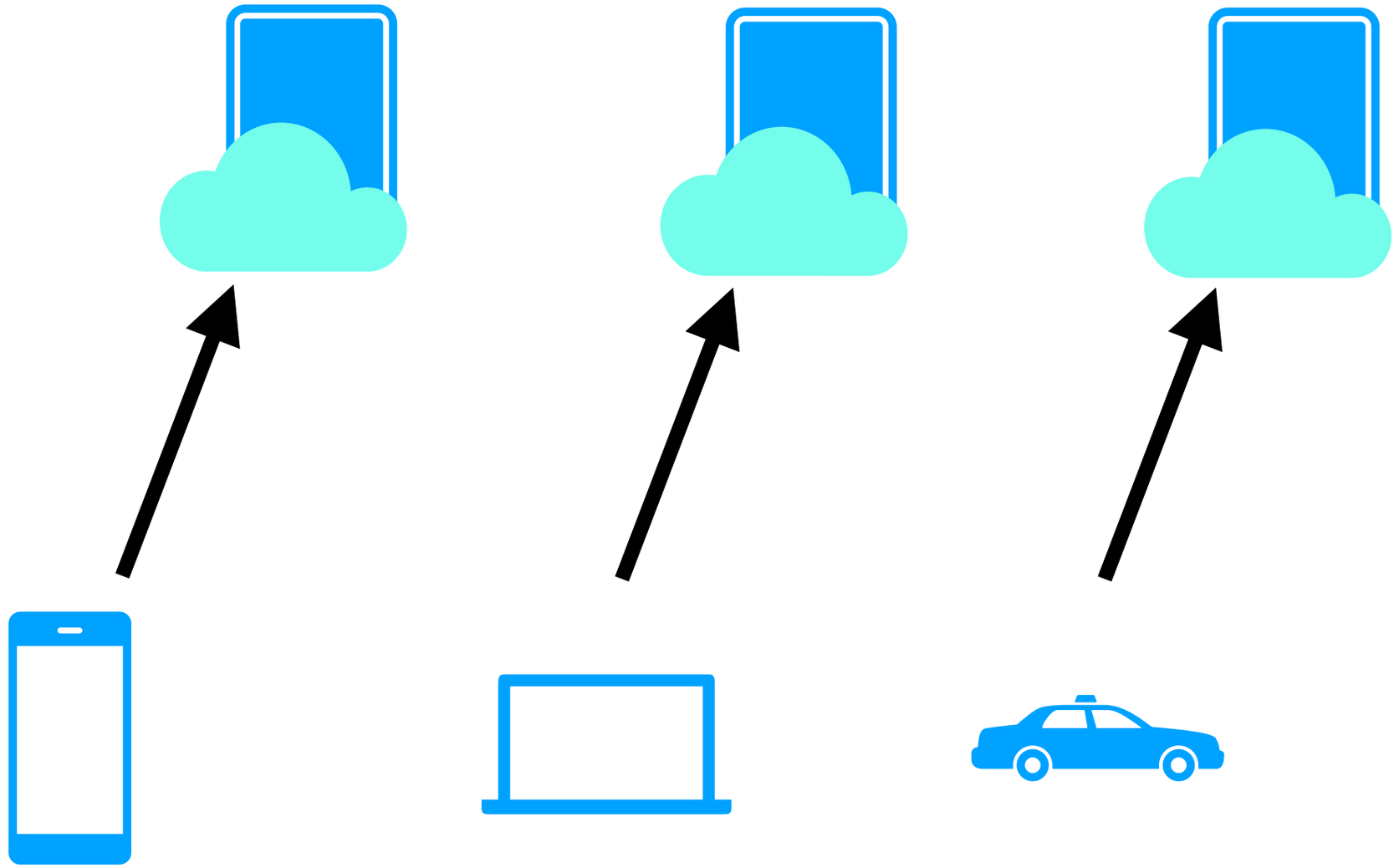
Transmission Control (TCP)



TCP turns the unruly packet stream
into a single, solid byte stream.

