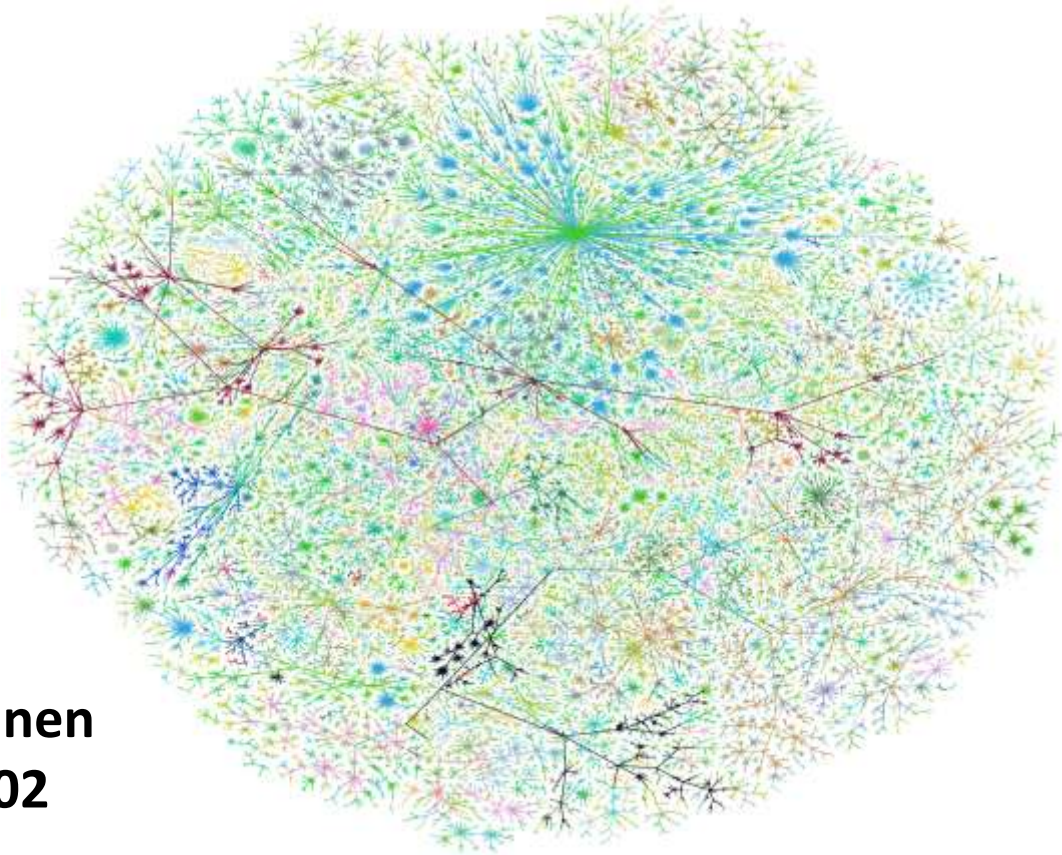


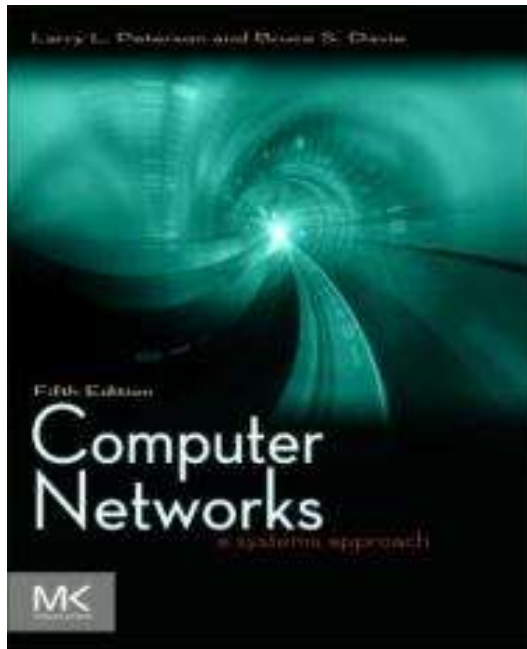
CSCI 466: Networks

Fall 2011



Keith Vertanen
Museum 102
496-4385
kvertanen@mtech.edu

The book



Chapter

1. Foundation
2. Getting connected
3. Internetworking
4. Advanced internetworking
5. End-to-end protocols
6. Congestion control
7. (skip) End-to-end data
8. Network security
9. Applications

