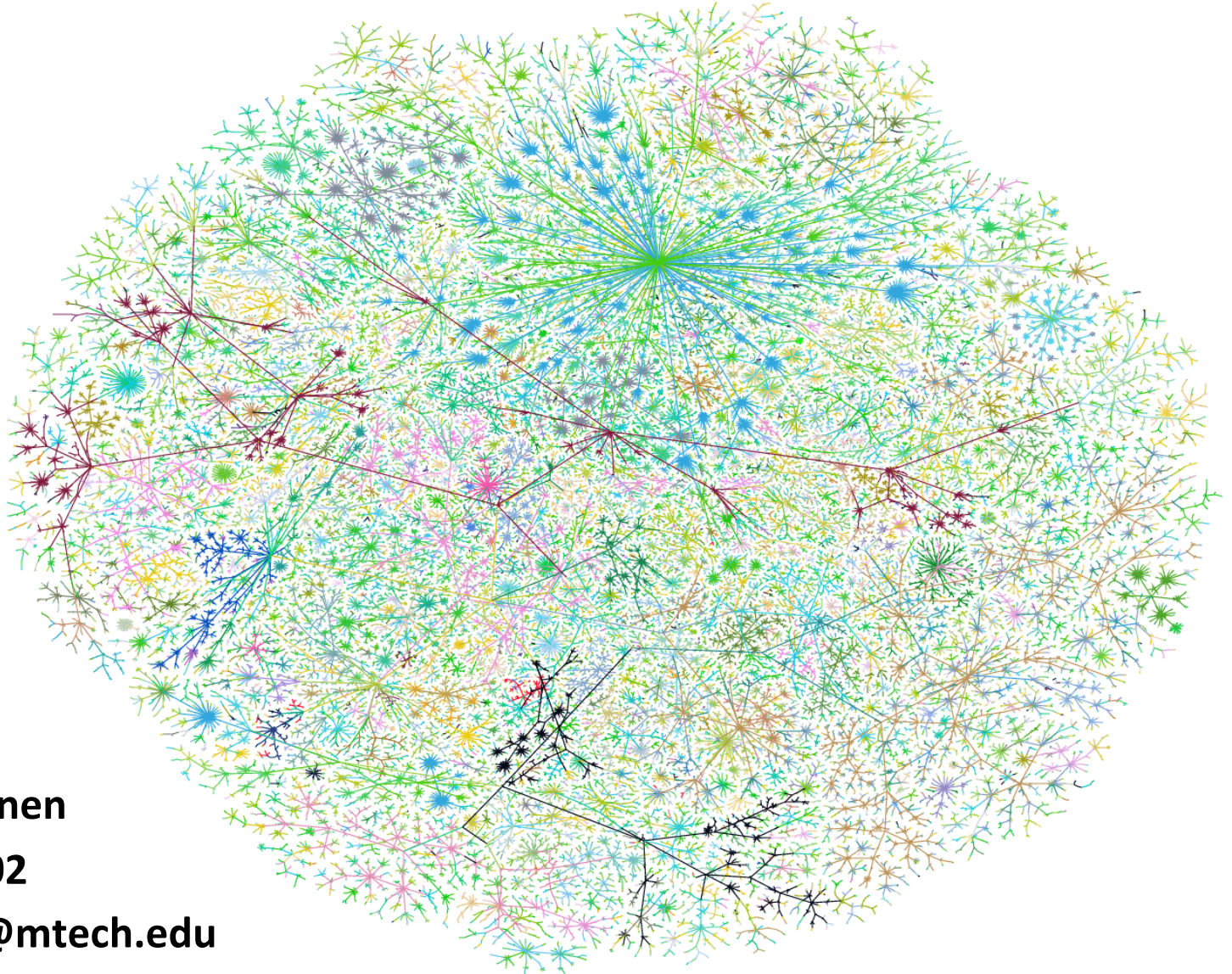


CSCI 466: Networks

Fall 2013

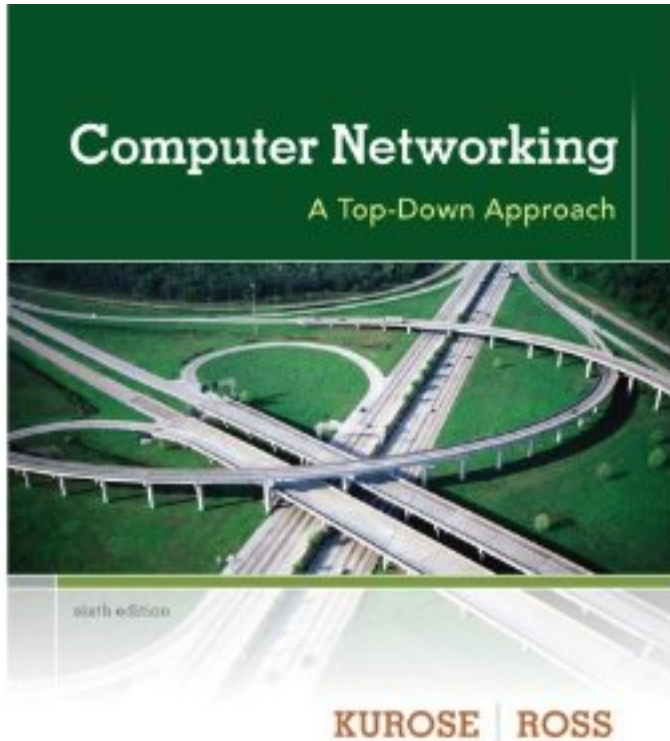


Keith Vertanen

Museum 102

kvertanen@mtech.edu

The book



Chapter

1. Computer Networks and the Internet
2. Application Layer
3. Transport Layer
4. Network Layer
5. The Link Layer: Links, Access Networks, and LANs
6. Wireless and Mobile Networks
7. Multimedia Networking (maybe)
8. Security in Computer Networks (maybe)
9. Network Managements (probably not)

Course web site

<http://katie.mtech.edu/classes/csci466/>

Moodle for grades and submitting programs.

Expectations (what you should already know)

- **Programming experience**
 - Advanced data structures
 - OOP design in a high-level language
- **Technical writing ability**

Course outcomes (what you'll learn)

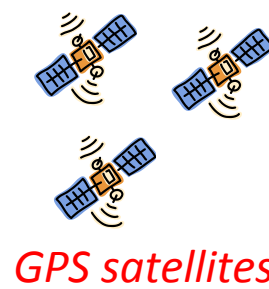
- Network **layers and protocols**
- Understand **common protocols**
 - IP, TCP, UDP, HTTP, SMTP, IMAP, RPC, DNS, DHCP
- **Physical and logical connectivity** of Internet
- **Presentation**
 - Show understanding of networking principles

Twitter mining

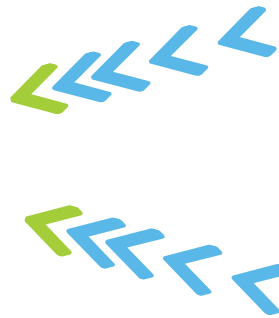
```
C:\Windows\system32\cmd.exe
[-5.8614969,54.6106767] You know its @bangorworldwide when Mrs @al_Ralph makes