Communication

Clients & Servers



Client always initiates connection to the **server.**

SMTP

```
$ telnet gmail-smtp-in.l.google.com 25
220 mx.google.com ESMTP ei3si40962456pbc.50 - gsmtp

HELO zamfi.net
250 mx.google.com at your service

MAIL FROM:<trump@whitehouse.gov>
250 2.1.5 OK ei3si40962456pbc.50 - gsmtp

RCPT TO:<zamfire@gmail.com>
250 2.1.5 OK ei3si40962456pbc.50 - gsmtp

DATA
354 Go ahead ei3si40962456pbc.50 - gsmtp

From: “Donald J. Trump" <trump@whitehouse.gov>
To: "J.D. Zamfirescu" <zamfire@gmail.com>
Date: Tue 15 October 2018 10:15:43 -0800
Subject: Got any extra cash?

Hey J.D.,

The US Treasury is running a little low on cash these days.

Could you spare some?

TIA,
DJ Trumpet
.
250 2.0.0 OK 1381541803 ei3si40962456pbc.50 - gsmtp

QUIT
221 2.0.0 closing connection ei3si40962456pbc.50 - gsmtp
```

Tools: telnet

HTTP

Client:

GET / HTTP/1.1↵
Host: tech.cornell.edu↵
↵

Server:

HTTP/1.1 200 OK↵
Date: Sun, 04 Nov 2012 18:11:20 GMT↵
Server: Apache↵
Set-Cookie:
COOKIE_DEVICE_CLASS=desktop; path=/;
domain=.cornell.edu↵
Accept-Rangebytes↵
Transfer-Encoding: chunked↵
Content-Type: text/html↵
↵
ce0↵
<!DOCTYPE html PUBLIC "-//W3C//DTD
XHTML 1.0 Transitional//EN" "http://
www.w3.org/TR/xhtml1/DTD/xhtml1-
transitional.dtd">↵
<html xmlns="http://www.w3.org/1999/
xhtml" xml:lang="en" lang="en">↵
<head>↵

Tools: telnet

nc

- Find a partner with a laptop; join the **RedRover** network

Server	**Client**
Get your local IP using `ifconfig` **or** `ipconfig`	
`$ nc -l 8003`	`$ nc` ***IP*** `8003`