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 high-level language (C++?)
- Technical writing ability

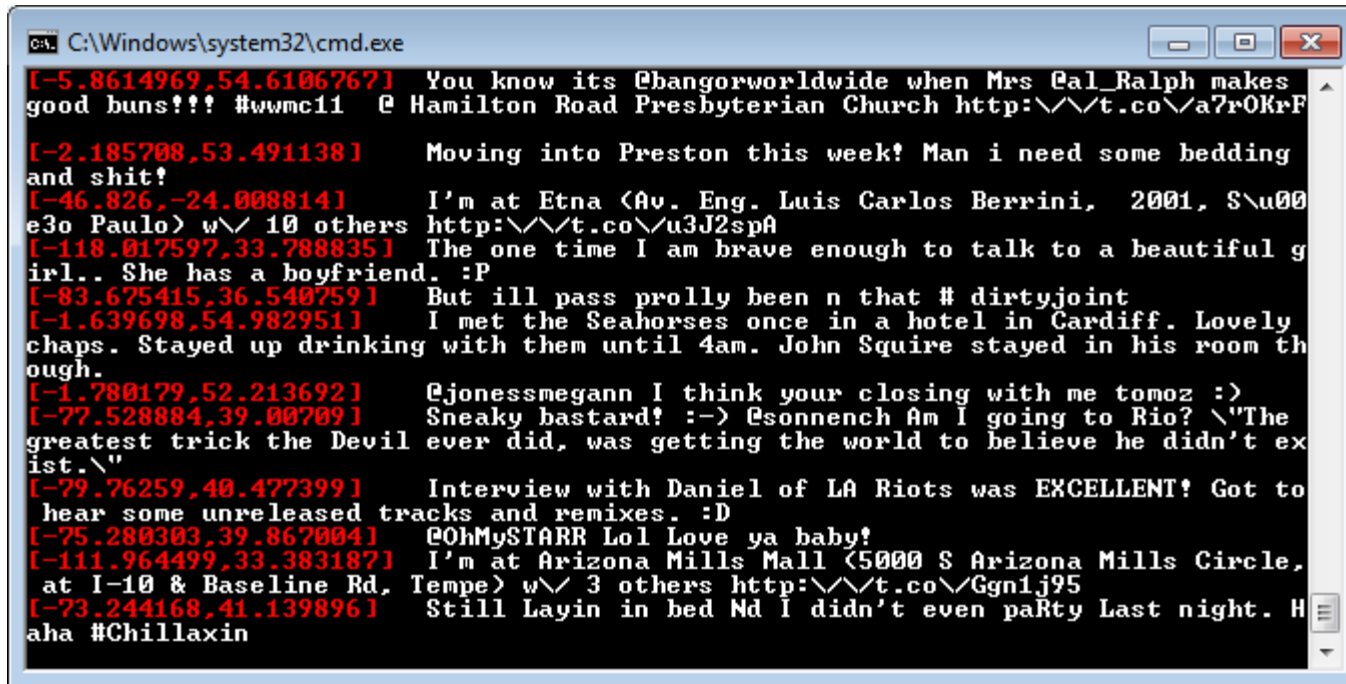
Course outcomes (what you'll learn)

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

Introductions

- Network experience
 - Built any networked software?
 - Built any physical networks?
- Programming experience
 - Languages?
 - Development environments?
- Expectations / preferences for the class
 - Specific technologies of interest
 - What do you want to take away?