good buns!!! #wwmc11 @ Hamilton Road Presbyterian Church http://t.co/a7r0KrF
[-2.185708,53.491138] Moving into Preston this week! Man i need some bedding
and shit!
[-46.826,-24.008814] I'm at Etna (Av. Eng. Luis Carlos Berrini, 2001, S\u00
e3o Paulo) w/ 10 others http://t.co/u3J2spA
[-118.017597,33.788835] The one time I am brave enough to talk to a beautiful g
irl.. She has a boyfriend. :P
[-83.675415,36.540759] But ill pass prolly been n that # dirtyjoint
[-1.639698,54.982951] I met the Seahorses once in a hotel in Cardiff. Lovely
chaps. Stayed up drinking with them until 4am. John Squire stayed in his room th
ough.
[-1.780179,52.213692] @jonesmegann I think your closing with me tomoz :)
[-77.528884,39.00709] Sneaky bastard! :-> @sonnench Am I going to Rio? \"The
greatest trick the Devil ever did, was getting the world to believe he didn't ex
ist.\"
[-79.76259,40.477399] Interview with Daniel of LA Riots was EXCELLENT! Got to
hear some unreleased tracks and remixes. :D
[-75.280303,39.867004] @OhMySTARR Lol Love ya baby!
[-111.964499,33.383187] I'm at Arizona Mills Mall (5000 S Arizona Mills Circle,
at I-10 & Baseline Rd, Tempe) w/ 3 others http://t.co/Ggn1j95
[-73.244168,41.139896] Still Layin in bed Nd I didn't even paRty Last night. H
aha #Chillaxin
```