Done? Try *`telnet towel.blinkenlights.nl`*

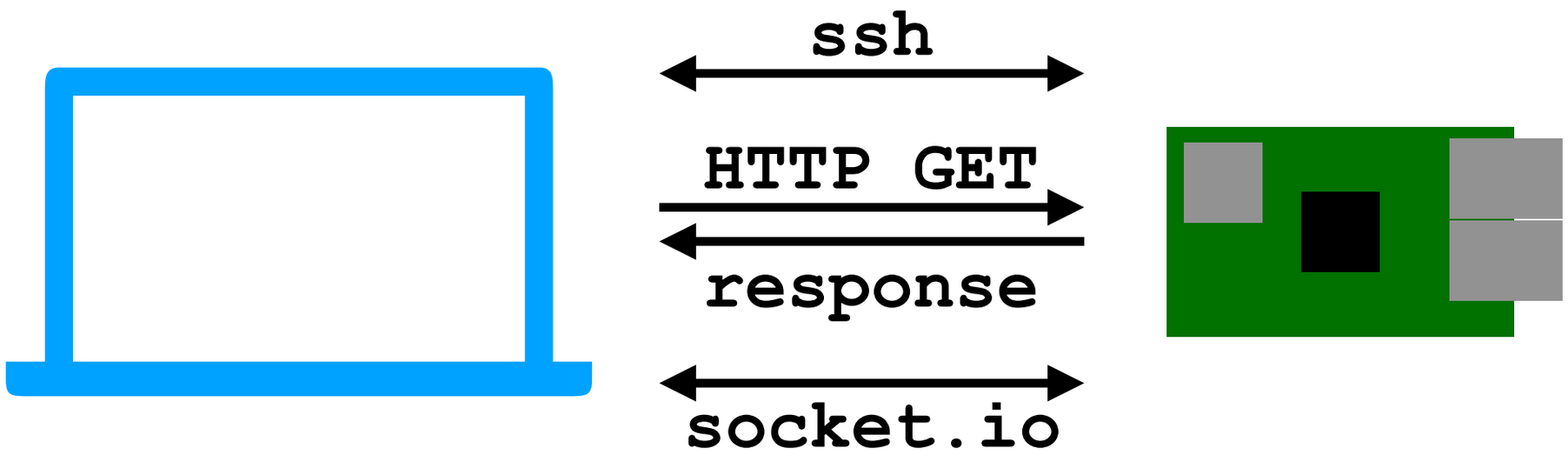
Distributed Applications

Key Design Aspects

- What are the **components** of the distributed application?
- How are the components **connected**?
- How and how often do the components **pass information**?
- Where does **sensing**, **computation**, **display**, **actuation**, & **data collection** occur?
- How does **addressing** and **configuration** occur? How is it **repaired**?
- What **language and platform** is used at each node of the application?

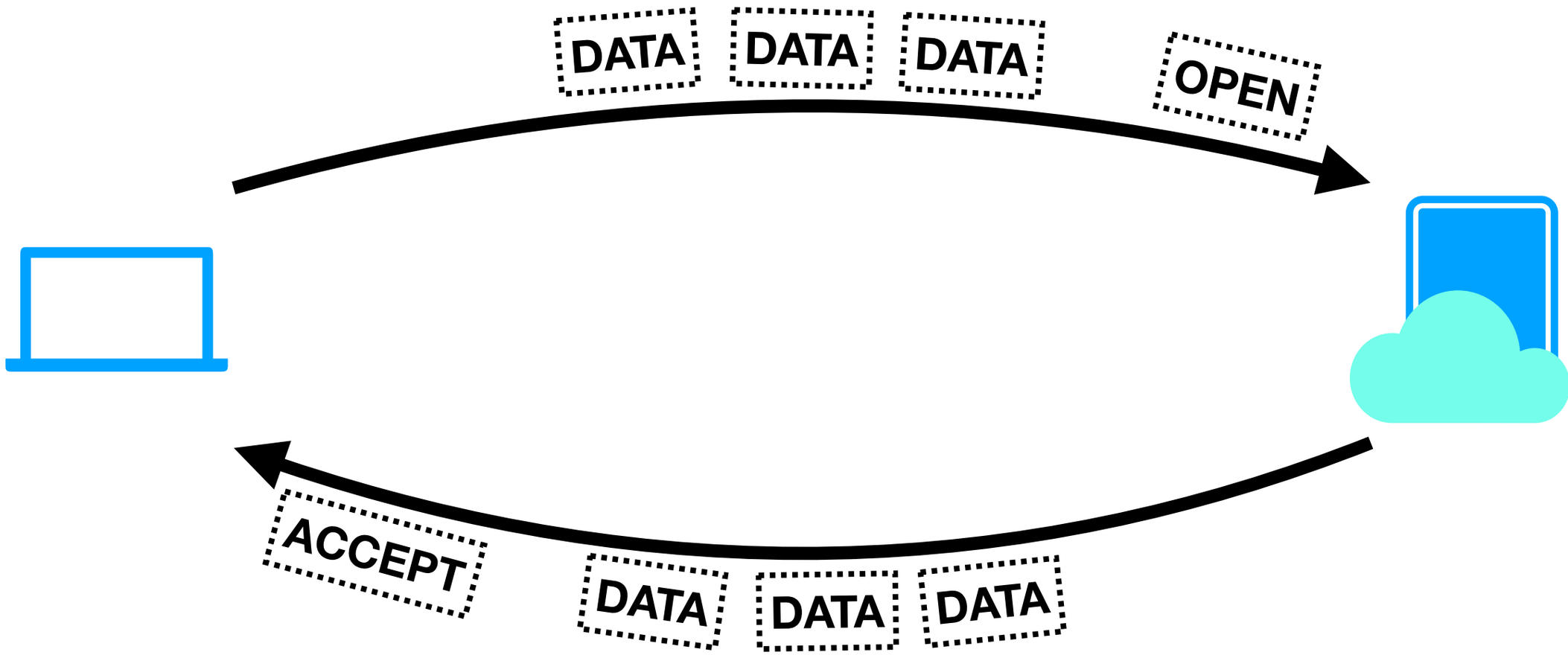
What of Lab 6?

