

Networks

Will Leeson

What is a network?

Definition - Network

An interconnected or interrelated chain, group, or system

What is an example
of a network?

Examples of networks

- The internet
- Social networks (Person to Person)
- Highway system
- The brain
- Professional network

What do we need for
a computer network?

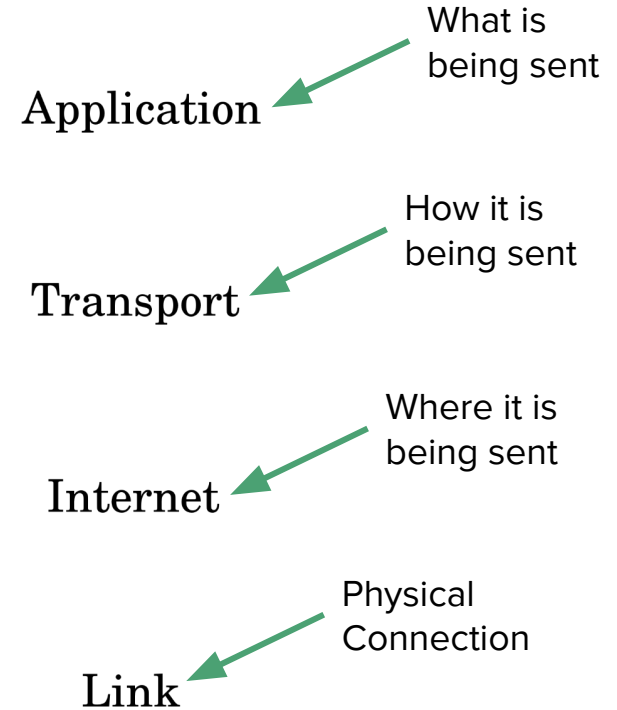
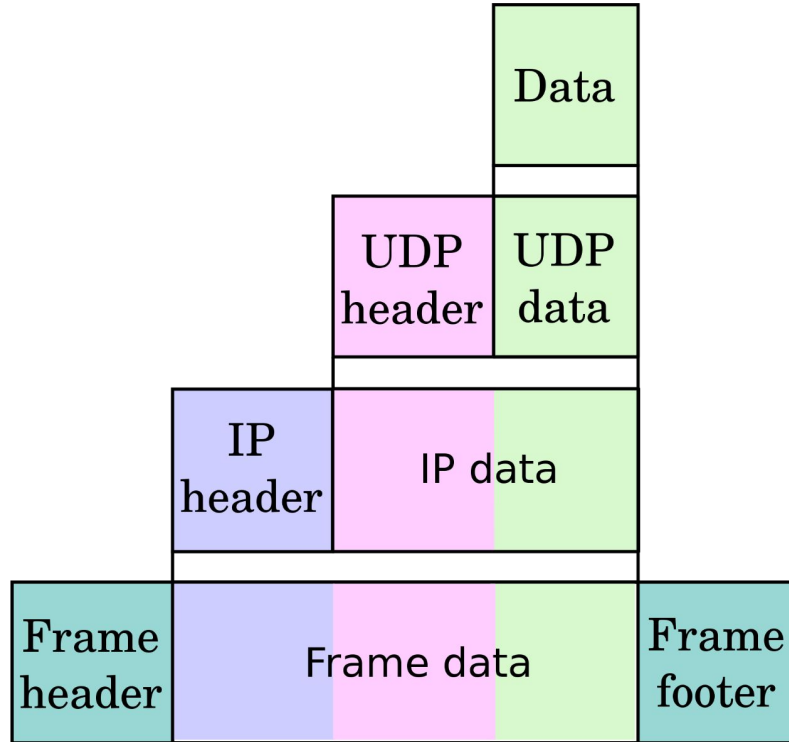
What do we need for a computer network?

