

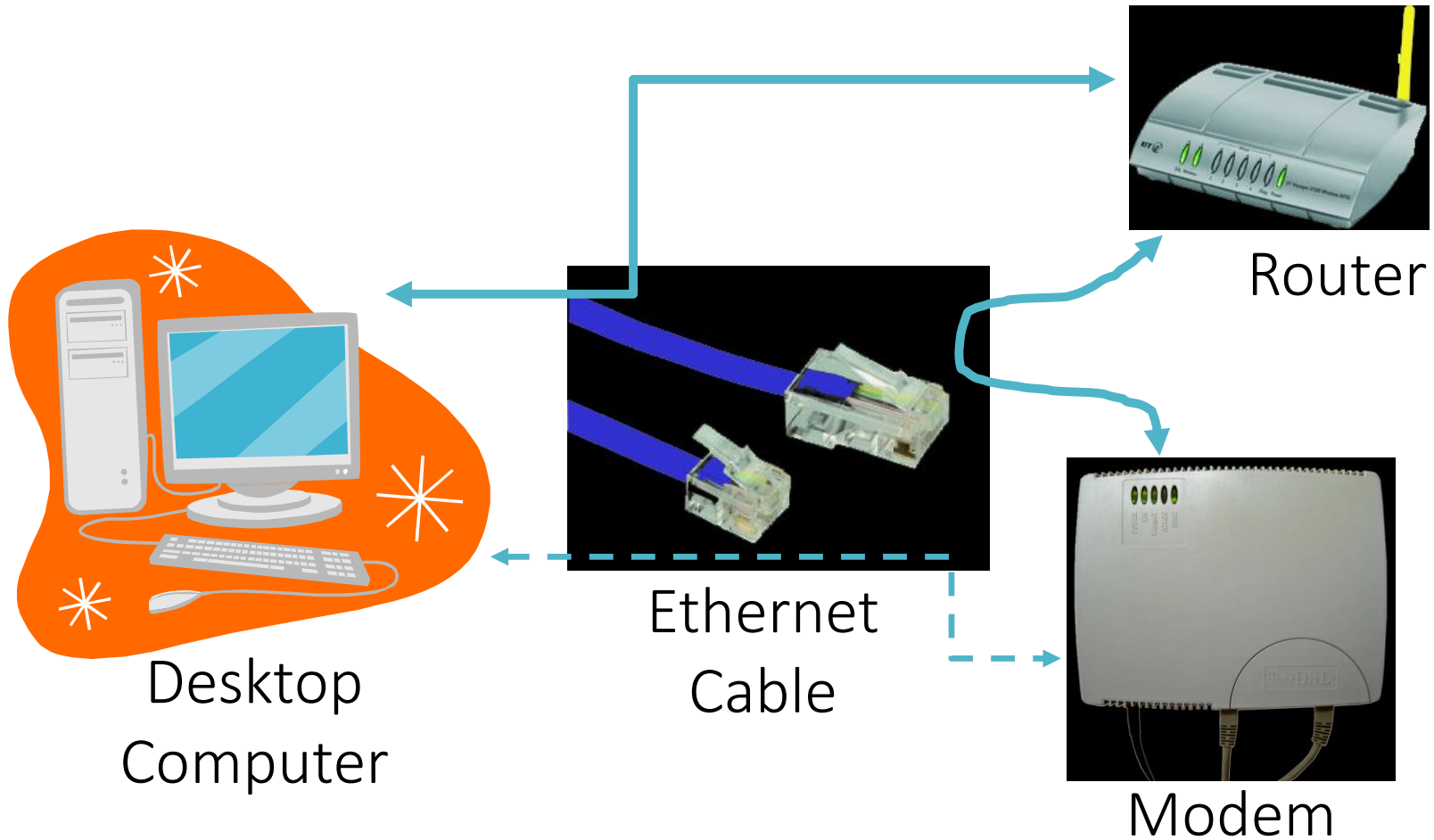
Topic 1: Fundamentals & Vocabulary

Eric Mlinar

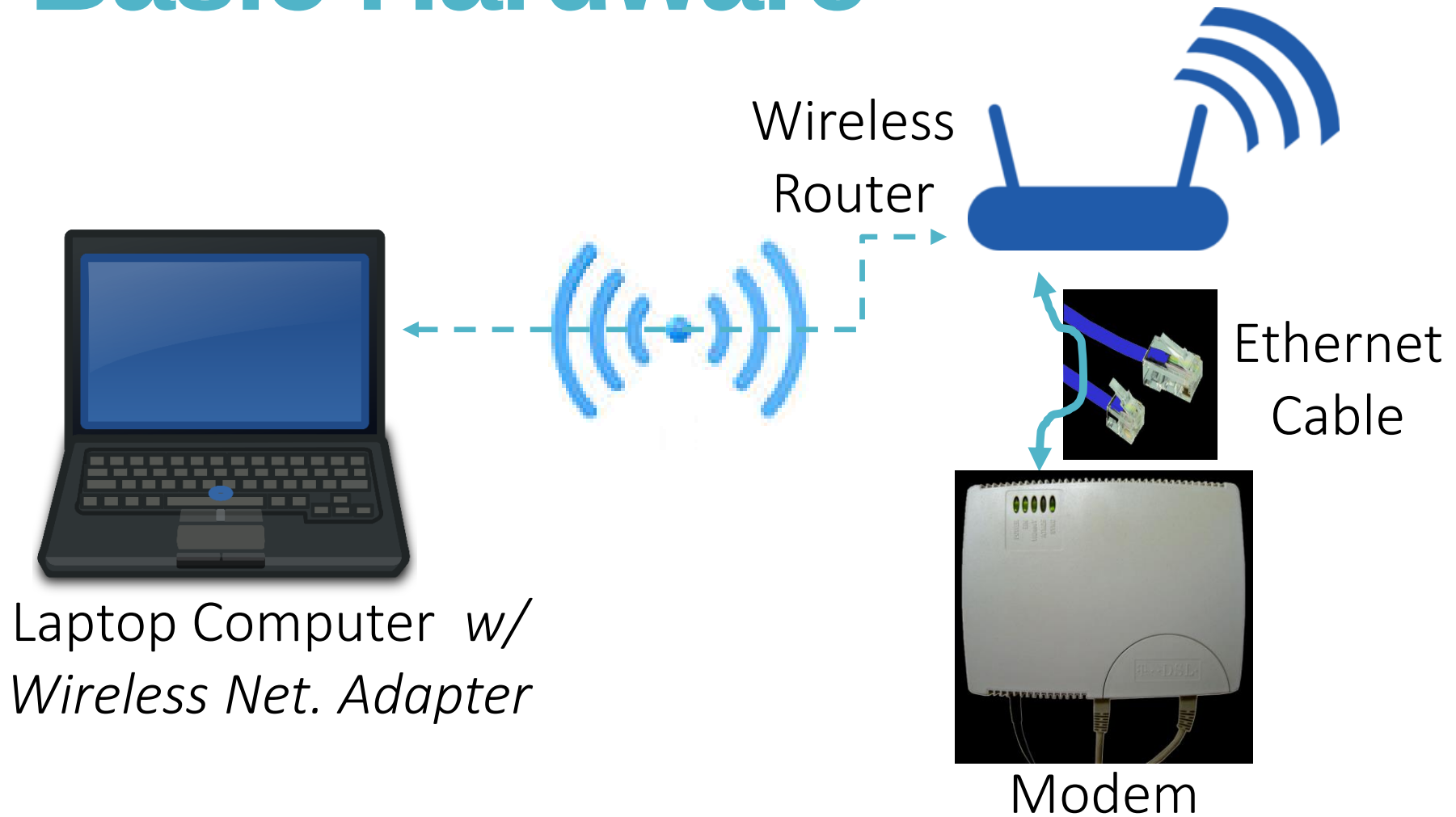
CS 6

3/30/2016

Basic Hardware



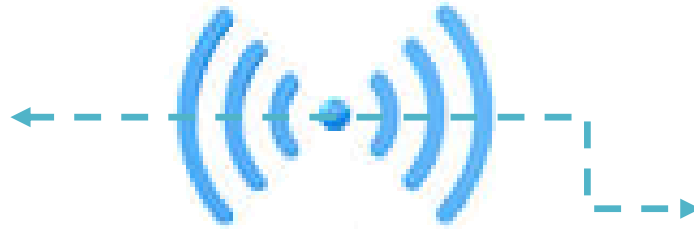
Basic Hardware



Basic Hardware



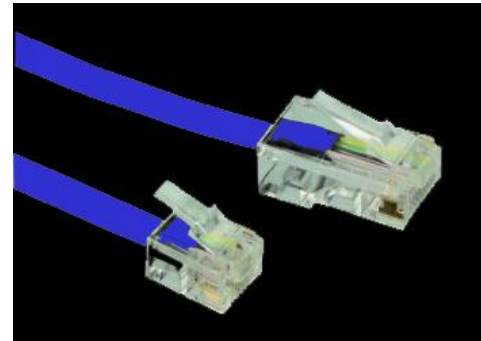
Laptop Computer w/
Wireless Net. Adapter



