

Session 3: The Internet

**Mastering the Internet
Duke OLLI Spring 2024**

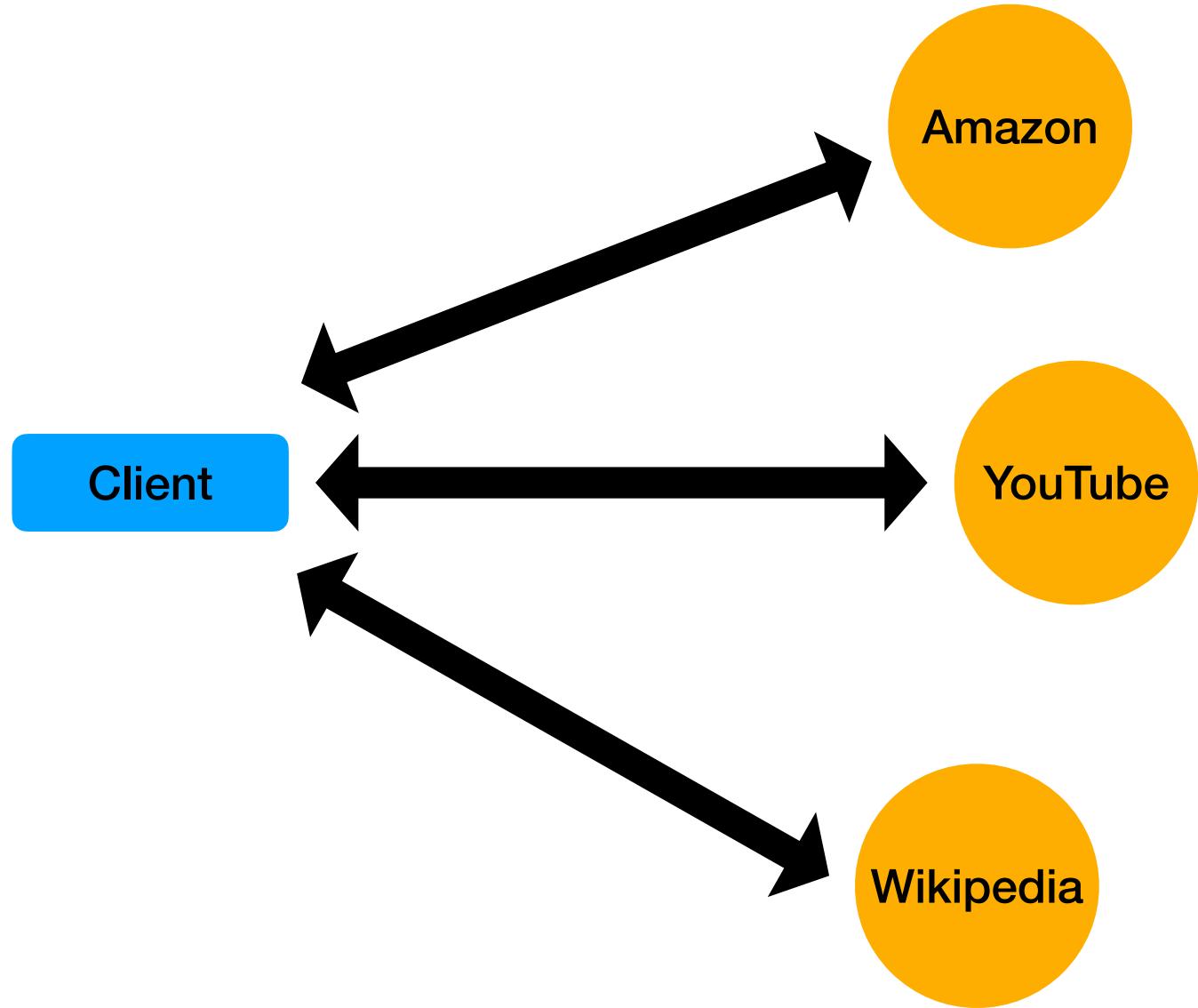
David Shamlan

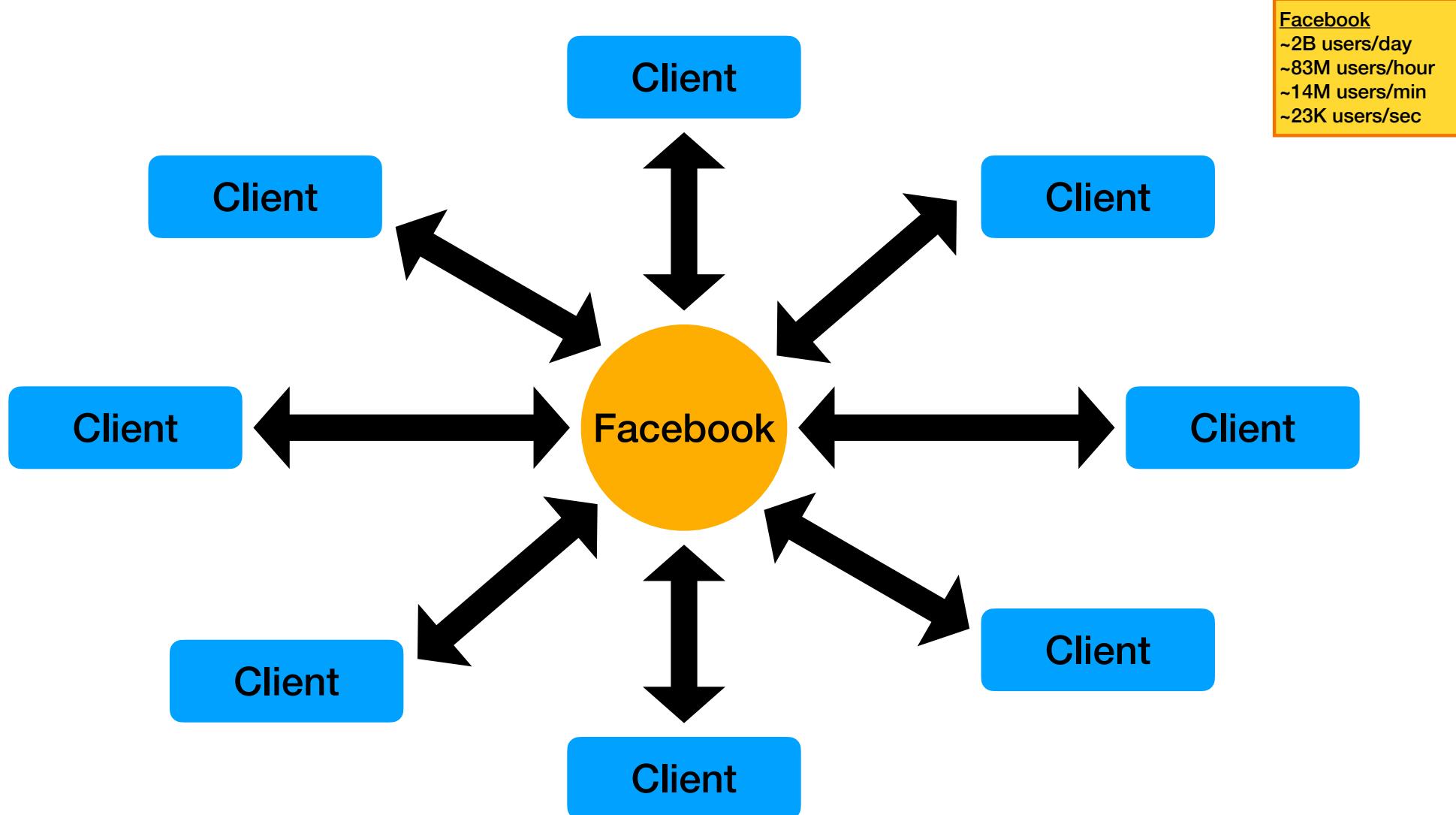
The word “app” is shorthand for “software application”