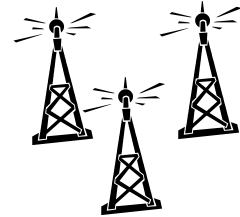

iPhone 4



GPS satellites



Wi-Fi access points



Cell towers

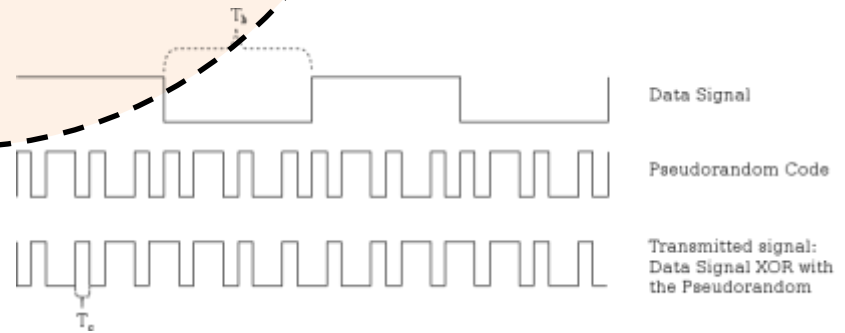
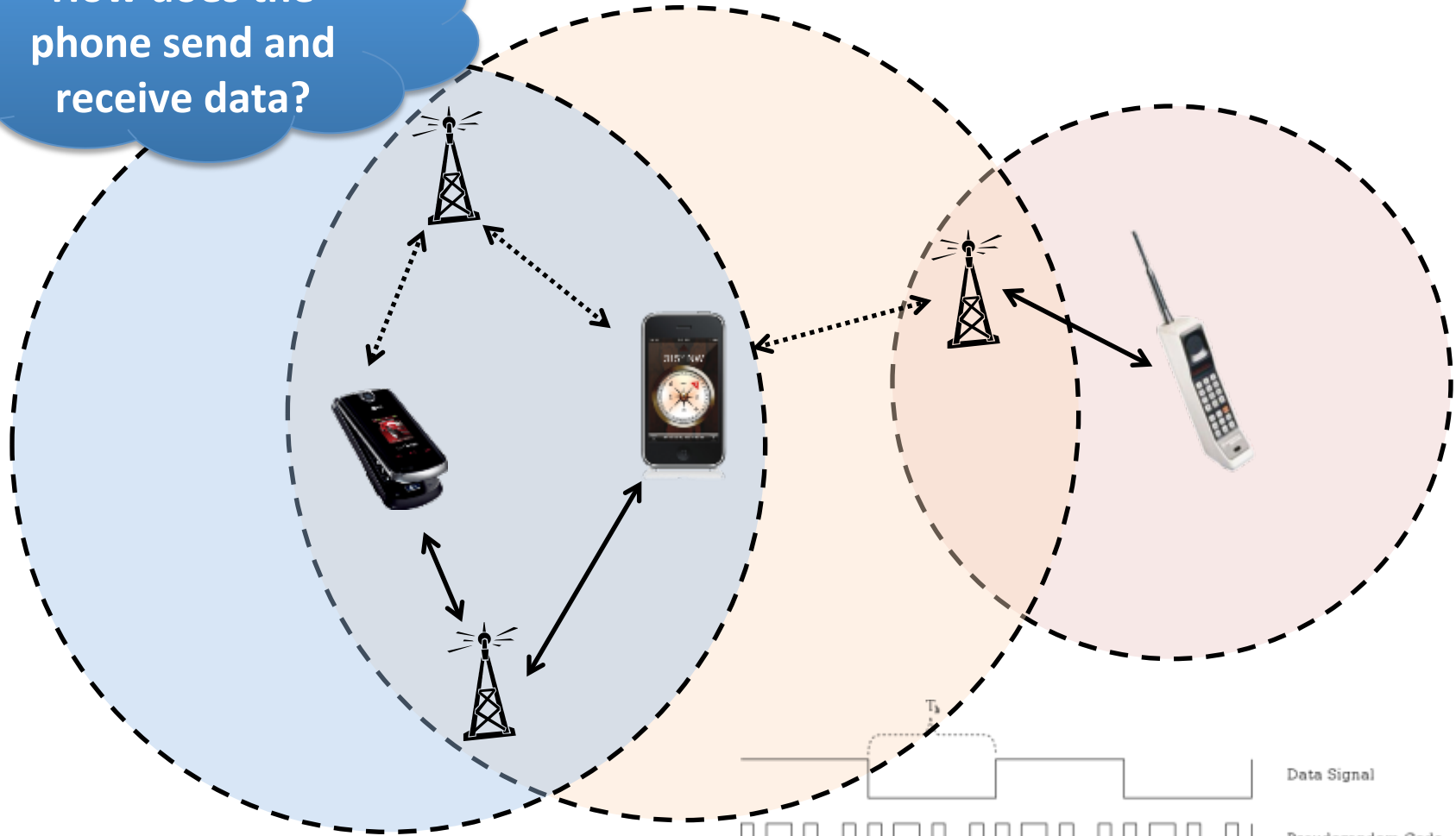
*Geographic location
[37.1316, 55.4908]*