- Used `ssh` to connect your laptop to the Raspberry Pi
- Ran the `chatServer.js` server code using node.js
- Visited `http://<your-ip>:8000` in your browser
- Opened a `socket.io` TCP socket from browser to server



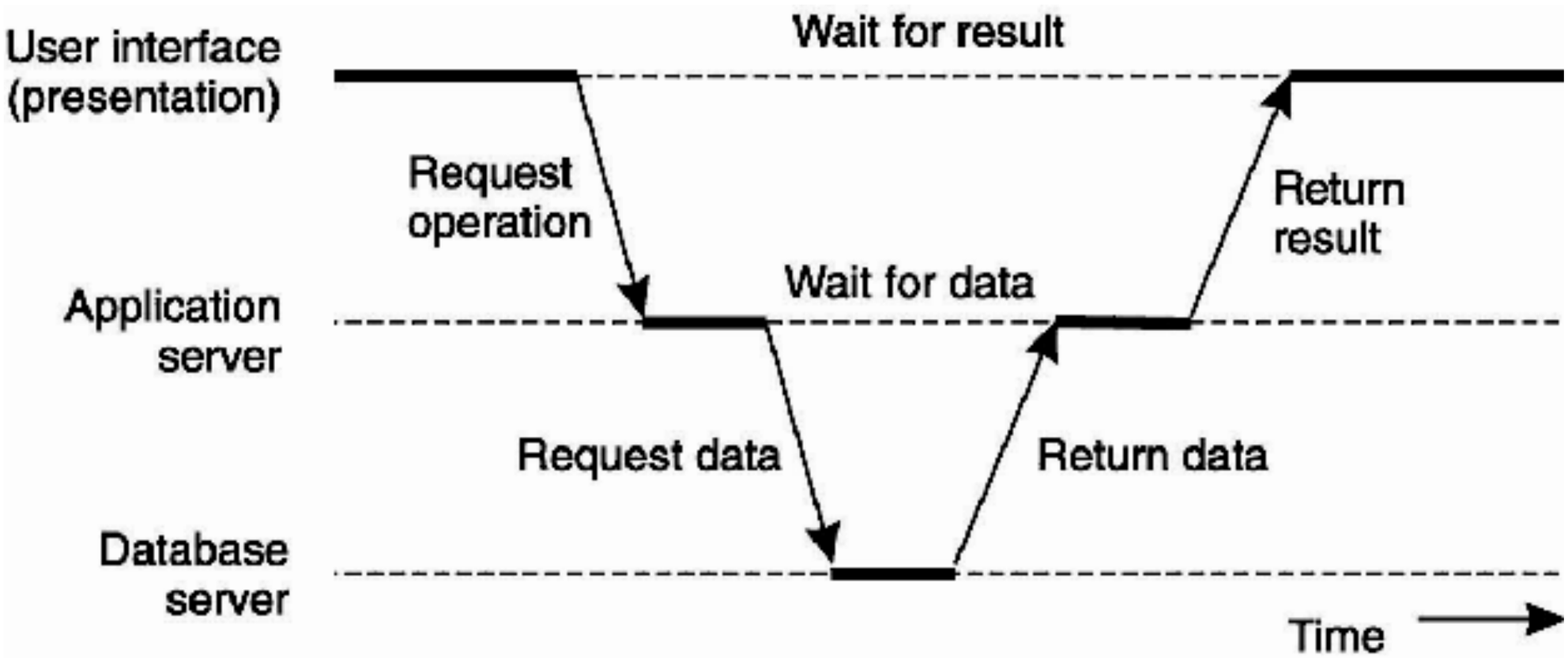
Events

- Network & distributed systems are all about **events**



Events

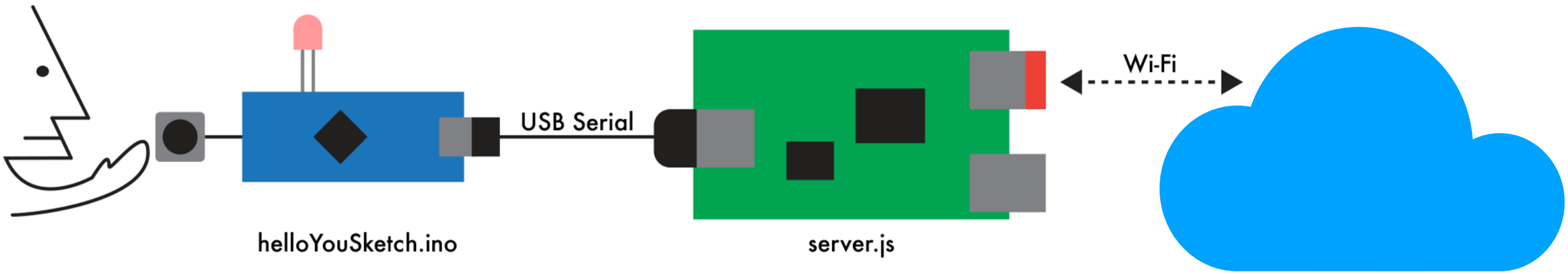
- Get a request, process it, respond.