Review of Sessions 1 & 2

- **Apps** (like Browsers) run on our personal devices (ie, laptop, iPad, iPhone, etc) “talk to” **sites** on the Internet using the **HTTP/S** protocol
- Apps send **request messages** to sites
Sites reply with **response messages**
- Sites run software applications too
Web Server software applications handle receiving request messages and sending response messages
- **Domain names** (e.g., www.amazon.com, wikipedia.org) act as site addresses







The technology path to the Internet

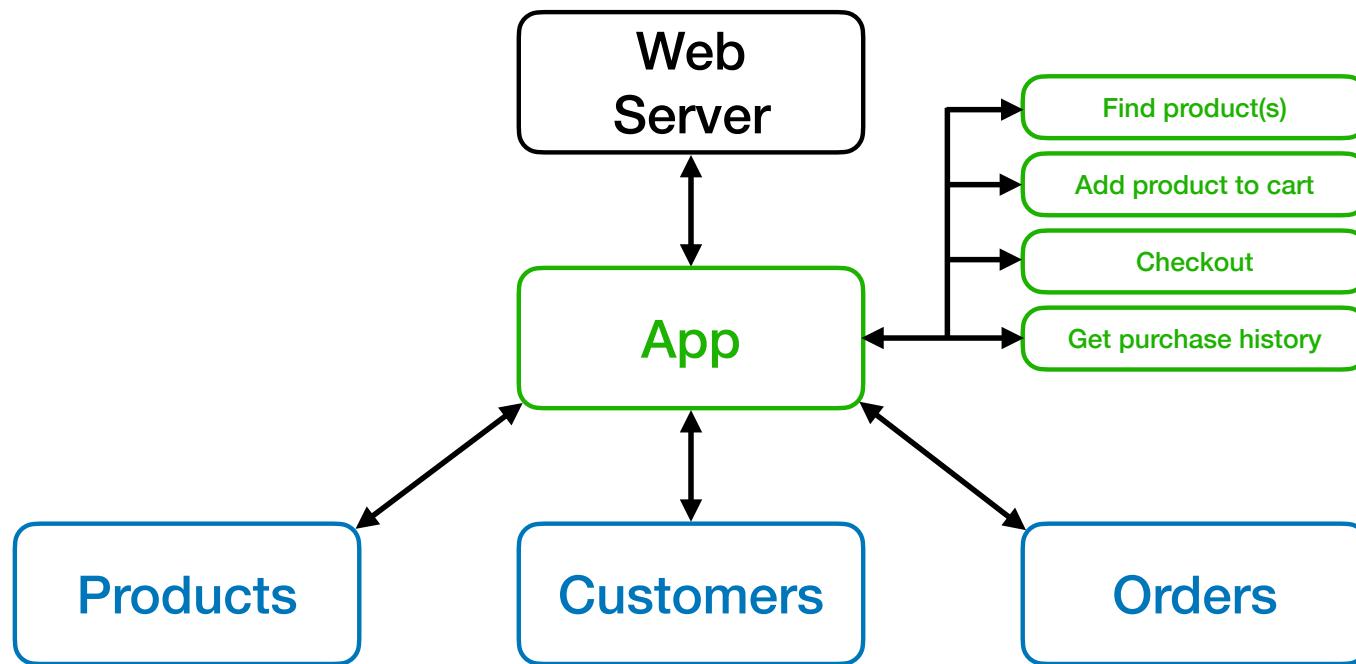
Computer scientists and researchers solved three key problems that make the Internet possible:

1. Enable more than one person to use a computer at the same time
I.e., enable computers to do more than one task at a time
2. Allow computers to share information with each other and
allow one computer to ask another computer to do some work
3. Connect computers separated by large geographical distances