Twitter client

How does the phone know where it is?

How does the phone send and receive data?

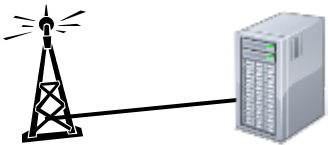


Multiple access networks
3G
CDMA

Ch. 6: Wireless and Mobile Networks



I need an IP address



Verizon's server

How does the network identify the phone?

Operation	HType	HLen	Hops
	Xid		
Secs		Flags	
	ciaddr		
	yiaddr		
	siaddr		
	giaddr		
	chaddr (16 bytes)		
	sname (64 bytes)		
	file (128 bytes)		
	options		

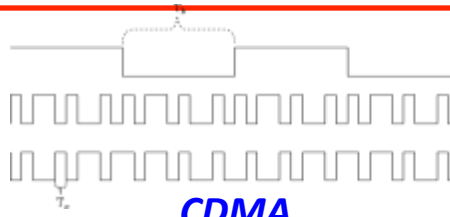
DHCP query



UDP datagram



IP packet



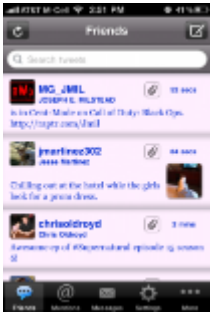
CDMA

Ch. 5: The Link Layer