Wireless
Modem/Router

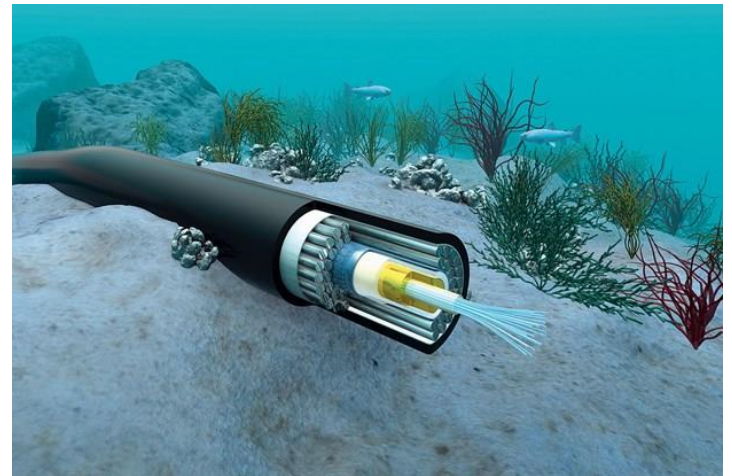
Intranet

- Internal network of computers (in a company or home). Also: “LAN”
- *Local Area Network*
- Geographically local – limited to one building, maybe a few buildings
- Use Ethernet cables or wireless signals to connect computers



Internet

- A network of networks. Also: WAN
- *Wide Area Network*
- Unlimited by geography
- Different wires



Server

- **Client**: requests and receives information
- **Server**: receives and processes info, returns the information
- Examples
 - *Viewing a webpage*
 - *Sending or receiving email*

Server

- **Client**: requests and receives information
- **Server**: receives and processes info, returns the information
- Examples
 - *Viewing a webpage*
 - *Sending or receiving email*
- Server is a *role*, not a piece of equipment

*loading

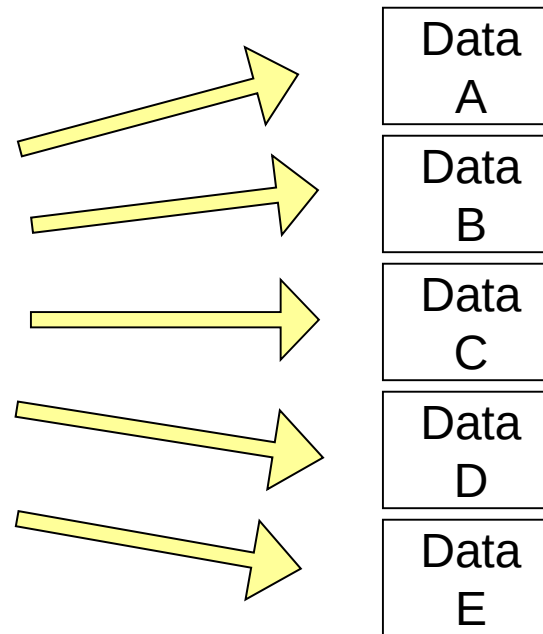
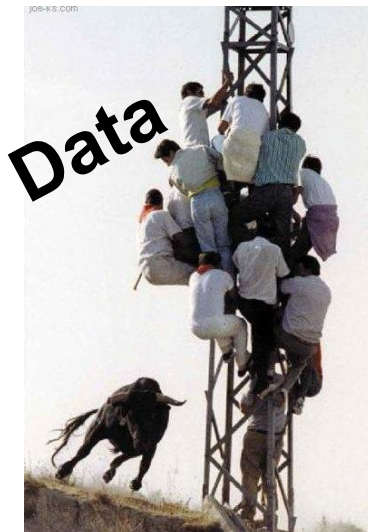
- **Downloading**: receiving data from a server
- **Uploading**: sending data to the server
- “Data”... typically refers to files
- **Bandwidth**: rate of data transmission
 - *Bits per second (bps) < Kbps < Mbps < Gbps*
 - *Not to be confused with Byte = 8 bits:
(KB, MB, TB, etc.)*

Data Transfer

- Data formatted in standardized way
- **Header** + data/“payload”/body, e.g.:
01110111001001001111010110001110100
- Header contains routing information
 - *Address to/from, protocol*
- Like envelope + letter at the post office
- What if data stream is too long?