app = code + data

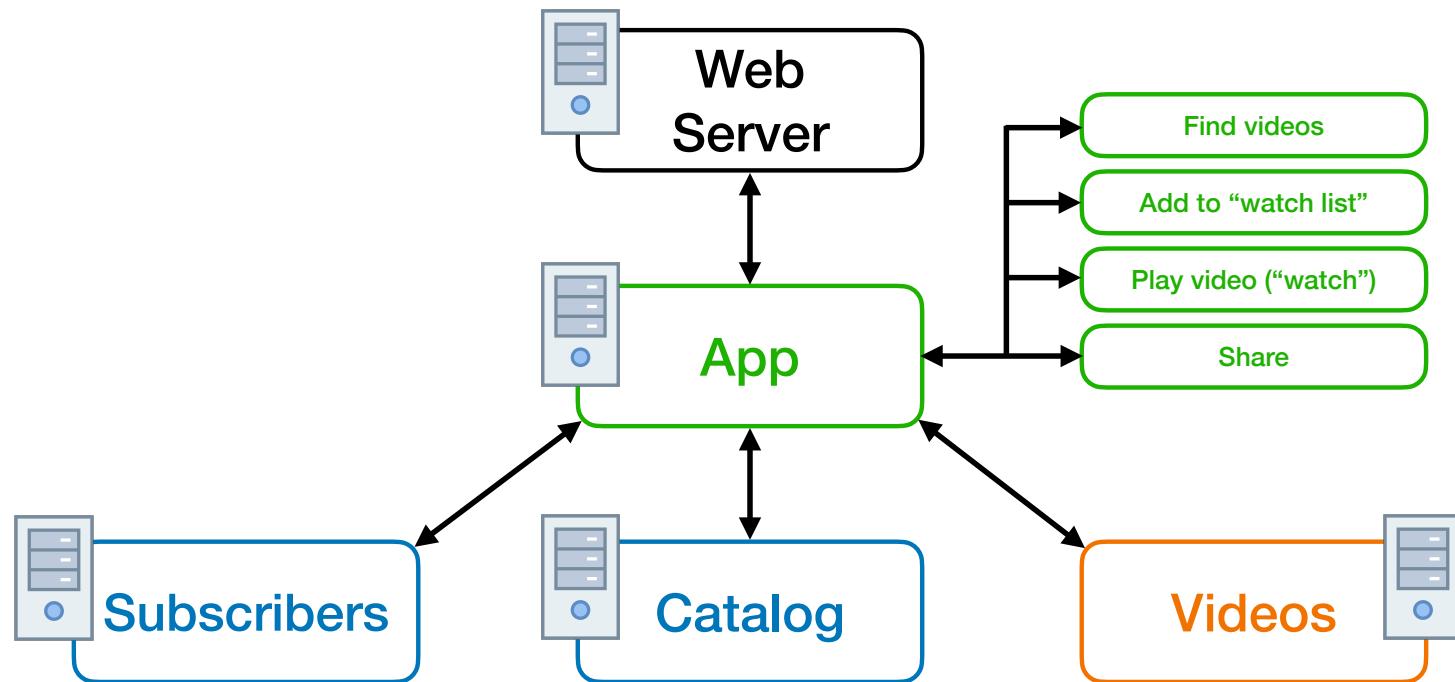
Example: Retail Site

Amazon
~12M products
~350M 3rd party products
~225K users/sec
~\$18K/sec

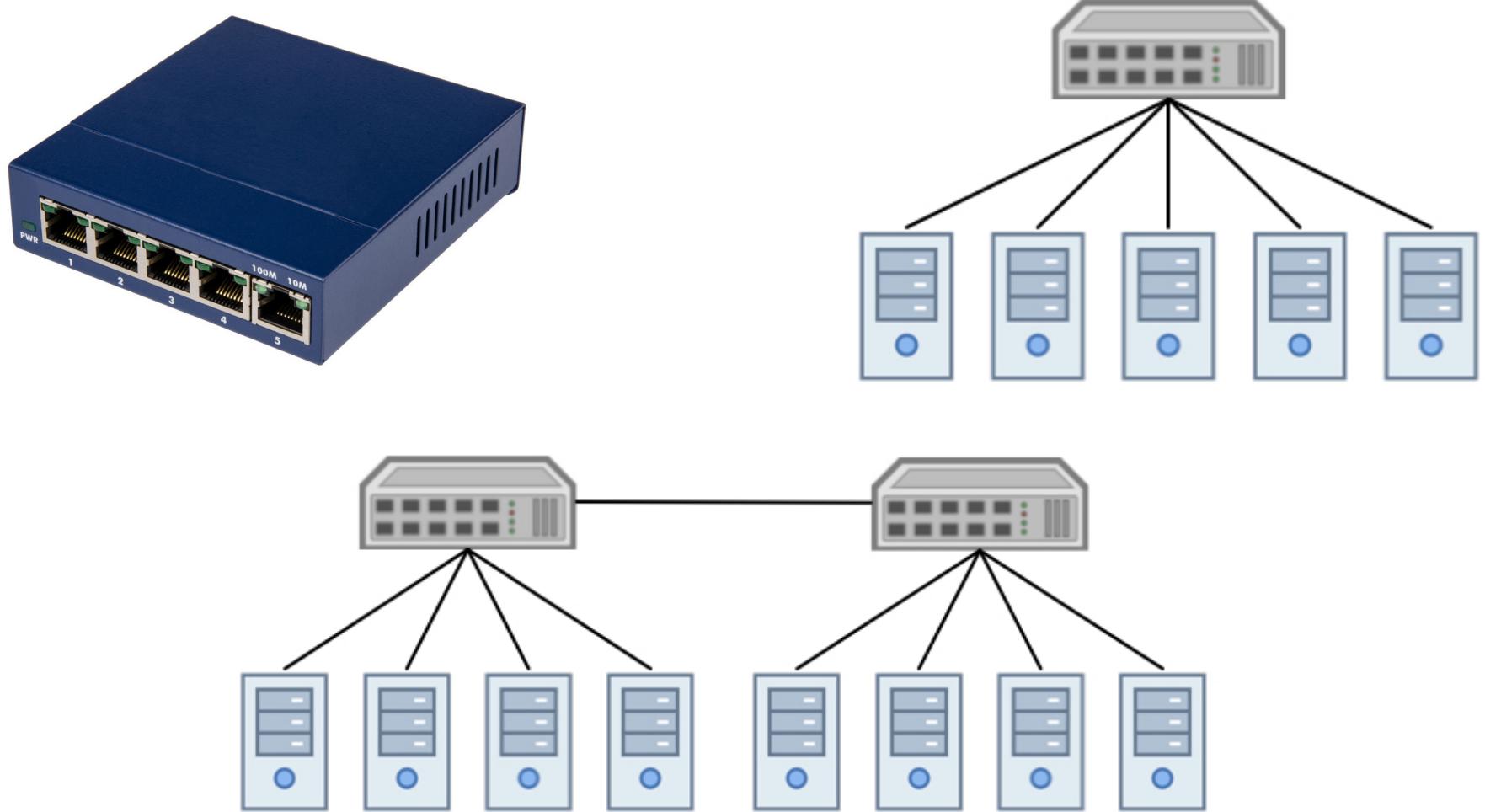


Example: Streaming Site

Netflix
~45.6M subscribers
~"Squid Game" streamed 1.65B hrs (~188K years)
~Avg user watches 3.2 hrs/day (~288GB/month)
~Combined 164M hrs/day watching content