Ch. 3: Transport Layer

Ch. 4: The Network Layer

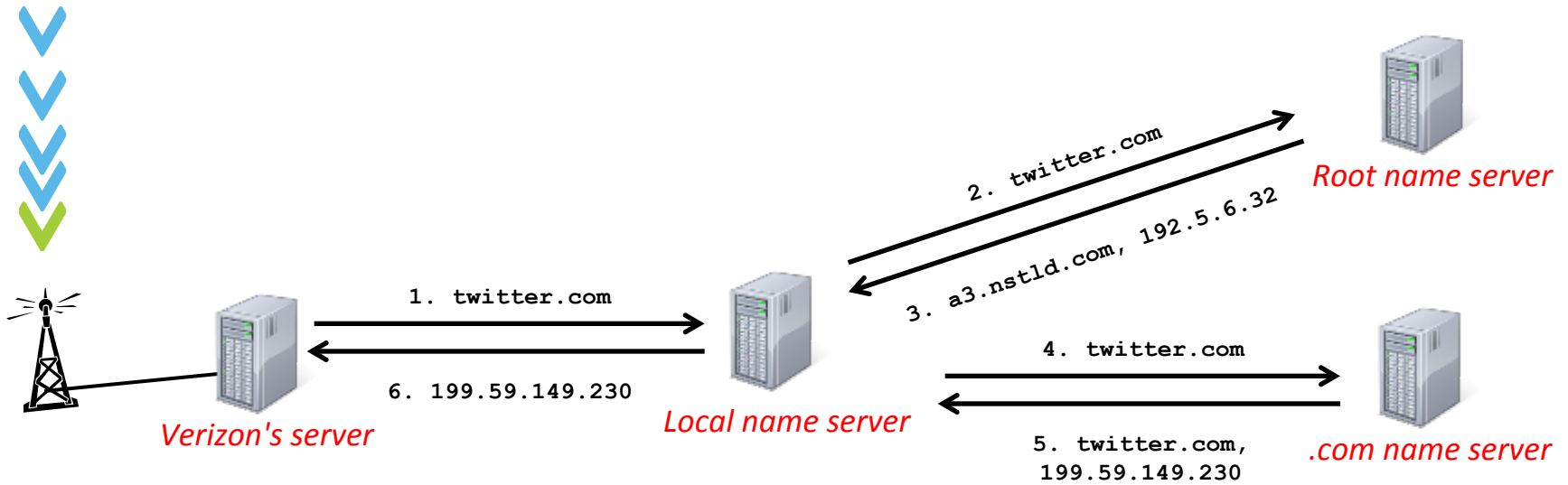
Ch. 6: Wireless and Mobile Networks



Twitter client

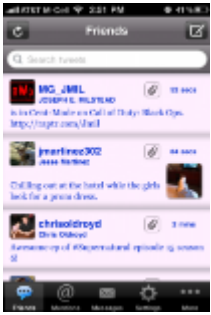
What is the IP address of twitter.com?

How does the phone find the Twitter server?



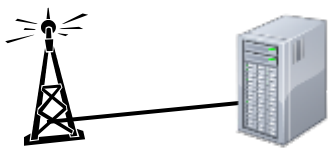
Domain name system (DNS)

Ch. 2: Application Layer



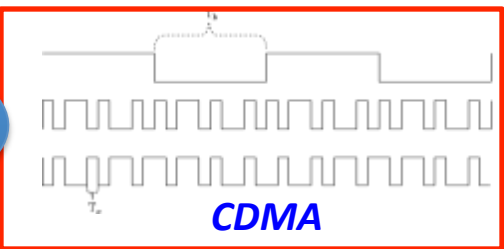
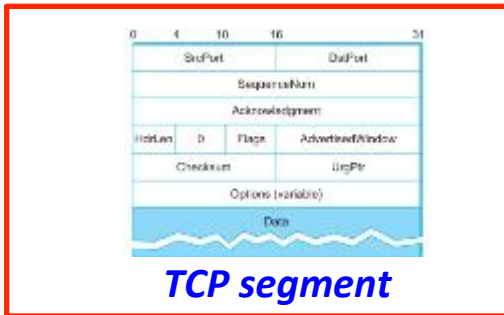
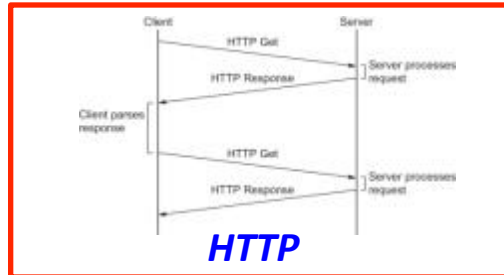
Twitter client

“I just bought some milk!”



Verizon's server

How does the phone package up a new tweet?