- A shared way of communication
- Multiple devices
- A connection

The Internet Protocol Suite

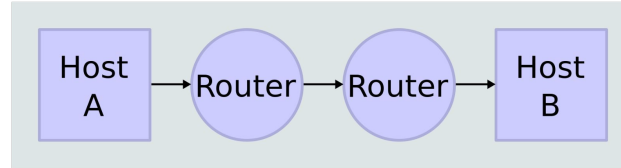
- The language of network communication
- Developed for DARPA
 - Early days of the internet (early 1970s)
 - Credited to the “Fathers of the internet”
 - Vinton Cerf and Bob Kahn
- 4 Layers
 - Link Layer
 - Internet Layer
 - Transport Layer
 - Application Layer

The Internet Protocol Suite

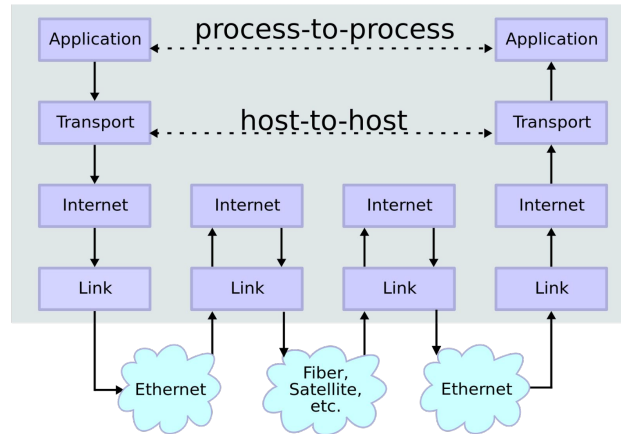


The Internet Protocol Suite

Network Topology



Data Flow



Let's talk connections

- Physical Connection - A wire

- Materials
 - Copper - Old
 - Fiber Optics - New(ish)
- Generally stable connection
- One cable per connection



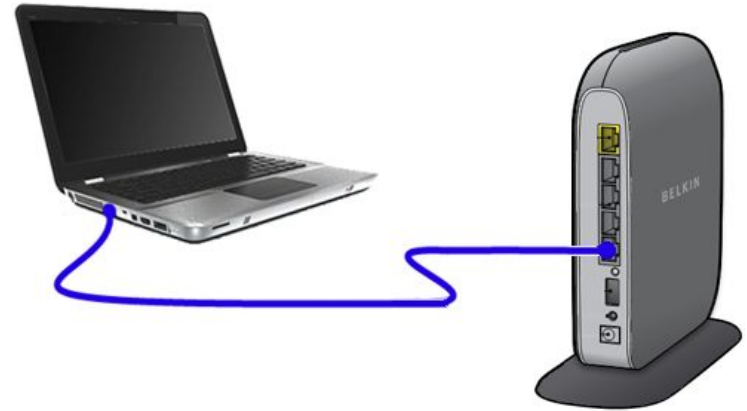
- Signal Connection - Radio Waves

- Requires some sort of hub
- Connection varies based on many factors
- Many connections per hub
- Different types
 - Bluetooth
 - WiFi
 - Cellular