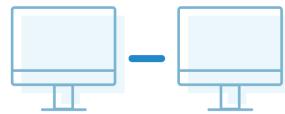




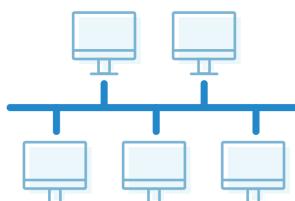


Common Network Topologies

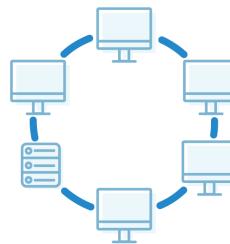
1 Point to point



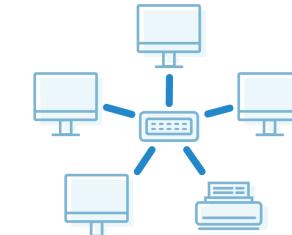
2 Bus



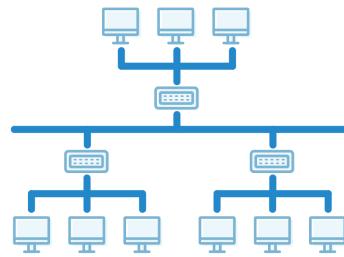
3 Ring



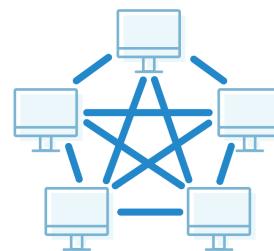
4 Star



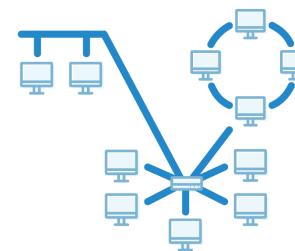
5 Tree

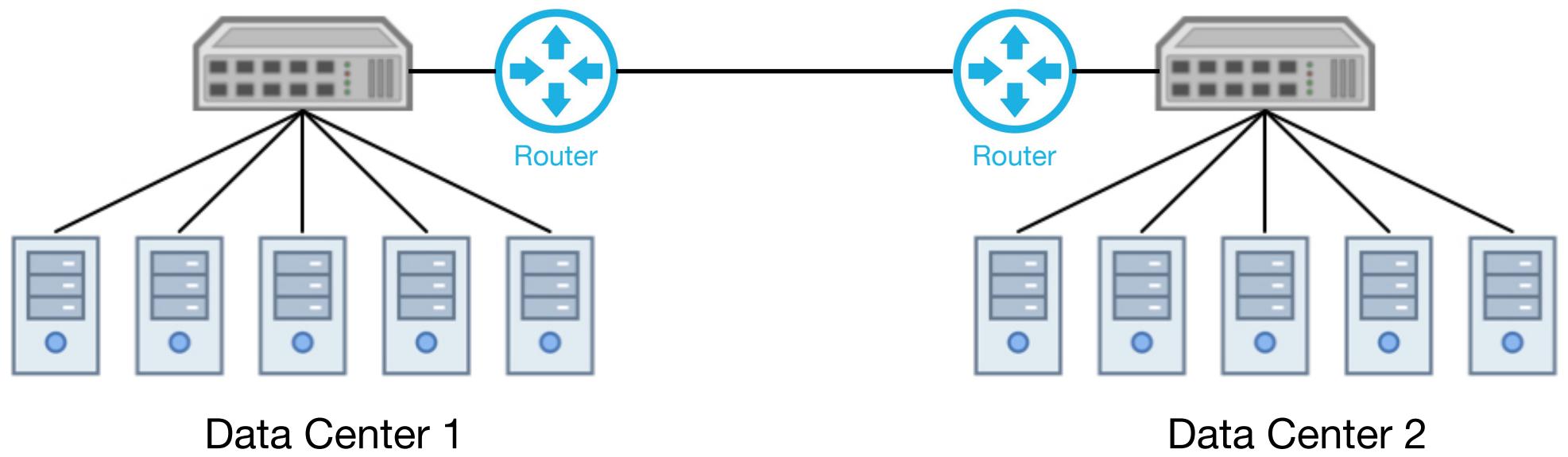


6 Mesh



7 Hybrid

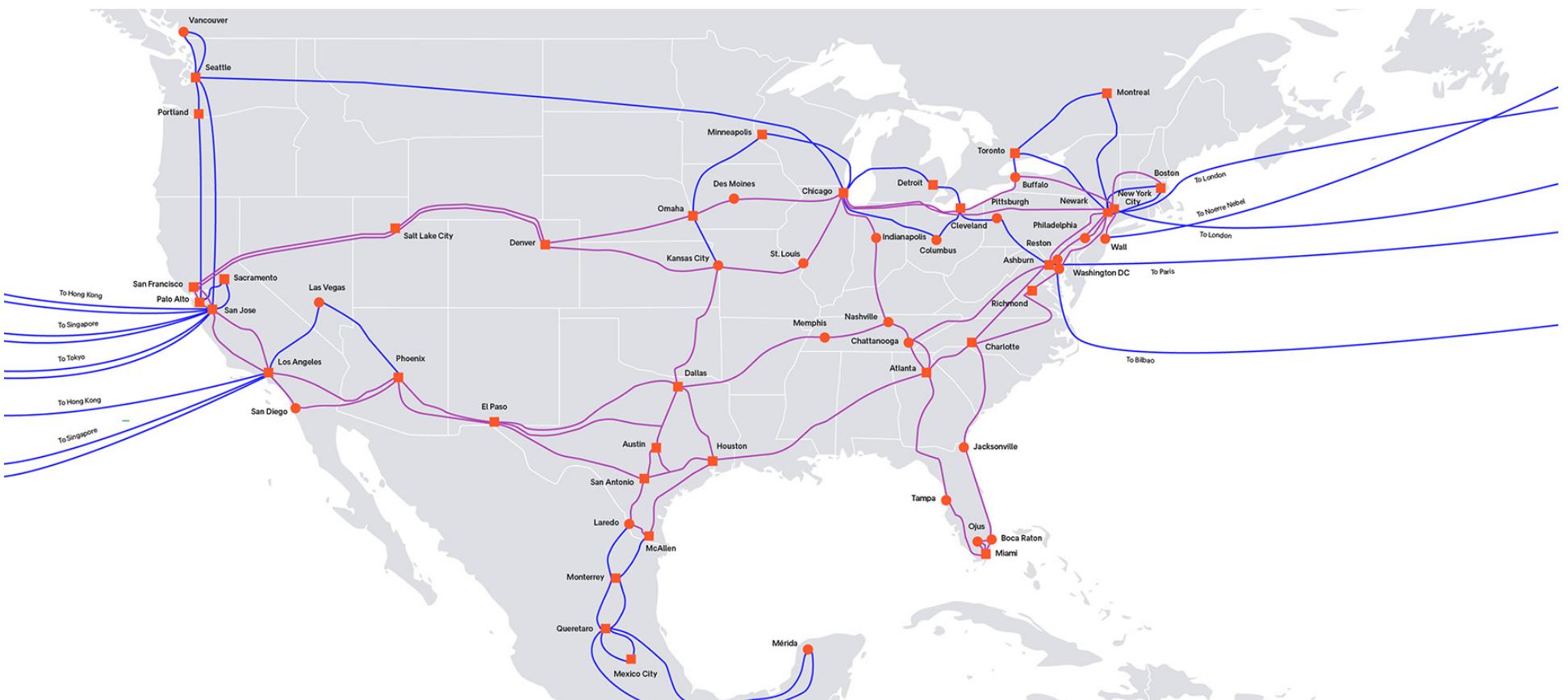




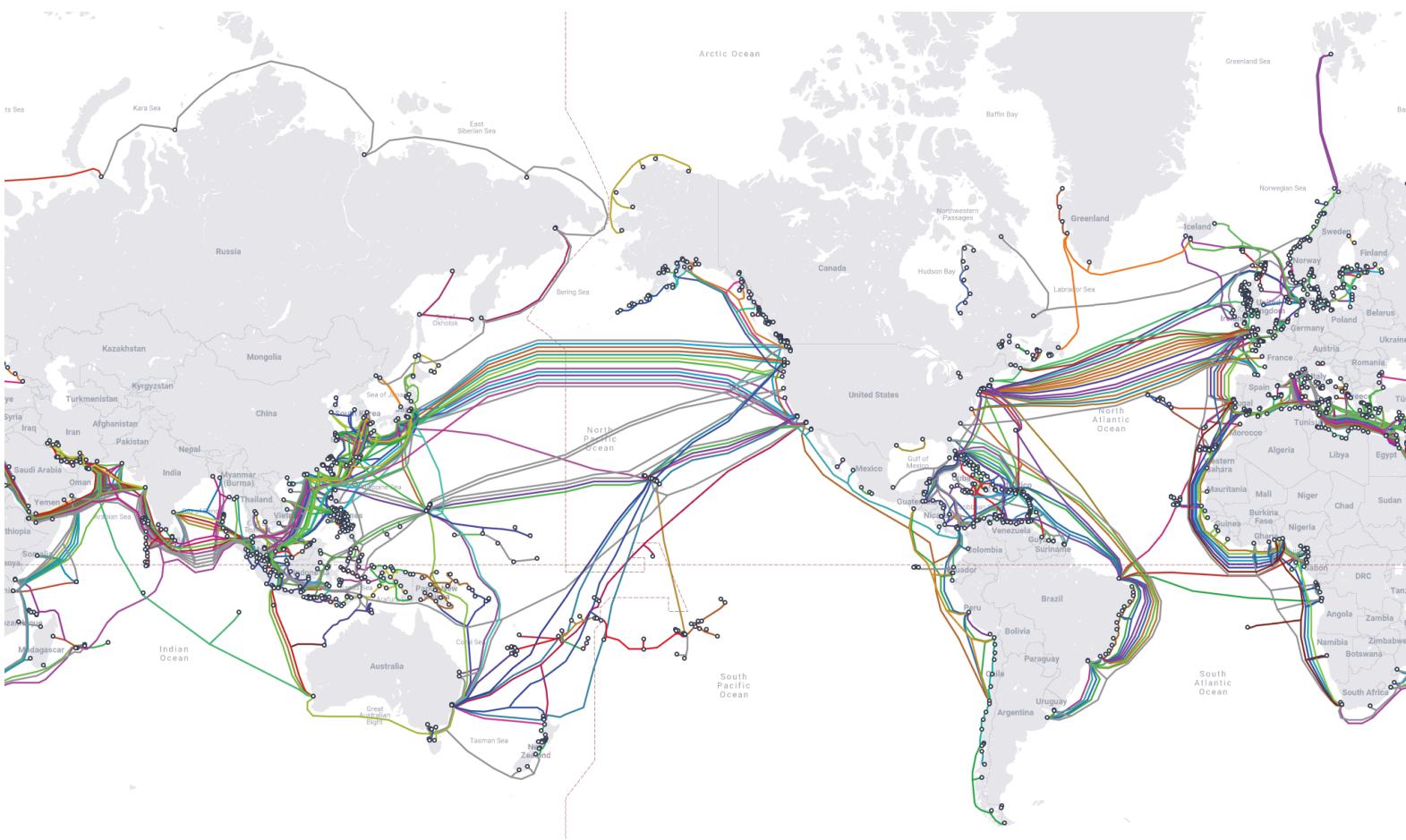
inter-network



US Internet Backbone



Global Internet Backbone



Internet Protocol Suite

Commonly referred to as TCP/IP

Transport Communication Protocol
User Datagram Protocol

Handle data transmission
I.e., packages the data and makes sure it arrives in tact

Handles navigation
I.e., physical addresses and transmission routes

Internet Protocol

IP Addresses

- An identifying number assigned to every device connected to the internet
- Examples
 - IPV4: 192.168.1.10
 - IPV6: 2603:6080:6500:1186:1c62:e0c1:ed4e:1fb0

Spoiler Alert: Domain names and IP addresses are closely related!

Demo: IP Addresses

- The site checkdns.io looks up the IP address(es) of domain names
- What are the IP addresses for the following domains?
 - google.com
 - facebook.com
 - wikipedia.org
 - github.io
- What happens if I enter a site's IP address into my browser's address bar?