CSCI 470: Web Science

Ch. 2: Application Layer

Ch. 3: Transport Layer

Ch. 4: The Network Layer

Ch. 6: Wireless and Mobile Networks

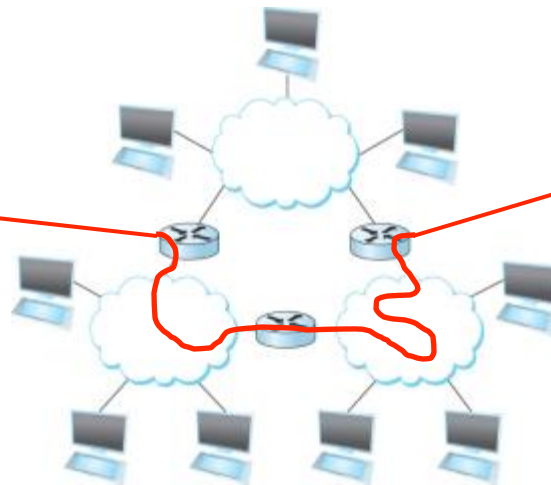


Twitter client

“I just bought some milk!”



Verizon's server



Twitter's server



How does the packet get transported along a path in the network?

- Bit encoding*
- Error detection/correction*
- Flow control*
- Congestion control*
- Wired links - Ethernet*
- Optical links - SONET*

Ch. 3: Transport Layer
Ch. 5: The Link Layer

I need an IP address



Operation	HType	HLen	Hops
Xid			
Secs		Flags	
ciaddr			
yiaddr			
siaddr			
giaddr			
chaddr (16 bytes)			
sname (64 bytes)			
file (128 bytes)			
options			

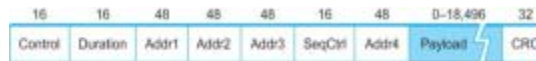
DHCP request



UDP datagram



IP packet



802.11 frame format

Internetworking
(Ch. 3)

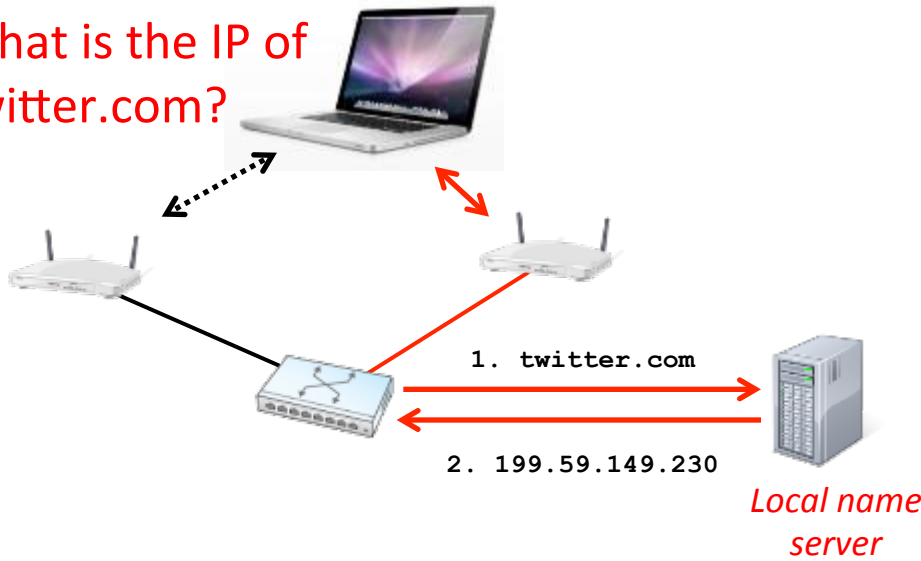
End-to-End Protocols
(Ch. 5)

Internetworking
(Ch. 3)

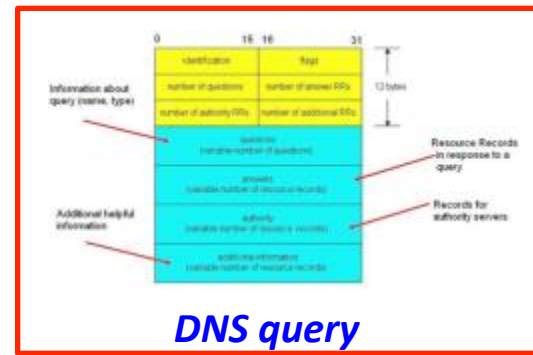
Getting Connected
(Ch. 2)

Now the other side:
What does the
network name my
laptop?