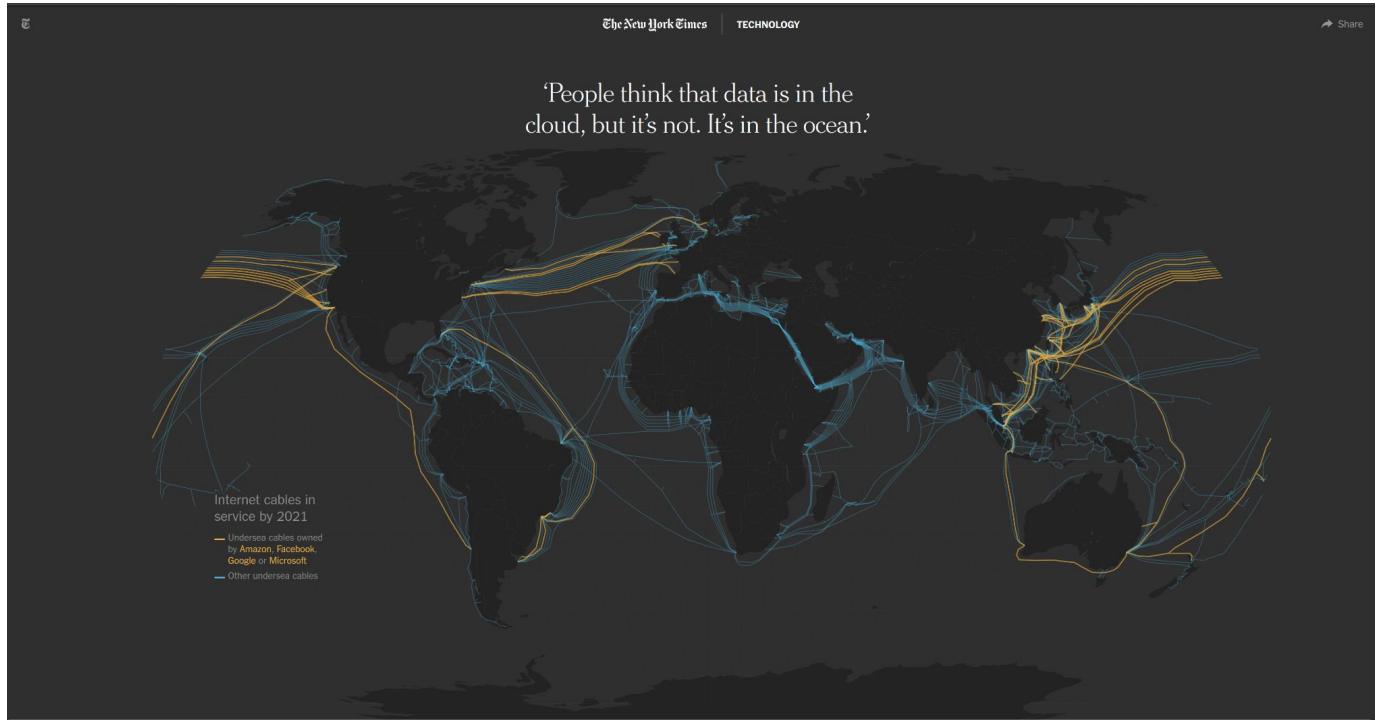


Wired Connections

- Information flows through wire
 - Binary pulses
 - Electric - Copper (Coax)
 - Infrared light - Fiber Optics (Fiber)
- Stable connection
 - Uninterrupted cable
 - Constant speed end-to-end
- How much of the information is travels
 - Wire below ground
 - Interconnected hubs



Wired Connections



Wired Connection comparison

Copper

Pros

- Existing Infrastructure (It's everywhere)
- Cheaper
- Fast enough for many things
- Can also power devices

Cons

- Slower
- Short range (about 300 feet)

Fiber

Pros

- Faster (>4 times faster)
- Long range (>20 miles)
- Smaller
- Not as affected by weather

Cons

- More expensive
- Need to revamp existing networks
- Can only carry information

Wireless Connections

- Information is sent over the air
 - Still binary
 - Radio waves
 - Different frequencies
- Connection Varies
 - Waves dissipate
 - Close = Strong, reliable
 - Far = Weak, variable
- How much of information is delivered
 - Wire travels most of the way
 - WiFi & Cellular travel the last leg

Short Range Wireless

- Typically around 10m (33ft)
- Personal Area Network (PAN)
 - Close interconnected devices
 - Wireless mouse
 - Wireless headphones
 - Smart watch
- Several Standards
 - Bluetooth
 - ZigBee (Smart homes)
 - IrDA (Infrared)



Bluetooth[®]



zigbee

Medium Range Wireless

- Typically around 20m (66ft)
- Local Area Network (LAN)
 - Many devices
 - Typically doing their own thing
 - Several Computers on WiFi
 - Printer
 - TV
- Wifi is the standard



Helpful Wifi Info

- There are two “bands”
 - 2.4 GHz
 - 5 GHz
- Modems
 - These don't create wifi
 - Take signals from outside
 - Converts signal you can use
- Routers
 - Wifi hub
 - Sends out wifi
 - Allows wired connections too