Lab 6, redux

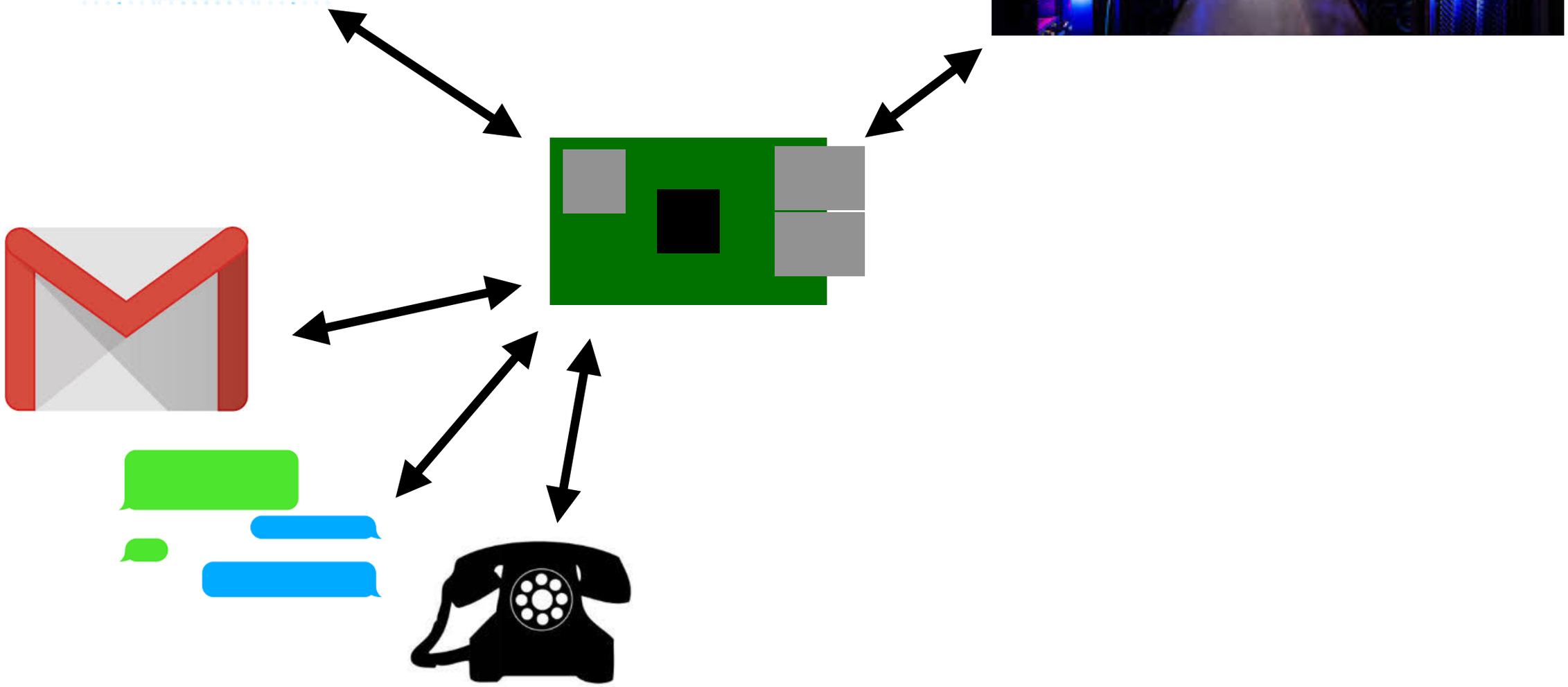
Server	Client
socket.on('message', …	socket.on('answer', …
socket.on('loaded', …	socket.on('question', …
socket.on('disconnect', …	socket.on('changeBG', …
socket.emit('answer', …	socket.on('changeFont', …
socket.emit('changeBG', …	socket.emit('message', …
socket.emit('changeFont', …	socket.emit('loaded', …
socket.emit('question', …	