Twitter mining



```
C:\Windows\system32\cmd.exe

[-5.8614969,54.6106767] You know its @hangorworldwide 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] @jonessmegann 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

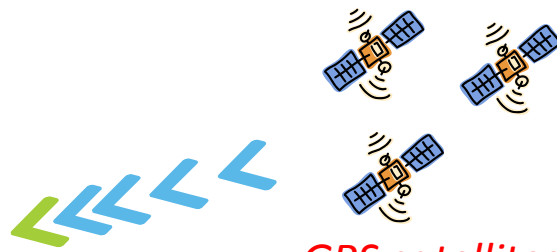
[-75.280303,39.867004] @OhMySTARR Lol Love ya baby!

[-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

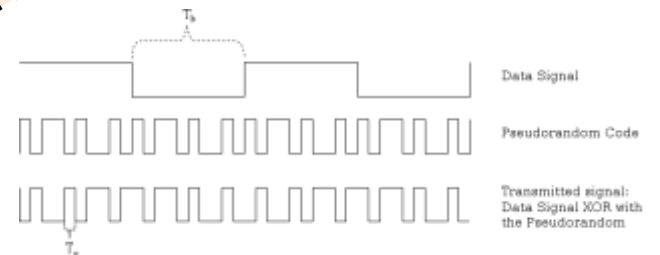
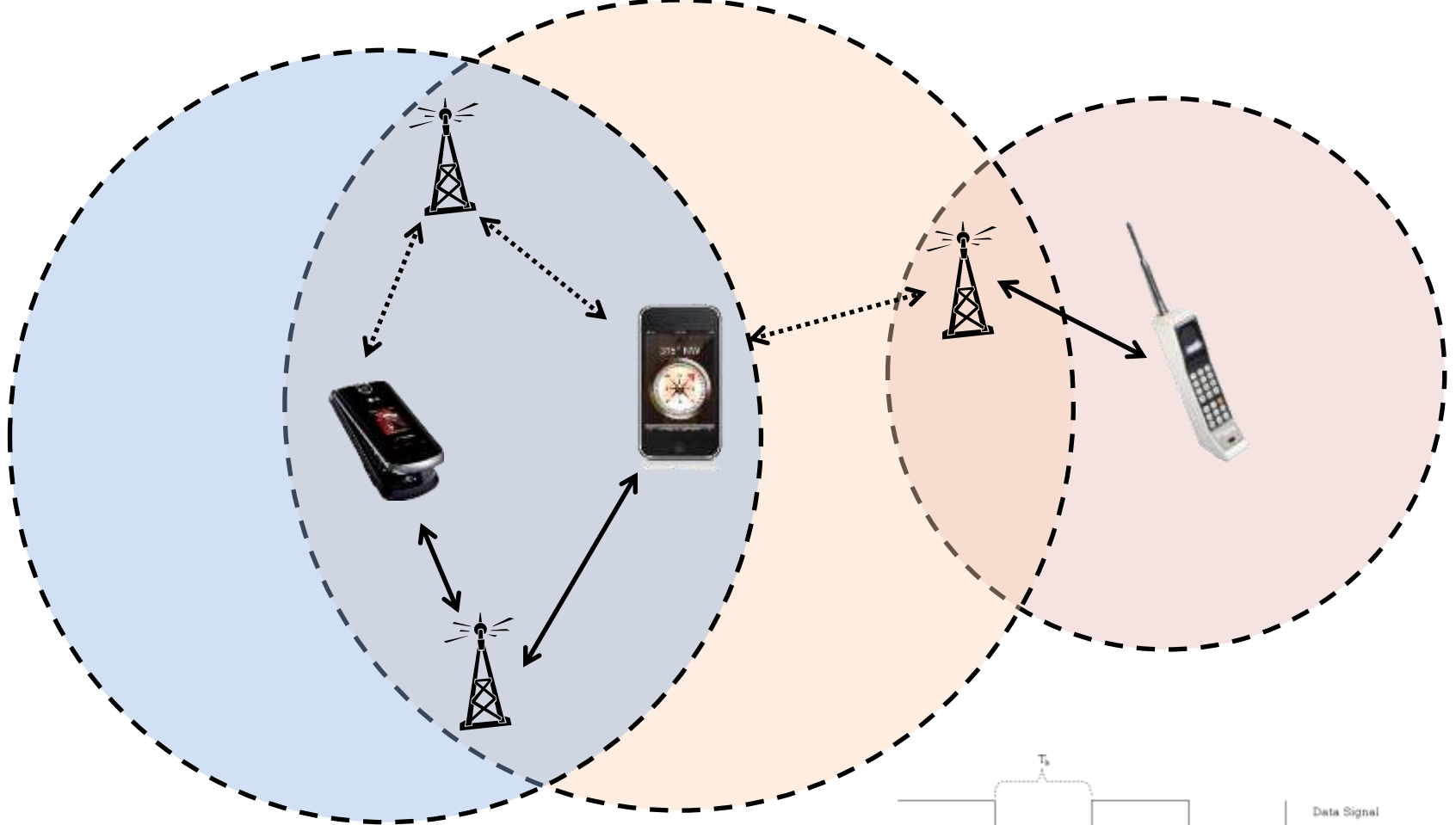


Cell towers

*Geographic location
[37.1316, 55.4908]*



Twitter client

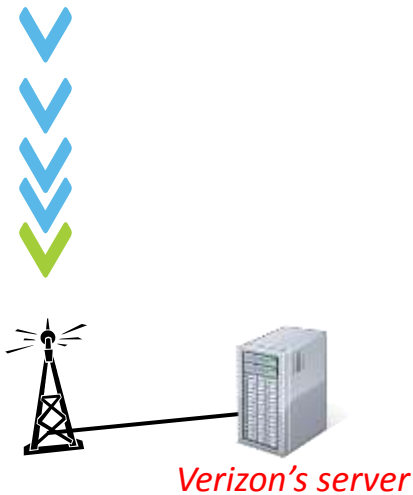


Multiple access networks
3G
CDMA

Getting Connected (Ch. 2)



I need an IP address



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