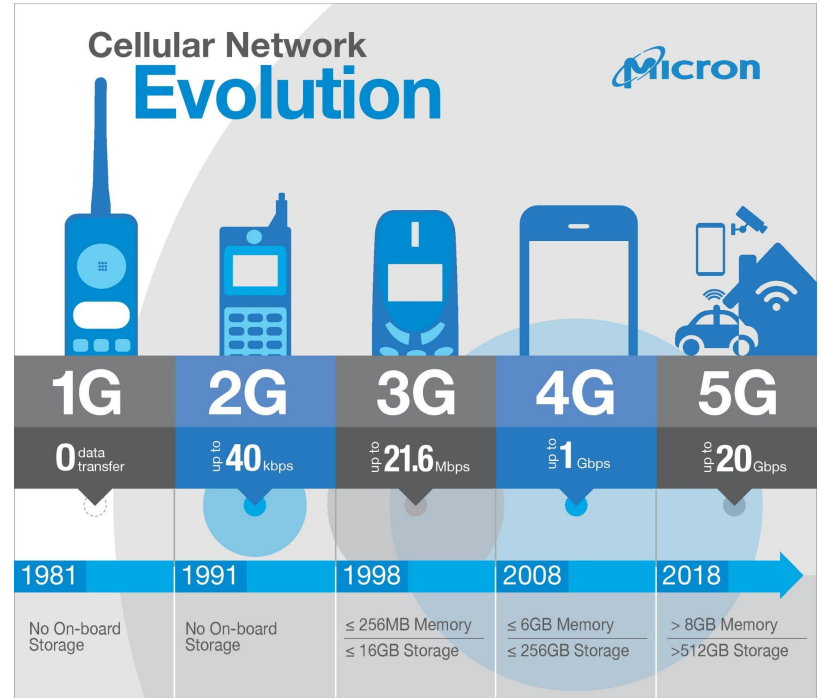
Modem

Router



Long Range Wireless

- Can travel hundreds of meters
- Sent from “base stations”
 - Range in size
 - Can support hundreds of people
- Main providers are telecoms
 - Verizon
 - AT&T
 - T-Mobile
- Standards are evolving
 - 5G is current



Public Network

- Network that requires no password
- Typically found in public places
 - Coffee Shop
 - Restaurant
 - Etc.
- Convenient, but dangerous
 - Unsecure
 - Host unknown
- Be careful when using one



3 Public WiFi Risks

1. Packet Sniffing
2. Man-in-the-Middle Attacks
3. Malicious WiFi Hotspots

The infographic features a large white WiFi symbol on a green background. Five stylized human figures are positioned around the symbol: one sitting on the top curve, one standing on the left holding a phone, one sitting on the ground with a laptop, one sitting on the ground with a laptop, and one standing on the right holding a phone. The background has a faint white network grid pattern.



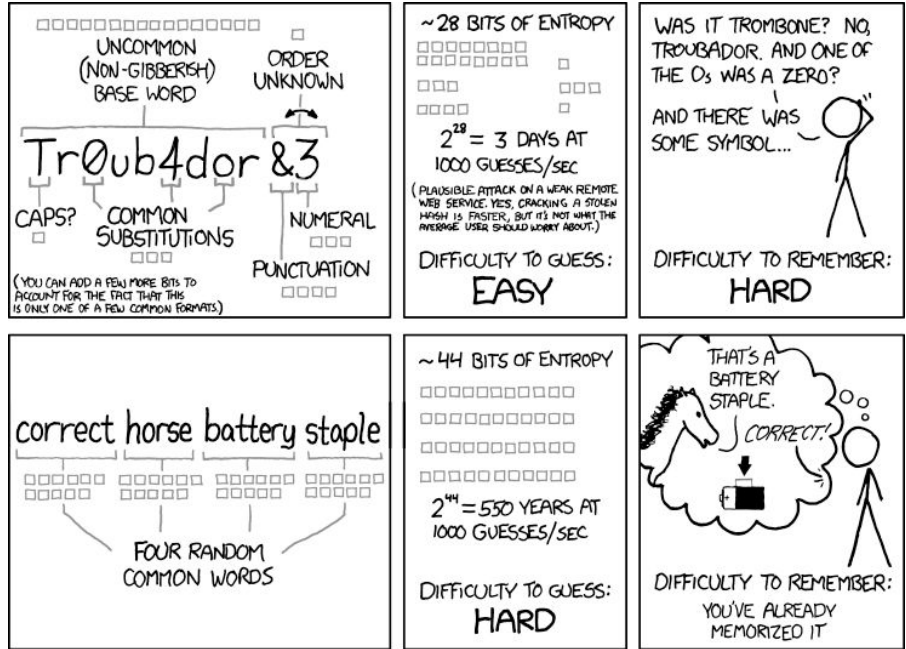
Tips To Protect Yourself On Public WiFi

- 1 Keep an eye out for fake public hotspots or "rogue hotspots."
- 2 Never visit websites with personal information
- 3 Only visit secure "HTTPS" websites
- 4 Level up the security settings on your mobile devices
- 5 Use a VPN
- 6 Use anti-malware or antivirus protection for your devices
- 7 Log out of websites when done

The infographic shows a hand holding a smartphone. The phone screen displays a yellow warning sign with a black exclamation mark. An orange banner with the text "Free Wi-Fi" is wrapped around the phone. The background is purple and white with a faint network grid pattern.