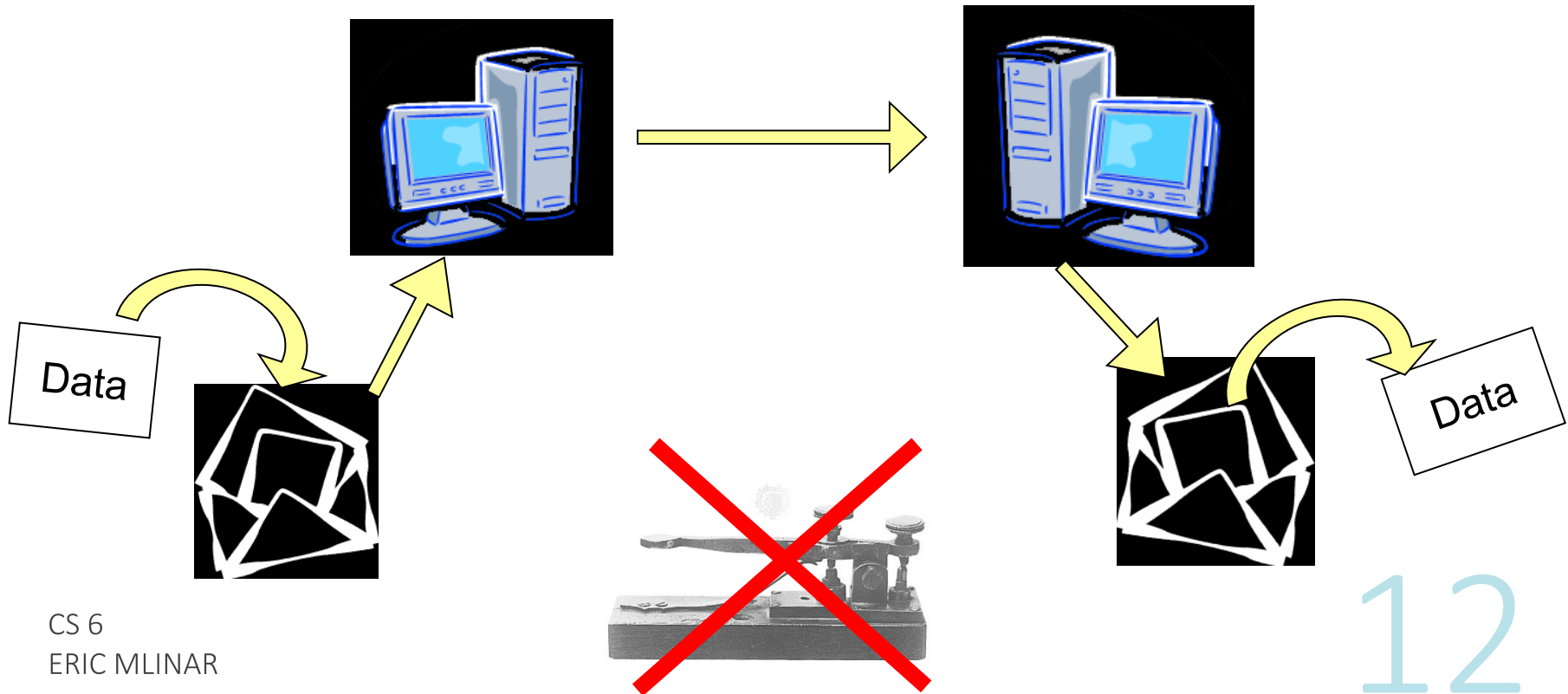
Packets

- Break up large data stream into several packets
- *Cutting up your food so you don't choke*