Lab 7 Preview

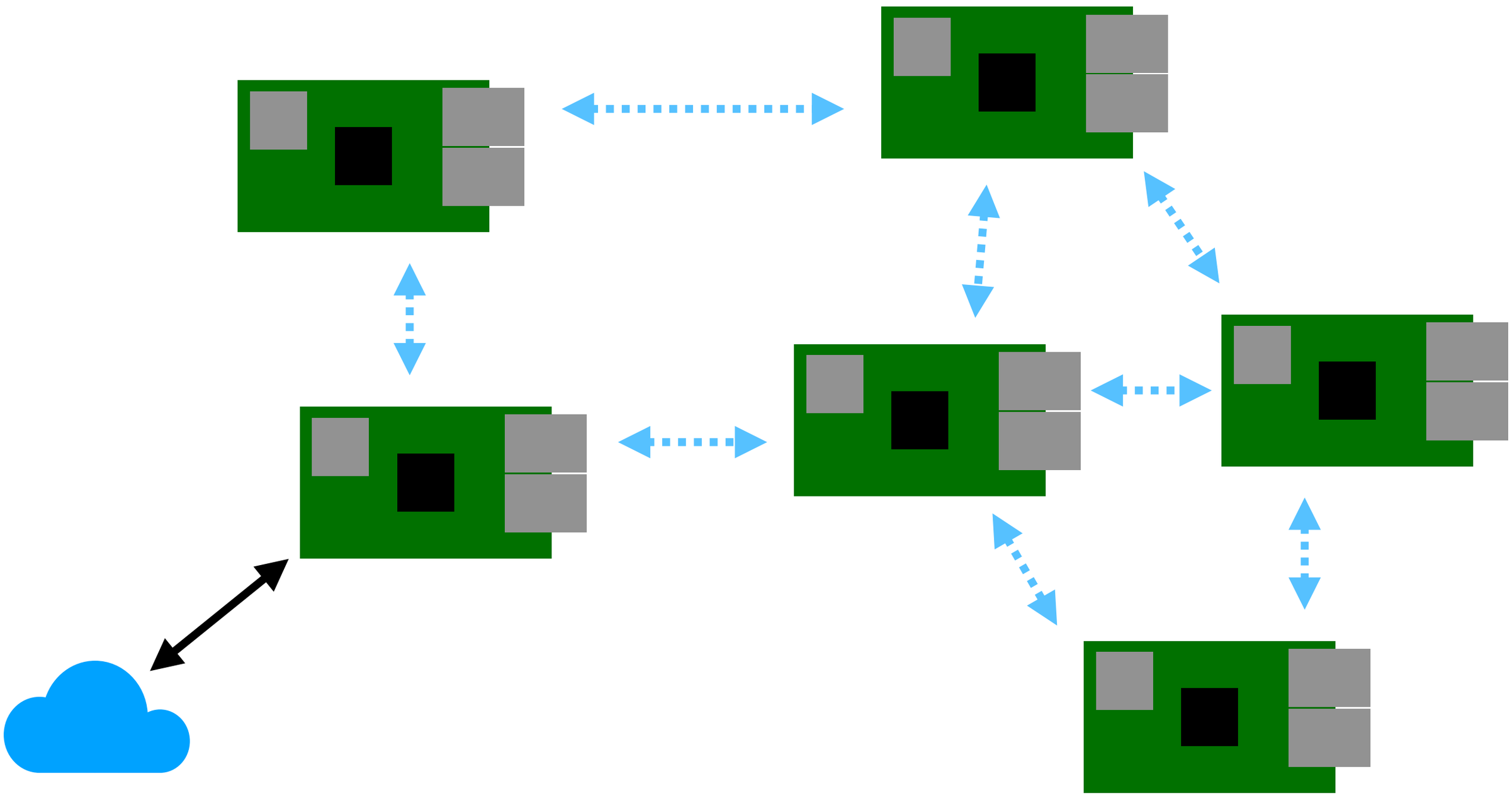


Adapted from Nik Martelaro's IxE Diagrams

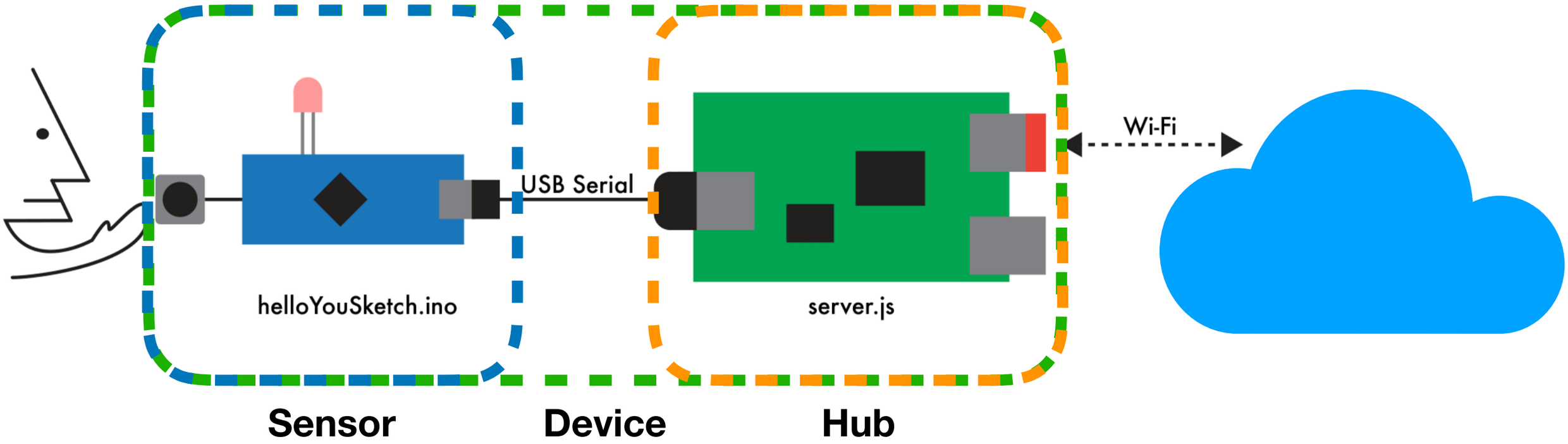
Distributed Services



Distributed Devices



Architectures



Adapted from Nik Martelaro's IxE Diagrams

Networks again?

- Short Range Wireless
  - Bluetooth Low Energy
  - Near Field Communication
  - RFID
  - Thread
  - WiFi, WiFi Direct. WiMAX
  - Z-Wave, Zigbee
- Medium Range Wireless
  - HaLow
  - LTE, NB-IoT,
- Long Range Wireless
  - LPWAN
  - LoRA
  - Very Small Aperture Terminal
  - Cellular 2G, 3G, 4G Mobile Technologies

https://www.slideshare.net/neeveehariharan/internet-of-things-architecture-topology

Considerations

- Latency
- Throughput
- Fault resiliency
- Scalability
- Hops
- Range

Exploring APIs

- newsapi.org
- openweathermap.org/api
- Bing Image Search: tinyurl.com/ybwdb5a9