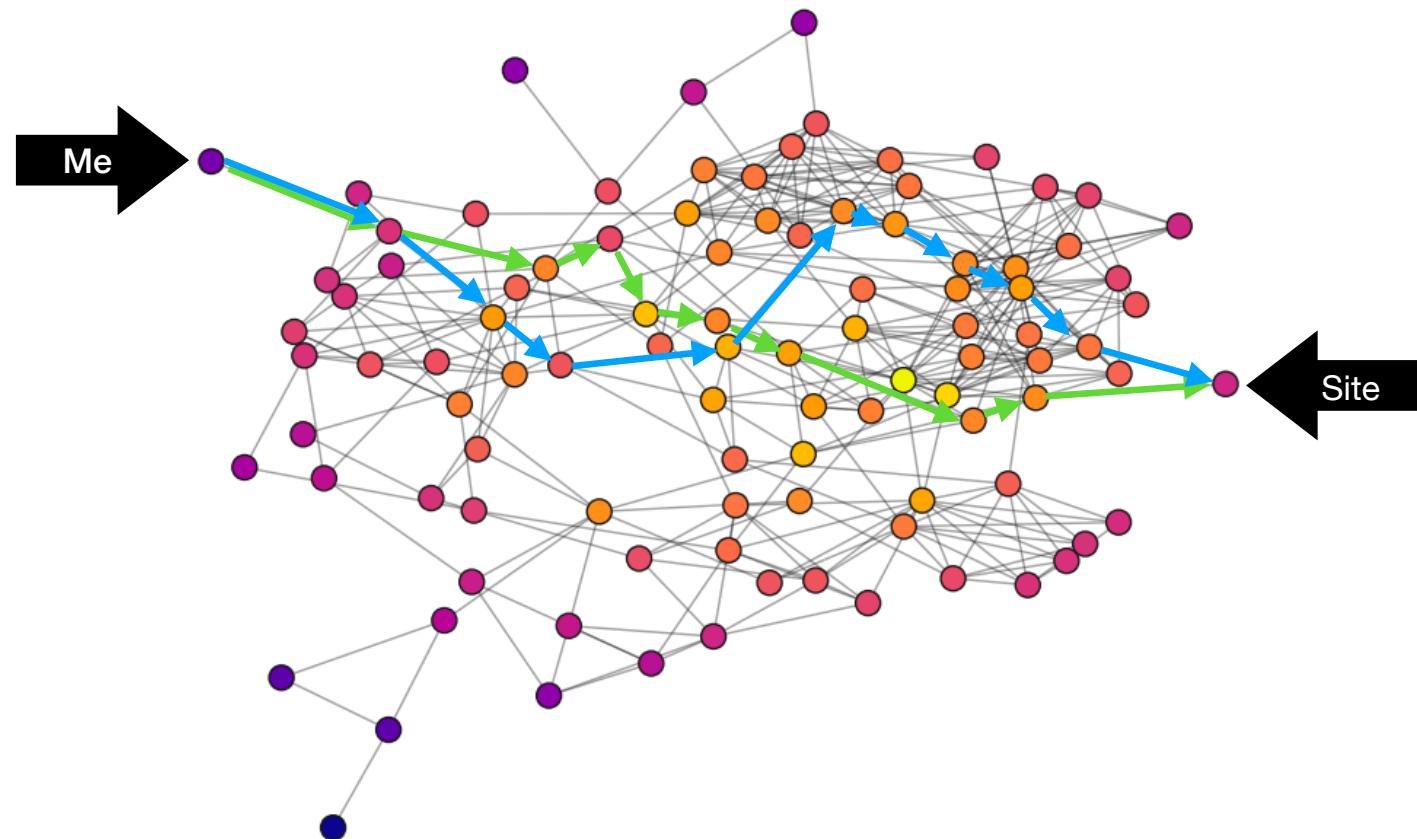
Why do we need both Domain Names and IP Addresses?

1. “wikipedia.org” is easier for people to remember than “208.80.154.224”
2. Sites’ IP addresses can be changed without disrupting/confusing the site’s users

A domain name is a *logical* address.
An IP address is a *physical* address.

Routing

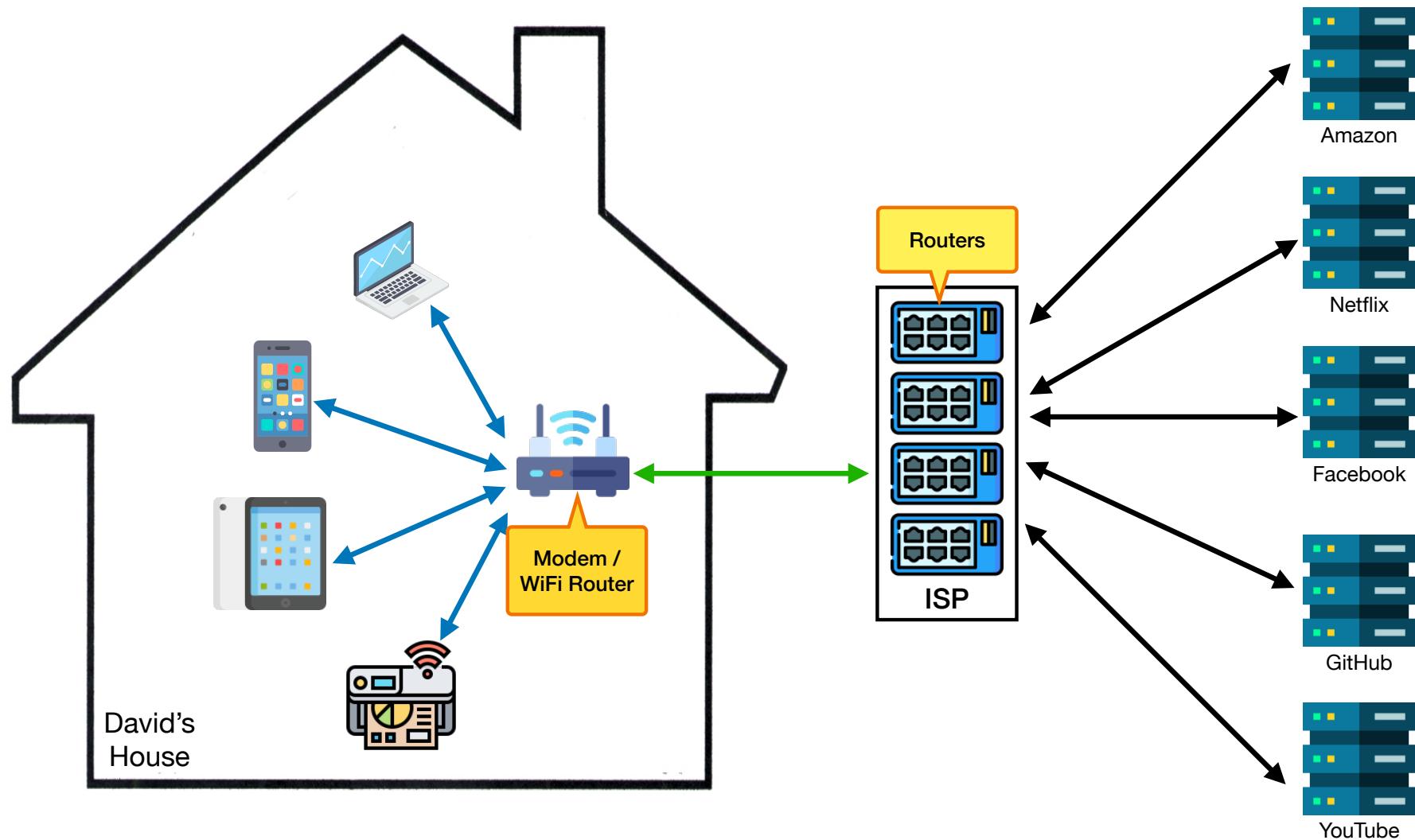
How packets find their way from point A to point B on the Internet