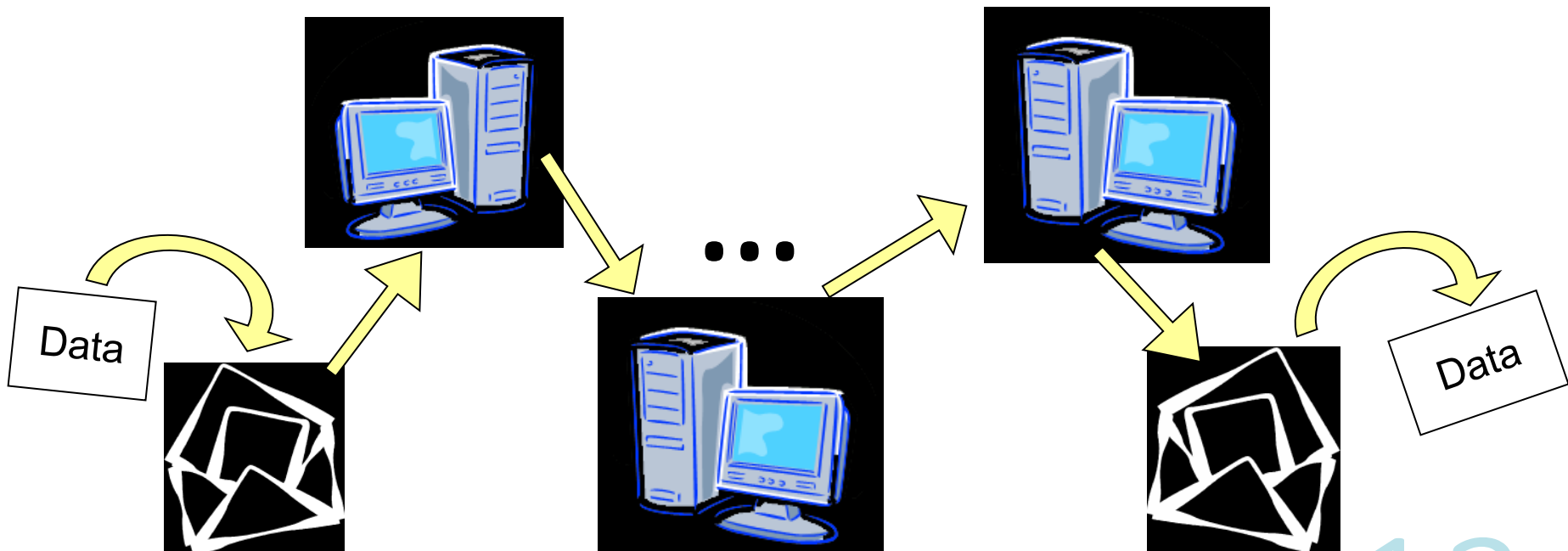
Packets

- Called “digital envelopes” (appropriately)
- Uniform size, contents irrelevant



Packet Switching

- Passed along until destination (hot potato)
- *“Is the destination address in my network, or should I pass it on?”*