Private Network

- Password protected network
- Most Wifi networks
 - Home Network
 - School Network
- Safer than Public
 - Assuming you trust the network
 - Must be setup correctly for optimal safety



THROUGH 20 YEARS OF EFFORT, WE'VE SUCCESSFULLY TRAINED EVERYONE TO USE PASSWORDS THAT ARE HARD FOR HUMANS TO REMEMBER, BUT EASY FOR COMPUTERS TO GUESS.

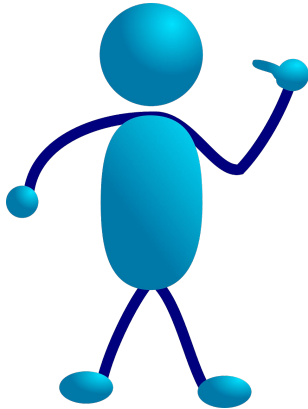
Situation

- It's the early 2010s
- I am in High School
- Streaming services aren't really a thing yet
- I want to rent a copy of the new fancy foreign film critics are talking about
- The popular kid, Doug MuhLooks, works at the rental store
- I don't want people to know I'm watching it, or I may lose my street cred
 - Sidebar - I have no street cred but for some reason, I think I do

The Direct Route

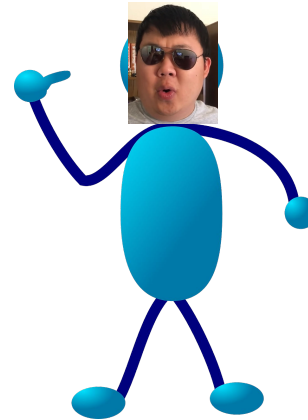
Me

One copy of "Le chat dans le chapeau" please!



Will, you are a loser! You should've gotten "Cool Movie Part 2: The Coolening"