DHCP packet

Internetworking
(Ch. 3)



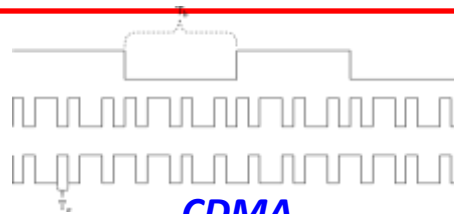
UDP packet

End-to-End Protocols
(Ch. 5)



IP packet

Internetworking
(Ch. 3)



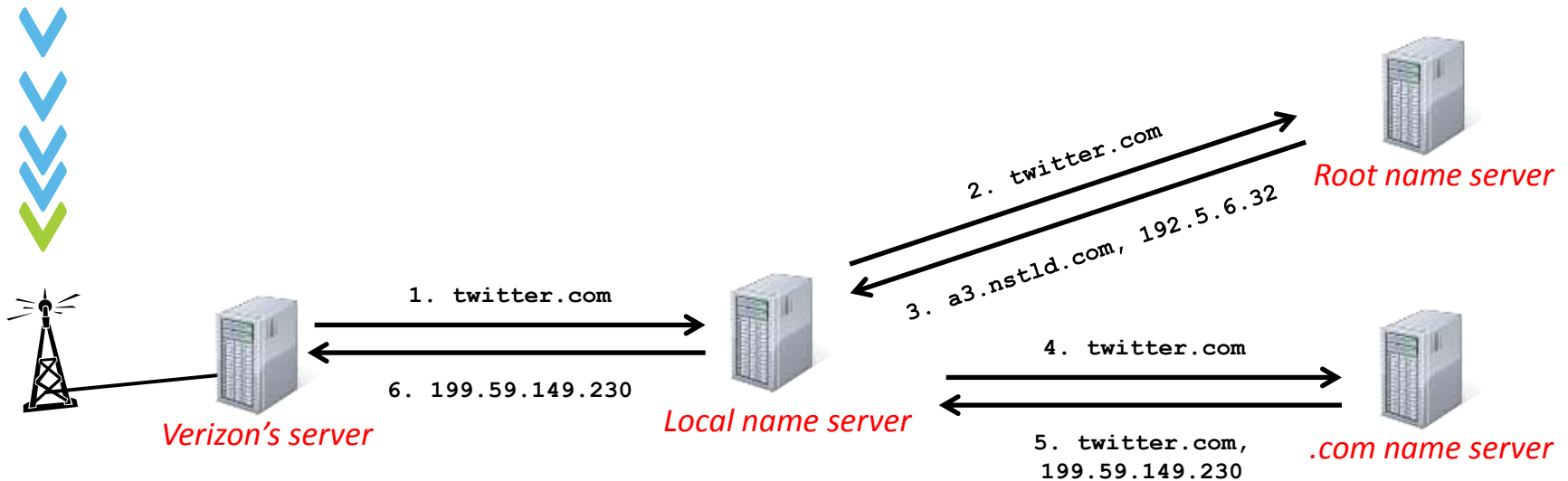
CDMA

Getting Connected
(Ch. 2)



Twitter client

What is the IP address
of twitter.com?



Domain name system (DNS)

Applications (Ch. 9)



Twitter client

“I just bought some milk!”

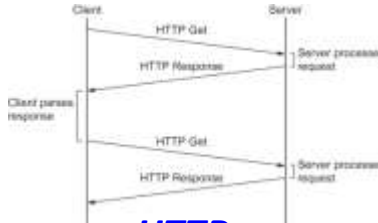


Verizon's server



twitter

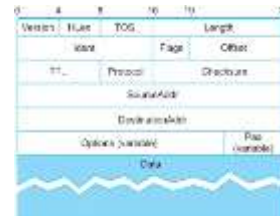
REST API



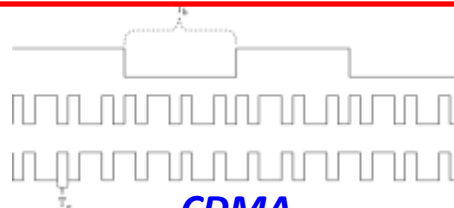
HTTP



TCP packet



IP packet



CDMA

Applications
(Ch. 9)

Applications
(Ch. 9)

End-to-End Protocols (Ch. 5)