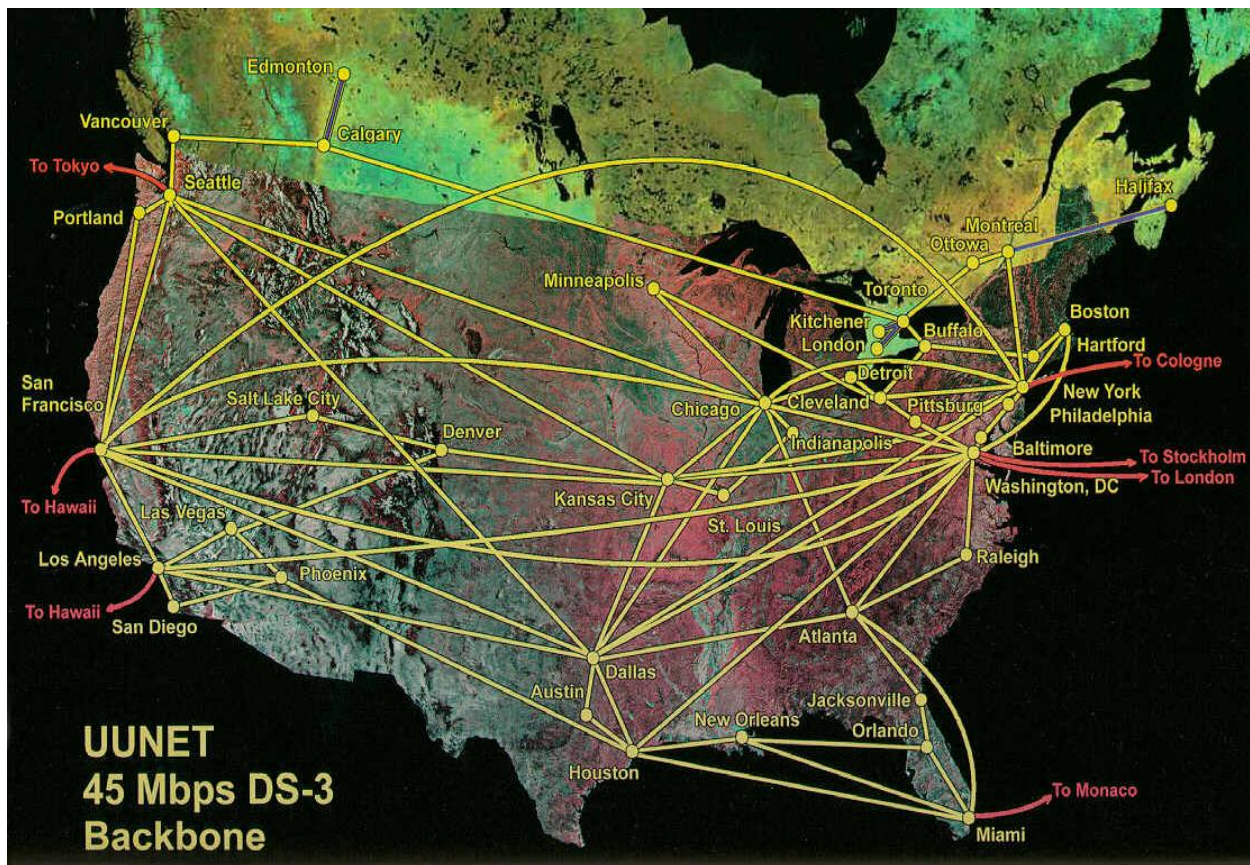
Repeaters

- What if distance between sending and receiving data too far?
- Repeater boosts signal, keeps it going



Internet Structure

- Physically structured? Yes ~ish



Internet Structure

- Local, Regional, and National levels
- *Just like roads:*
Local roads, state highways, interstates



- Information only goes up as high as it needs to...
- *...for the game of hot potato*

Protocols

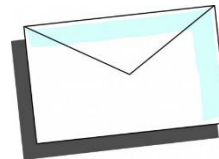
- Packet envelopes: addresses & **protocol**
- Guidelines for computers to talk with each other
 - *Different envelopes that data packets can use*
- Transferring web pages uses HTTP
 - *Hypertext Transfer Protocol*
- Direct file transfers → FTP
 - *File Transfer Protocol*

Protocols

- Protocols stacked on top of each other
- HTTP or FTP at “Application Layer”



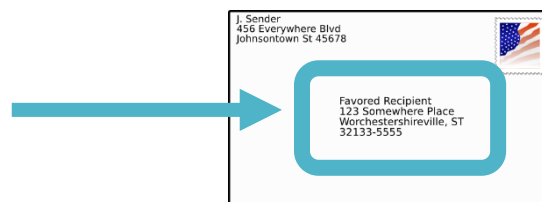
- Transmission Control Protocol (TCP) at “Transport Layer”



VS



- Internet Protocol (IP) at “Internet Layer”



RECAP...

- Internet is network of networks sharing data with each other
- Data packets sent with header + payload
- Header contains address & protocol
- Data routed to destination by jumping from network to network (hot potato)

Web Browser

- Translates HTML into a pretty webpage
- *Hypertext Markup Language*
- *Modern Browsers*
 - *Microsoft Edge*
 - *Apple Safari*
 - *Google Chrome*
 - *Mozilla Firefox*
- *Legacy Browsers*
 - *Microsoft Internet Explorer*
 - *Netscape Navigator*

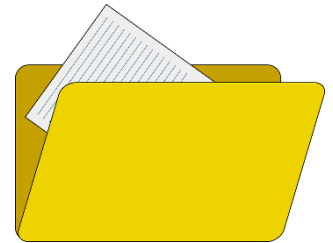
Browser Cache

- Temporary storage (se *cachar* “to hide”)
- Downloading can be intensive
- Instead of re-downloading everything, save local copy → cache
- *Quickly reopen pages (+)*
- *Delays page from updating (-)*
- *Takes up lots of disk space (-)*
- Clear your cache through browser options



Browser History

- Internet history: Addresses saved, find a recently viewed page
 - *Useful for remembering that one page (+)*
 - *Privacy issue (-)*
- Different from cache: only stores address, but not any content
- Clear internet history in browser options