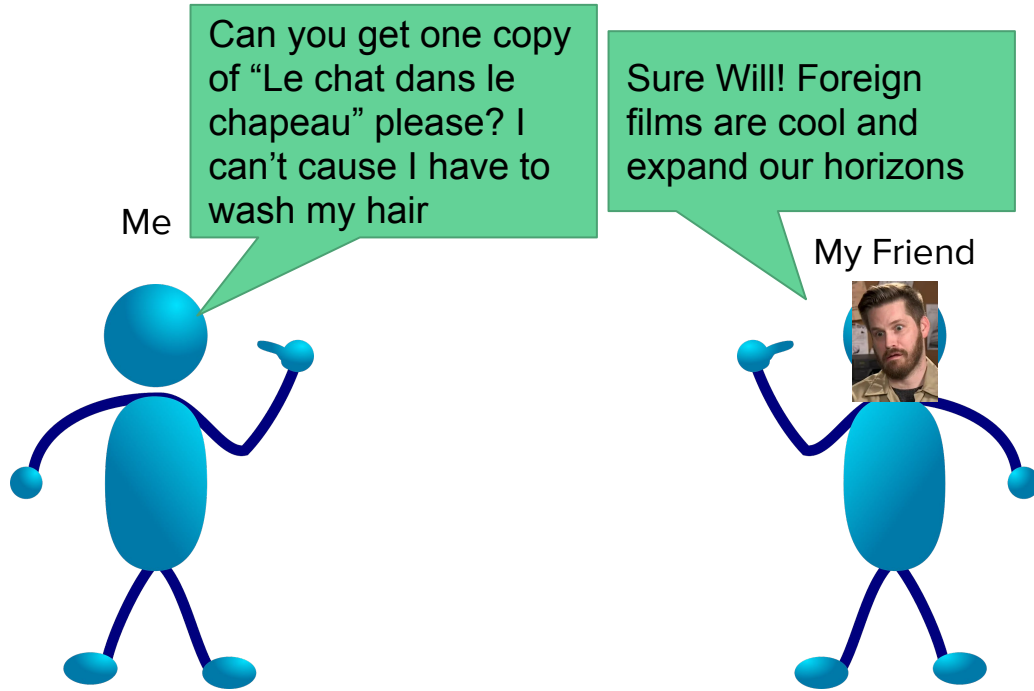
Doug
MuhLooks



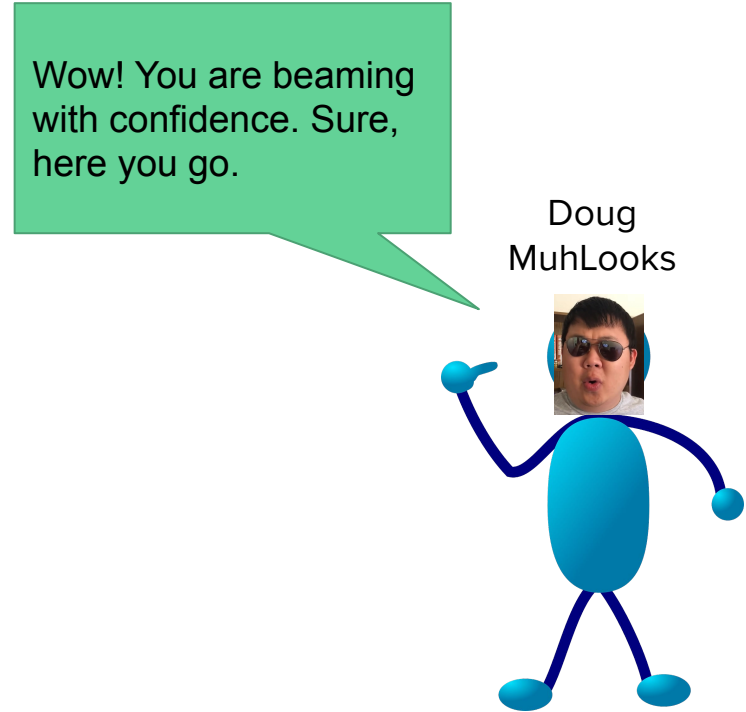
Update

- I have a friend
- He is self confident
- He doesn't care about street cred
 - Effectively giving him street cred
- He will do me a solid because he is a “generally cool person”

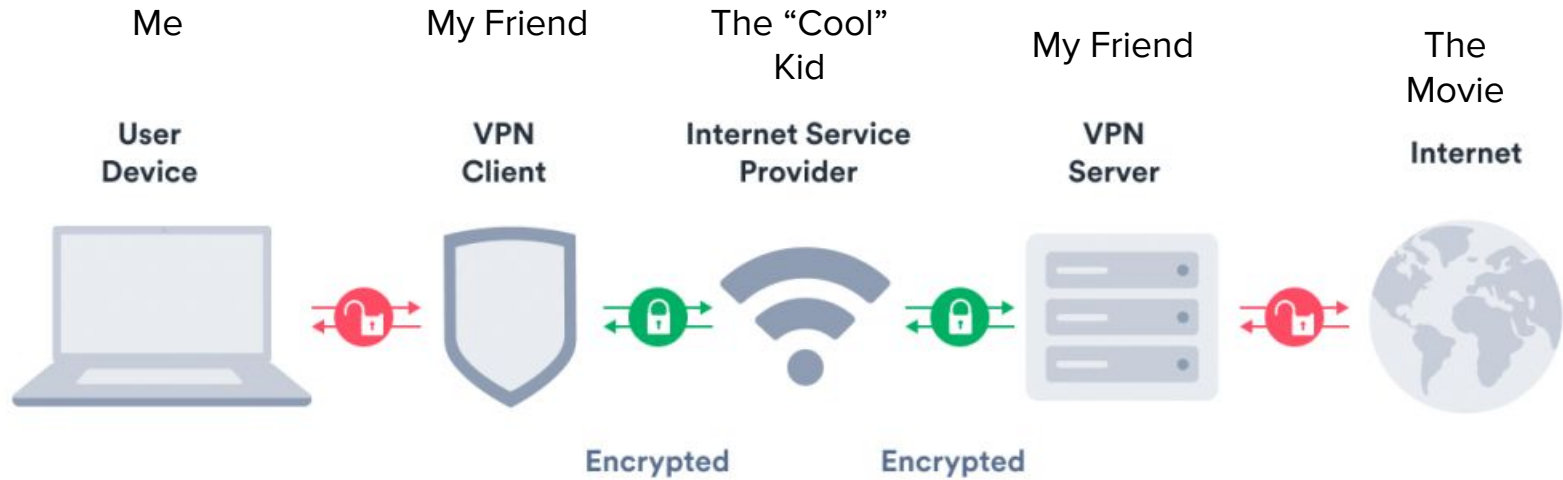
The Indirect Route



The Indirect Route



Virtual Private Network (VPN) - The Indirect Route



VPN

VPN

- Main Uses
 - Make data difficult to track
 - Pretend to be somewhere else
- Beware
 - If law enforcement is involved, they will likely cooperate
 - If ToS are violated, they may cooperate
- Make sure it's reputable
 - You are essentially forwarding information through them
 - If there isn't a charge, you are the product