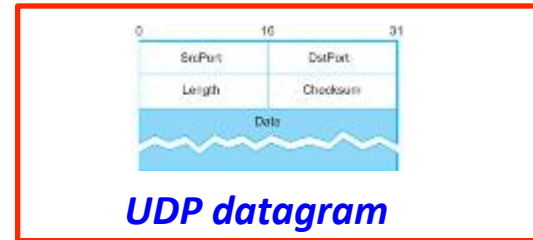
What is the IP of twitter.com?



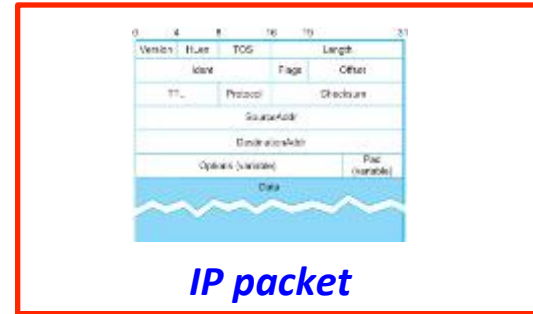
How does the laptop find the Twitter server?



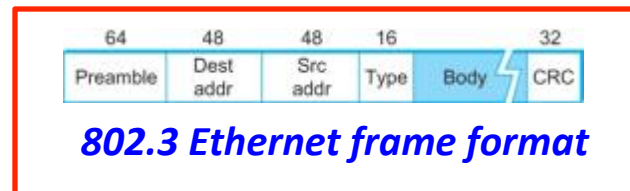
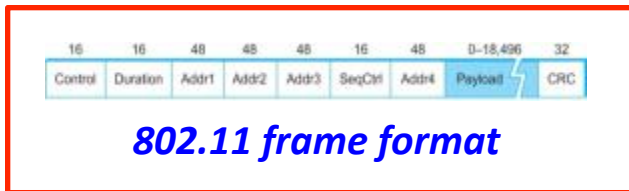
Ch. 2



Ch. 3

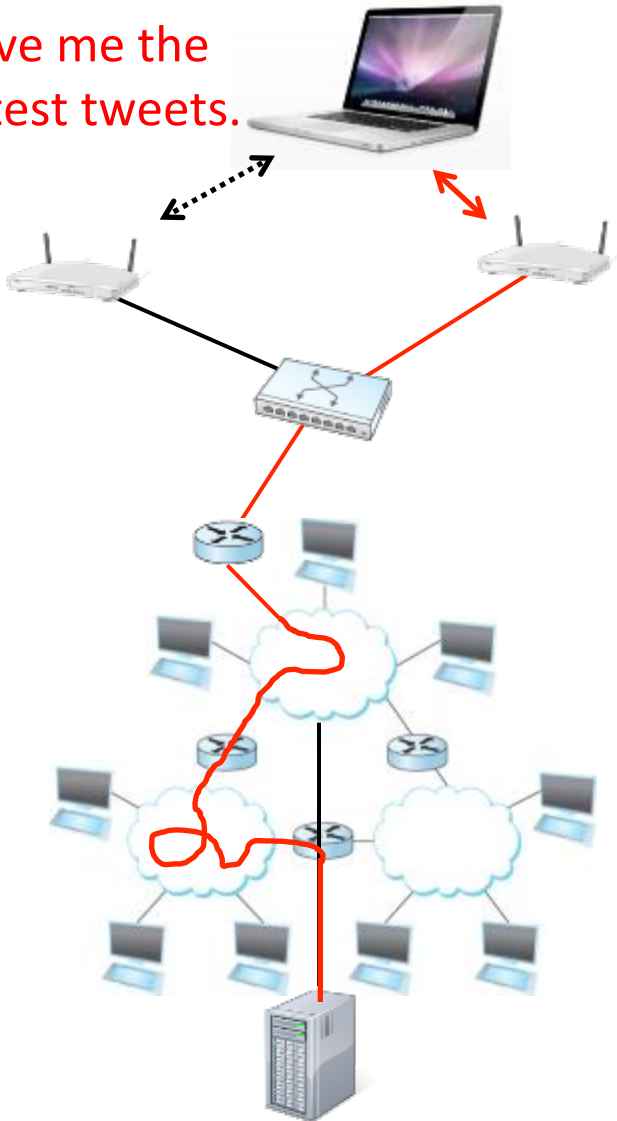


Ch. 4



Ch. 6

Give me the latest tweets.