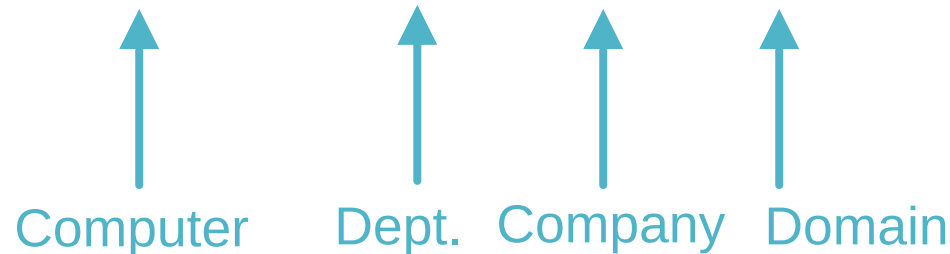
DNS

- Domain Name Service
- Translates google.com to IP address (e.g., 216.239.39.99)
- *Technically* <http://www.google.com>
- Domain names vary (.com, .org)
- *Restricted: .gov, .edu, .mil*
- *Genre: .net, .biz, .tv*
- *Country: .us, .uk, .cn, .au*

Address Details

- With an address, we go from specific to general using the dots (.)

`http://moodle.cs.ucr.edu/`


Computer Dept. Company Domain

- Slashes (/) progress into subfolders

`http://moodle.cs.ucr.edu/lectures/cs6/lecture01.html`

IP Address

- Dotted decimal: four bytes (0 to 255)
- *Ranges from 0.0.0.0 to 255.255.255.255*
- *Uniquely identifies all computers on internet*
- Uniform Resource Locator (URL)
- *Using words (like [google.com](https://www.google.com)) in place of actual IP address for domain names*

Static vs. Dynamic IP

- To be on Internet, you need an IP address
- Usually assigned one by ISP (from a pool of available addresses) for your session
- *Address can change → dynamic IP*
- To host a web page directly, generally need a static IP address
- *Costs extra \$\$*
- *Caveat: web page running 24/7 will rarely be assigned new address*

IP Address Limitation

- Current IP limits addresses to $2^8 * 2^8 * 2^8 * 2^8 = 2^{32} \approx 4,000,000,000$ devices
 - *Some forbidden/reserved addresses*
- Every networked device needs an address
 - *Includes both webpages and users*
 - *Server and clients*
- Workaround? Routers.