Internetworking
(Ch. 3)

Getting Connected
(Ch. 2)



Twitter client

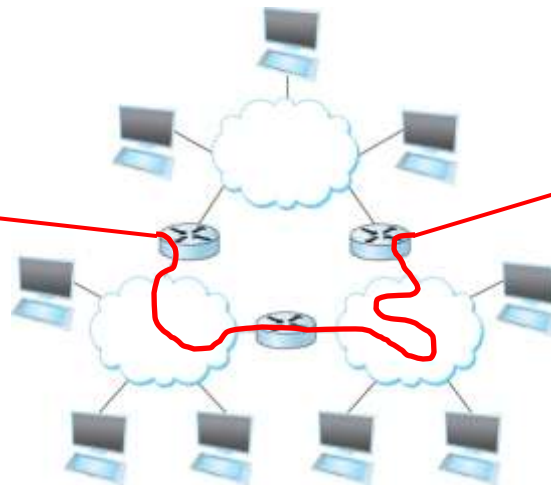
“I just bought
some milk!”



Verizon's server

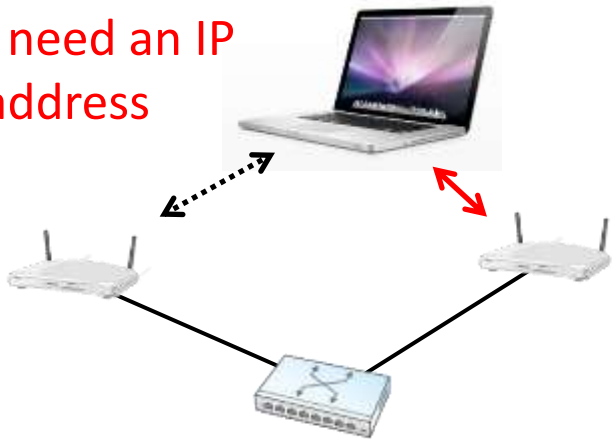
Bit encoding
Error detection/correction
Flow control
Wired links - Ethernet
Optical links - SONET

Getting Connected (Ch. 2)



Twitter's database

I need an IP address



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

DHCP packet

Internetworking
(Ch. 3)

0	16
SrcPort	DstPort
Length	Checksum
Data	

UDP packet

End-to-End Protocols
(Ch. 5)

0	4	8	16	24
Version	Header	TOF	Length	
Ident		Flags		Offset
TTL		Protocol	Checksum	
SourceAddr				
DestinationAddr				
Options (variable)				Pad (variable)