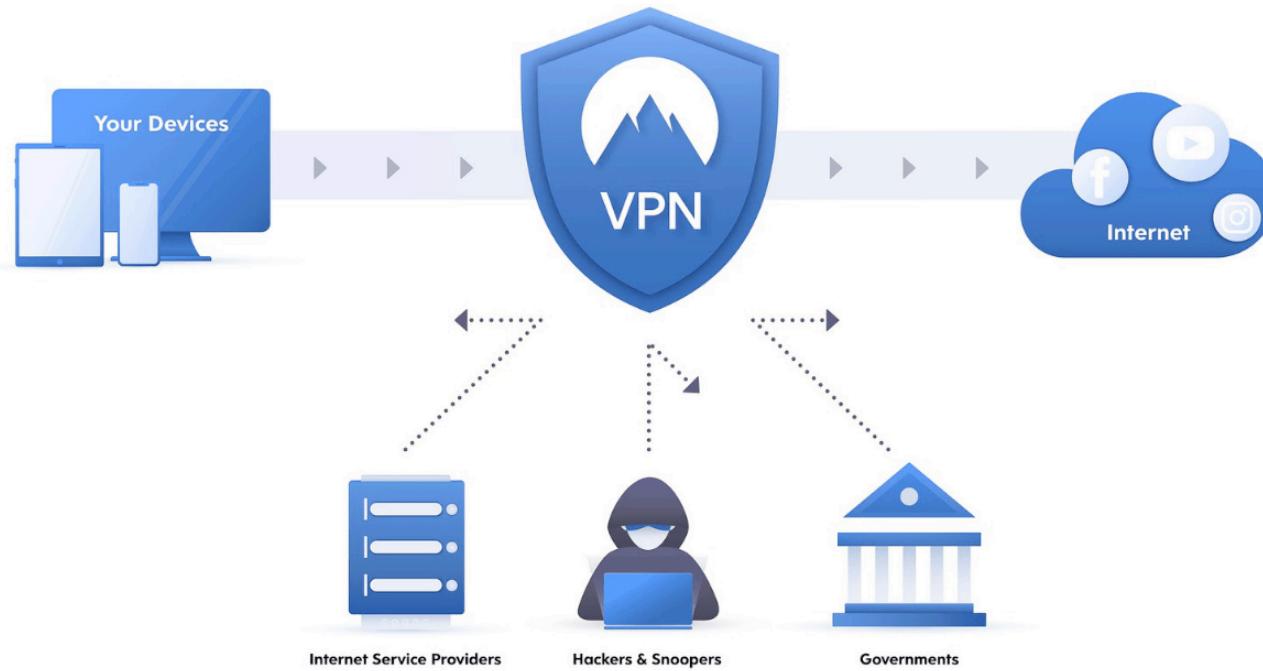
Demo: Video Streaming & Data Packets



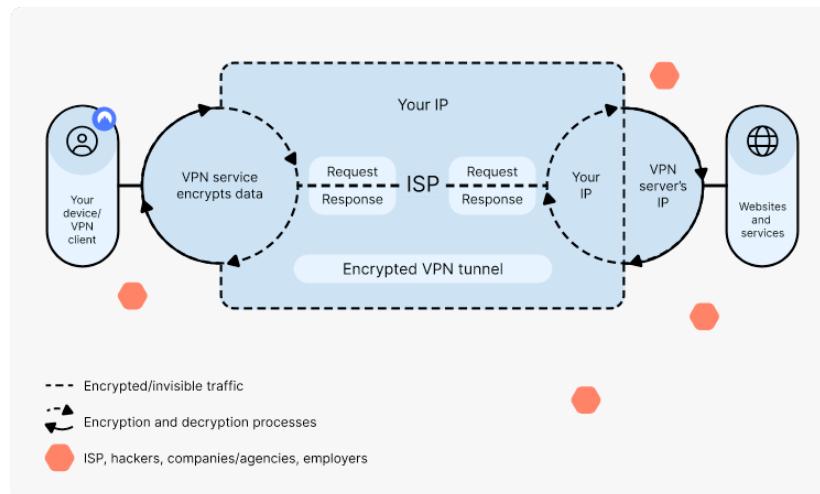
Bandwidth: the speed
data travels on a network



What is a Virtual Private Network?



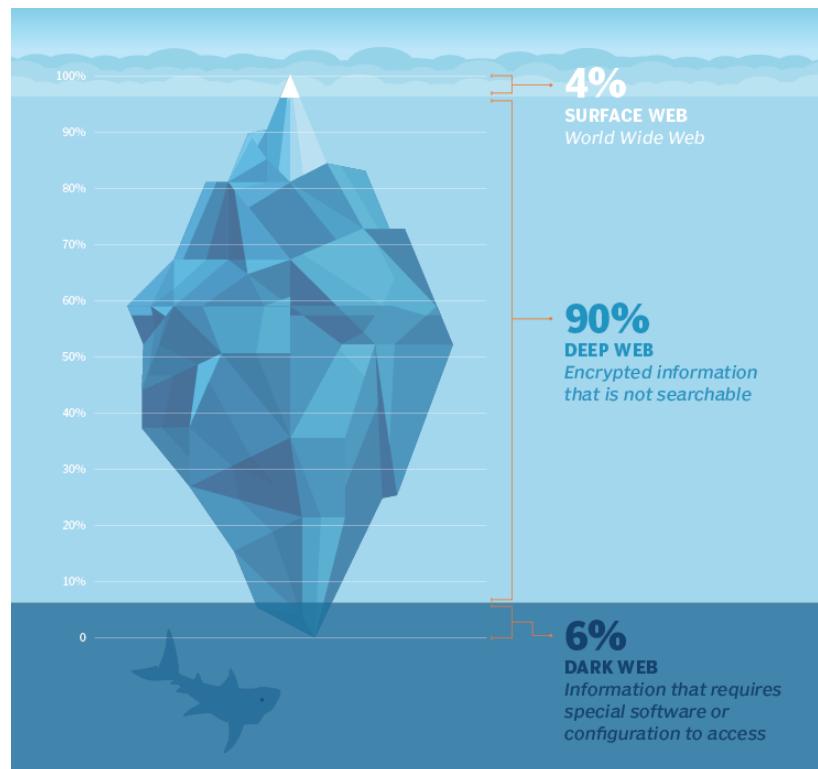
How VPN Works



Why use a personal VPN service?

- Stay secure on public WiFi
- Bypass ISP and/or geolocation restrictions
- Access sites while traveling internationally
- Avoid price discrimination when shopping online
 - Save money on international travel bookings (ie, airfare, hotels, rental cars, etc)
- Avoid targeted bandwidth throttling

What is the Dark Web?