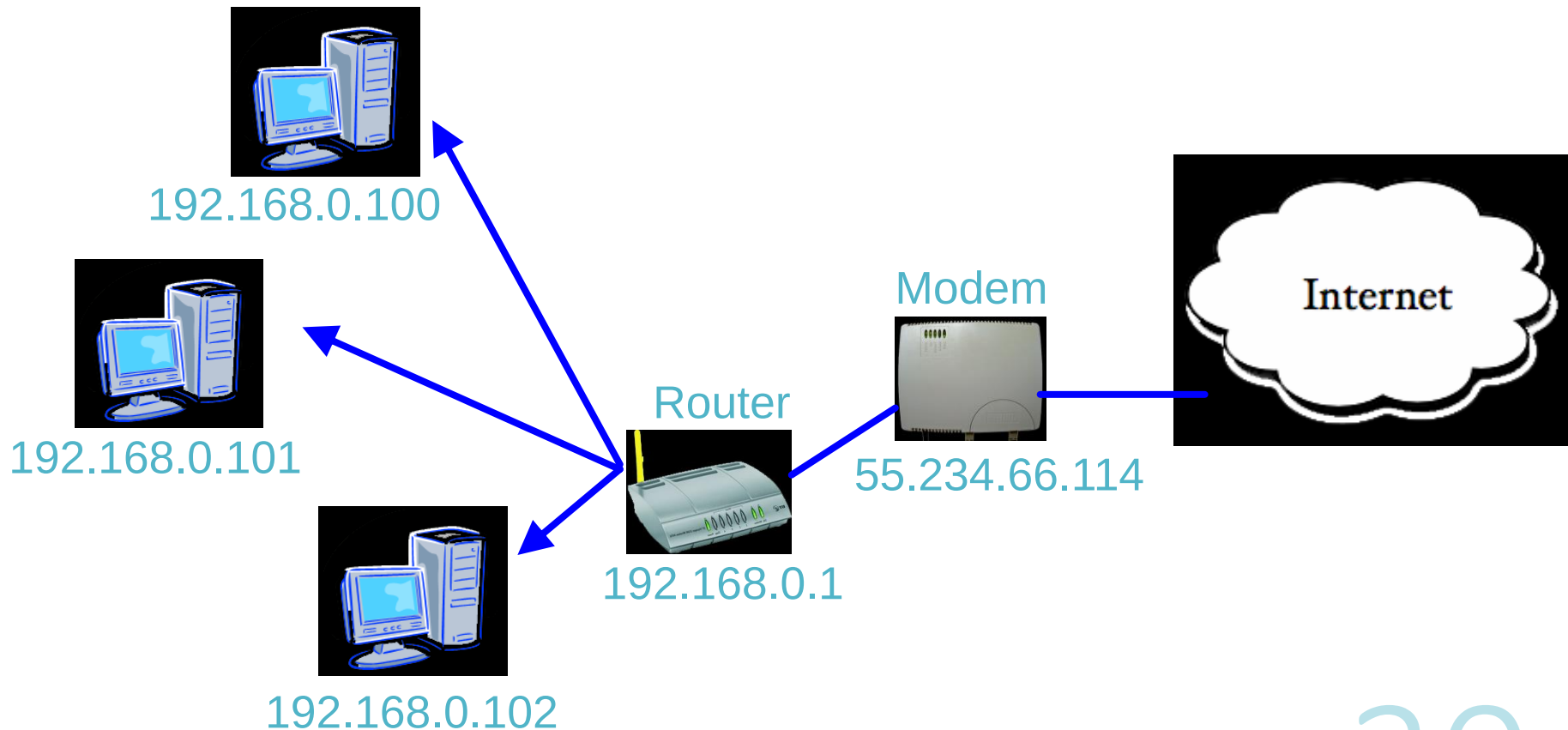
Routers

- Pass along information to its destination
- Occupy one IP address to the world, while hosting many devices itself.



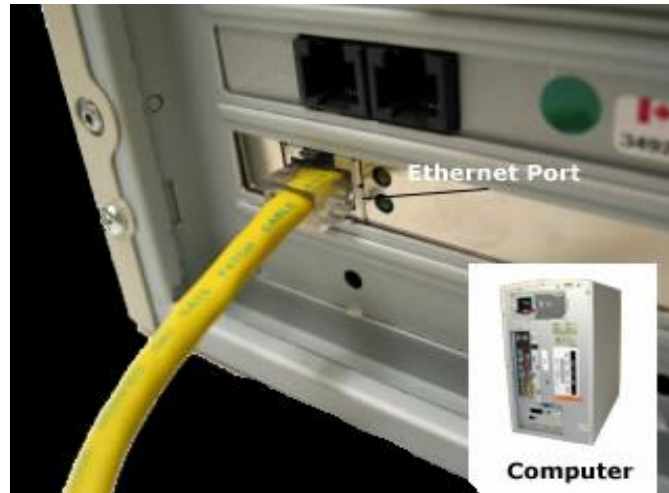
Internal IP Addresses

- modem → internet / computer → router



Networked Computers

- **Network Card:** Ethernet, wireless, dial-up (most Ethernet, many wireless)
- **MAC address:** serial number for network card, unique physical address
- *E.g. 00-16-D4-40-8E-4D (> 100 zillion comb.)*



Modems

- Home network requires a **modem** to connect to the Internet
- Different types with different connections
 - ***Dial-up modems** using telephone lines*
 - ***DSL** (Digital Subscriber Line) – telephone*
 - ***Cable Modem** – TV (cable) line*
 - ***Satellite Modems** – Lineless*
 - ***Fiber Optics** (e.g. Google Fiber)*

Broadband Availability

- DSL has incomplete availability
 - *Requires upgraded telephone lines*
 - *Within certain distance of phone company's central office (i.e. switching station)*
- Fiber to the curb: requires fiber optic cable (placed below ground)
- “**Broadband penetration**” is now used as a key economic indicator

ISPs

- **Internet Service Provider:** provide access to the internet (\$\$), and typically give/rent the modem used to connect to it
- Time Warner, Comcast, Charter...
- AOL used to be the biggest
- *Repeatedly had lowest customer satisfaction rates, is now #5 ... (Good riddance)*



AUP / TOS

- Every ISP (and most networks) has
- **AUP: Acceptable Use Policy**, or
- **TOS: Terms of Service**
- Restrictions:
 - *Copyright infringement*
 - *Hacking/illegal trespassing*
 - *Types of internet data (gaming?) – throttling*
 - *Harassment*
 - *For-profit Activities*

ISPs and Beyond

- Tiered structure of Internet
- Where money goes

