Sockets, TCP/IP and Bluetooth

Lecture 5
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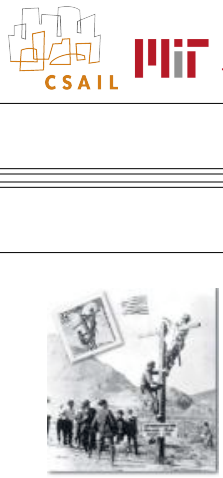
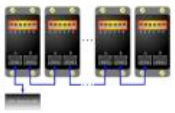


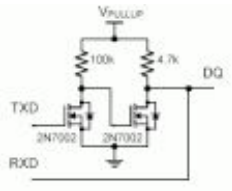
A little history

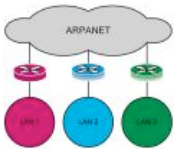
- Simple case: two devices, one cable (2 wires)
  - e.g. first telephone
  - one device puts pulses on wire, the other senses them. Went from analog => digital
- Generalize: multiple devices, one wire
  - why do we want this?

Bus

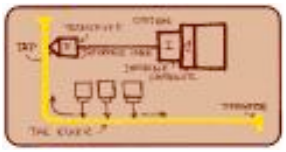


- signal broadcast (all devices "sense" it)
- first broadcast an address
- device with that address receives data
  - and ack's it
- Who knows the device's address?



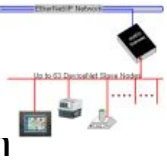


Ethernet



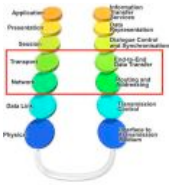
- Ethernet is a type of bus -- easy to add devices
- Every ethernet device has a unique device address
  - how do you know it is unique?
  - a company sells you a unique address
  - this is known as a MAC
    - all devices listen for their mac on bus
- What if devices is not on the bus?

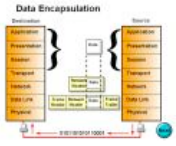
Gateway or Bridge



- Special device that transfers packets from ethernet to the rest of the world
- How does it know where to send it?
  - Another address
  - IP address aaa.bbb.ccc.ddd
    - 4 fields of 8 bits (256 values) per field
    - last field is local network
- Where is that address specified?

Layers





- Need different layers
  - lowest (bottom) for physical transport
  - higher layers as get more removed
  - Which picture makes sense? (first bits on left)
    - (top Header (bot H B T) top Trailer)
    - (bot Header (top H B T) bot Trailer)

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Lots of Layers

- seven official layers to ISO, but mostly three:
  - DNS name (domain name system)
    - blah.com blah.edu blah.sg stuff at the end
  - IP address
  - MAC address

What happens at end?

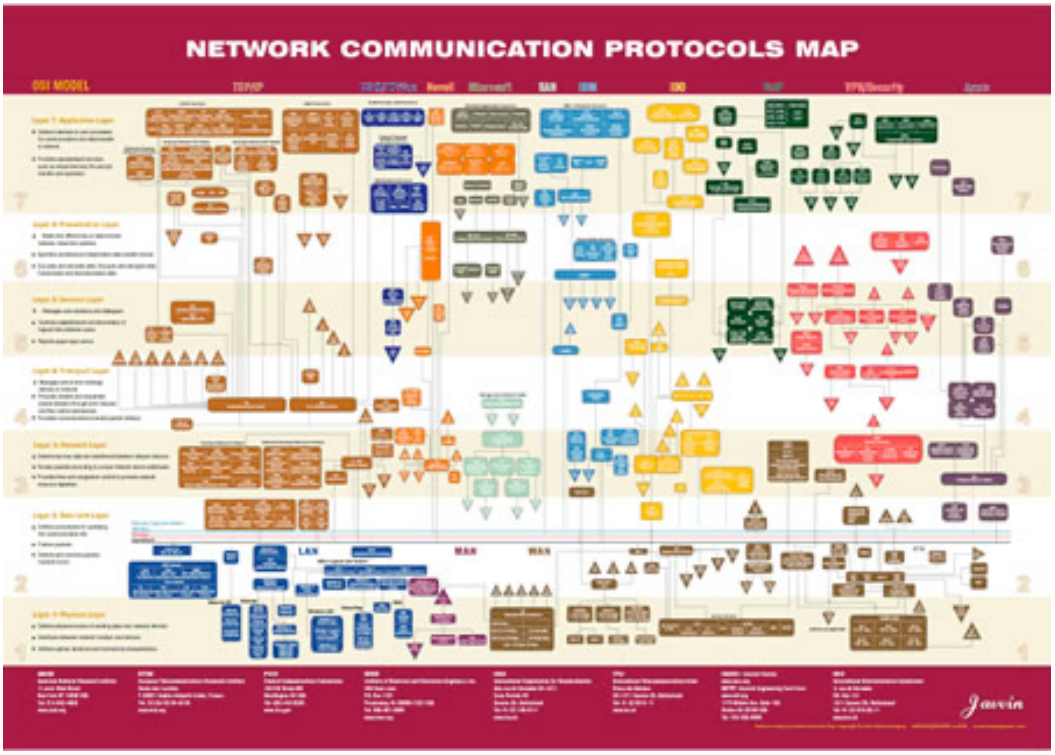
- message arrives at destination machine
- Operating system deals with it -- why?
  - places msg buffer in system memory
- How does OS know the associated app?
  - what are the choices?
    - must specify some type of name
    - done via agreement

Ports





- First allocate **socket**
- Message contains a port number
- Sending message:
  - must specify port in destination address
- Receiving message
  - application tells OS its associated port
    - the **Bind** command



Protocols

- Lots of different protocols -- common two:
  - UDP (unreliable) & TCP (reliable)
- Why different protocols?
  - End-to-end argument
    - Don't put stuff in lower layers that may not be needed by the end-points.
    - What is an end-point?
- Specify in **socket** allocation, AF_INET, SOCK_STREAM

Setting things up

- Client & Server agree on Port number
- Server starts up first
  - specifies protocol, IP, port
  - activates the socket
  - waits for a client to connect
- Client starts up second
  - specifies protocol,
  - Connects to IP, Port

Server Code

```
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)

s.bind( ("0.0.0.0", port) )

s.listen(5)

(client, address) = s.accept()

while True:
    data = client.recv(1024)
    if len(data) == 0: break

client.close()
```

Client Code

```
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)

s.connect( (sys.argv[1], int(sys.argv[2]) ) )

while True:
    s.send(question)
    ans = s.recv(max_size)
```

Bluetooth

- Nearly the same

```
from bluetooth import *

port = 1
server_sock = BluetoothSocket( RFCOMM )
server_sock.bind( “”, port)
server_sock.listen(1)

client_sock, client_info = server_sock.accept()

data = client_sock.recv(1024)

client_sock.close(): server_sock.close()
```