Does the Internet have an “off” switch?

- No
 - The Internet is not owned, operated, or managed by any single entity/organization
 - The Internet is designed to be highly available and highly reliable
- Networking software
 - Assumes computers, switches, and routers will sometimes fail
 - Has the “smarts” to
 - Find alternative routes if/when the current route is blocked or broken
 - Resend packets if/when some get lost or damaged

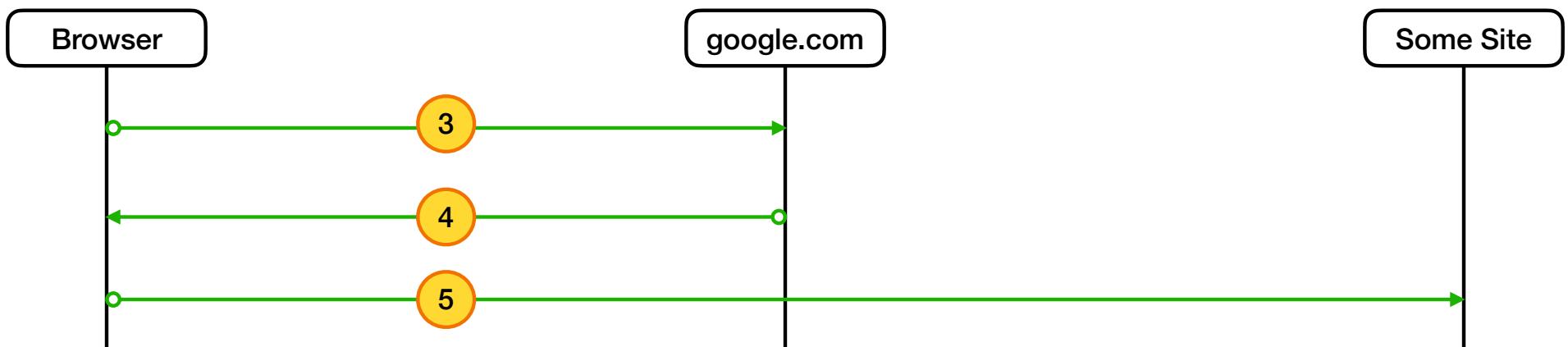
Is “search engine” synonymous with “browser”?

Short answer: No

- A browser is an app running on your device
- A search engine is a site on the Internet

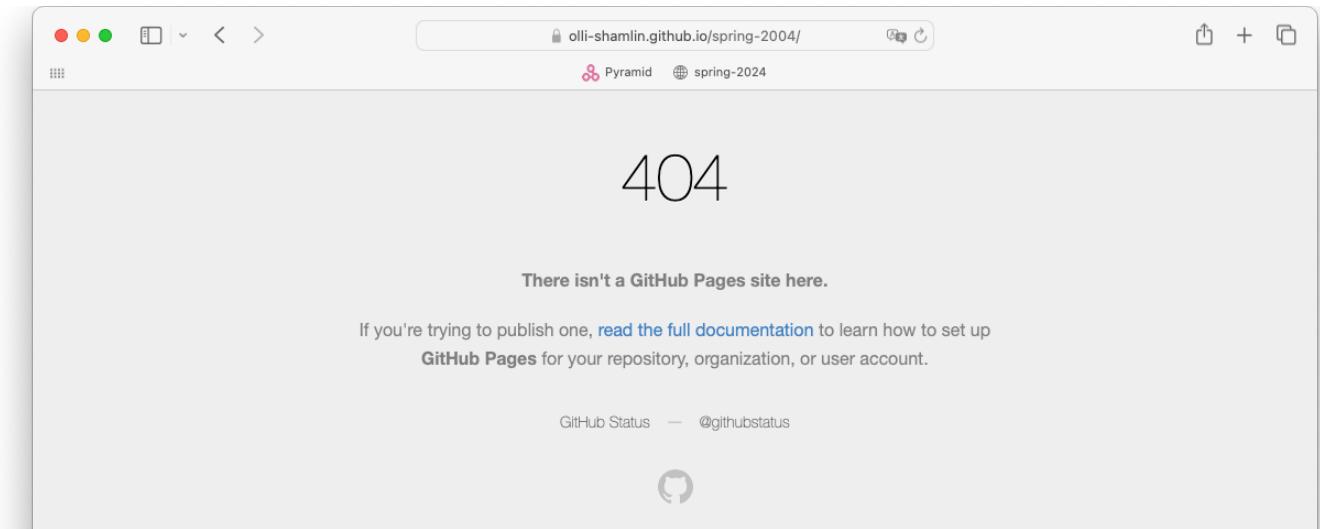
What happens when you enter a string of characters into your Brower's Address Bar and hit return/enter/go

1. If the string of characters looks like a URL
 1. Your browser sends a message to the site indicated by the URL's domain name
 2. Site responds by sending a message containing the resource in the URL
2. Else the browser sends the string of characters you entered to Google's search engine as a URL of the form `https://www.google.com/search?query="string of characters"`
3. Google's search engine builds a list of URLs that match your query and sends them back in a response
4. You click on one of the URLs in the response from google.com and your browser send a “GET” message to that site



HTTP Error Response Codes

- A good reference should you ever need it (unlikely)
<https://restfulapi.net/http-status-codes/>
- Codes that start with a “4” indicate an error on the client
- Codes that start with “5” indicate an error on the server (ie, site)



What am I paying what I buy a digital device?

The main “decision points” that affect the purchase price:

1. Screen (size & type)
2. CPU
3. RAM
4. Storage (size & type)

Example: [Apple Macbook Pro](#)

Review

- Many Internet sites handle volume of work that are more than one computer can handle
 - Computer **networks** allow large workload volumes to be spread across multiple computers
- A network is a collection of computers connected to each other by **switches**
 - Networks reside in **data centers**
 - Networks are connected to each other by **routers**
- **The Internet is a network of networks!**
- **TCP/IP** is the protocol of the Internet
 - TCP/IP finds the **physical** location of a site on the Internet by translating the site's domain name into its **IP Address**
 - TCP/IP handles the **packaging** and **routing** of data **packets** across the Internet
- **HTTP(S)** is the protocol of the Web
HTTP(S) handles the **messages** that pass between a client-side APP and a web server
- An HTTP(S) message is usually comprised of many data packets

Homework

- Review session slides if that seems interesting/valuable.
If so, share any new/additional questions via an email to David and/or at the beginning of next week's session
- Next week's theme: **Accounts and how they work**
 - We will create a new Google account during next week's session
 - We will use our Google accounts again during our May 29 session on the Cloud