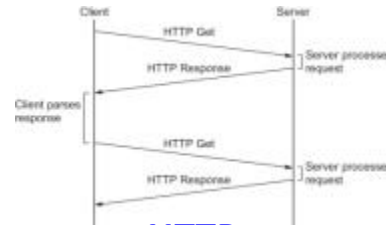
Twitter's server

How does the laptop request latest tweets?

twitter

REST API

CSCI 470: Web Science



HTTP

Ch. 2: Application Layer



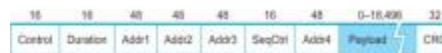
TCP segment

Ch. 3: Transport Layer



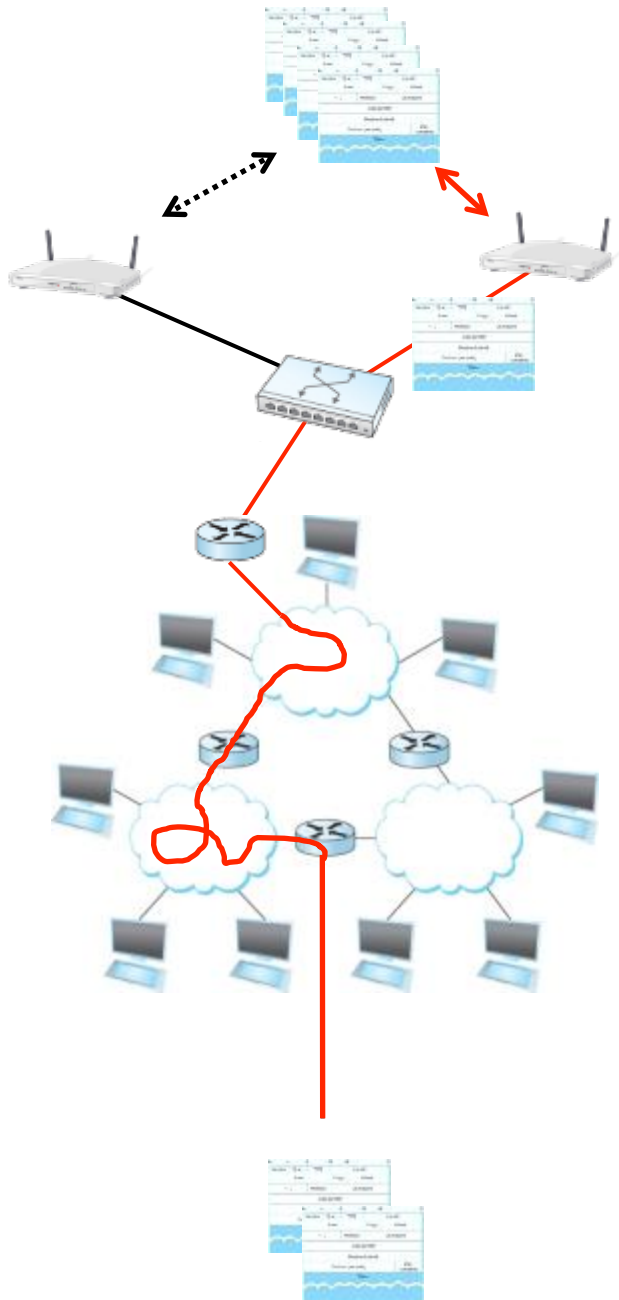
IP packet

Ch. 4: The Network Layer



802.11 frame format

Ch. 6: Wireless and Mobile Networks



How do the packets find their way through the network?

- Ch. 4: The Network Layer

What if my packets contain secrets?

- Ch. 8: Security in Computer Networks