Data				

IP packet

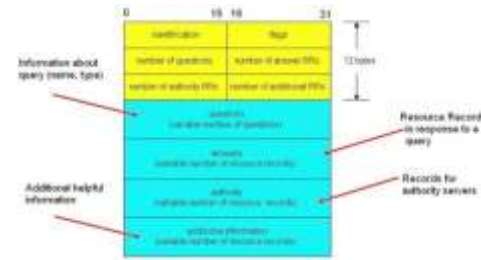
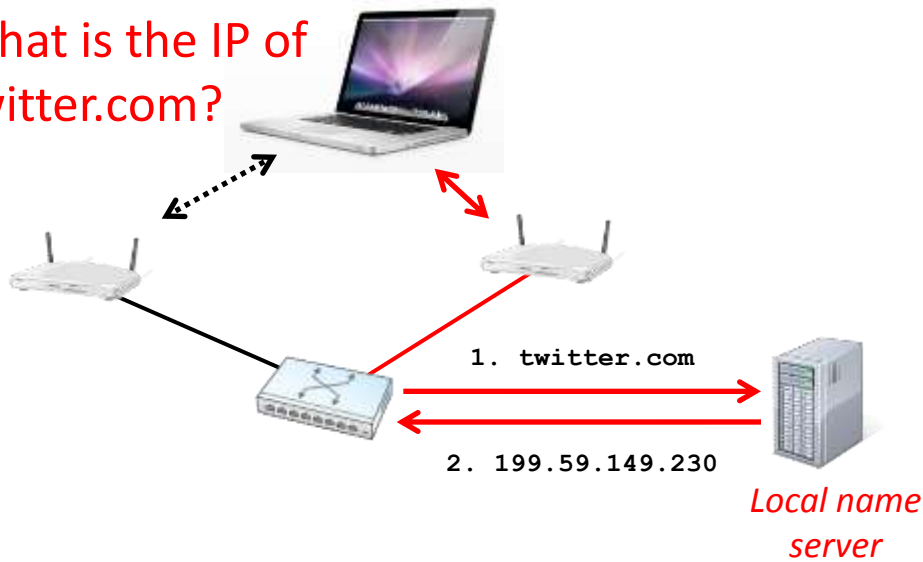
Internetworking
(Ch. 3)

16	16	48	48	48	16	48	0-15,408	32
Control	Duration	Addr1	Addr2	Addr3	SeqCtrl	Addr4	Payload	CRC

802.11 frame format

Getting Connected
(Ch. 2)

What is the IP of
twitter.com?



DNS message

Ch. 9



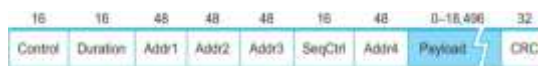
UDP packet

Ch. 5

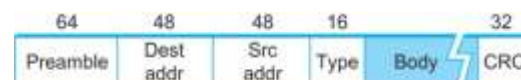


IP packet

Ch. 3



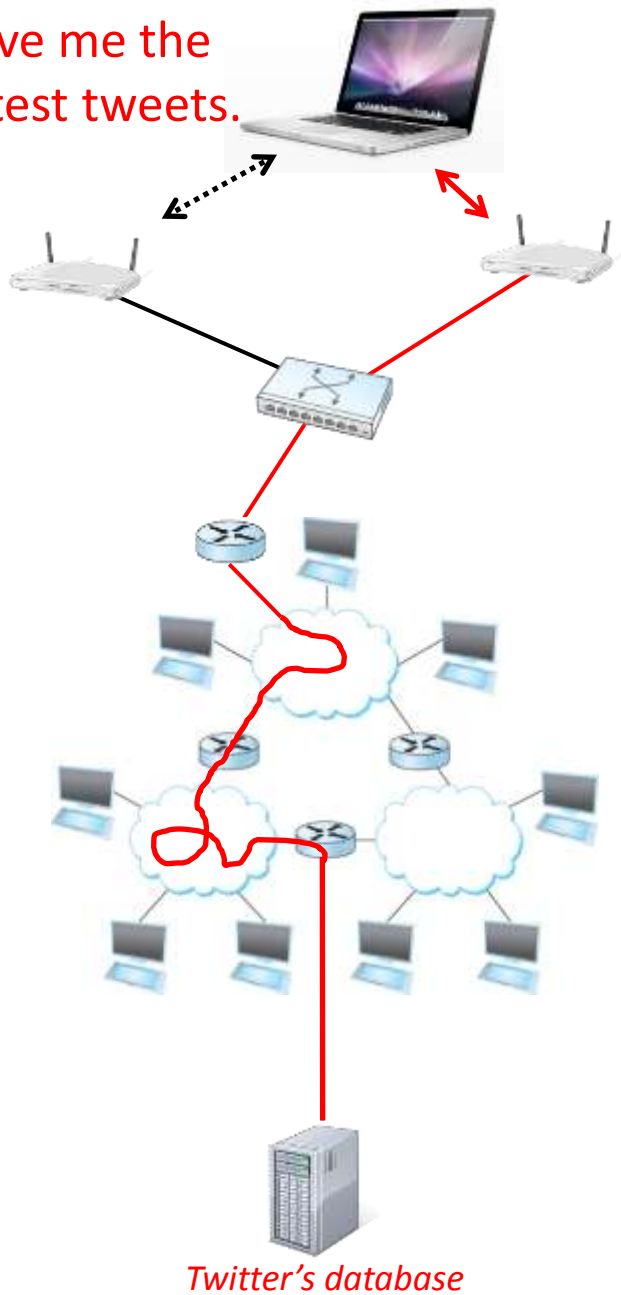
802.11 frame format



802.3 Ethernet frame format

Ch. 2

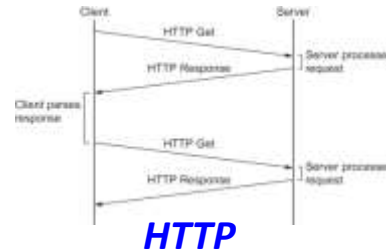
Give me the
latest tweets.



Twitter's database

twitter
REST API

Applications
(Ch. 9)

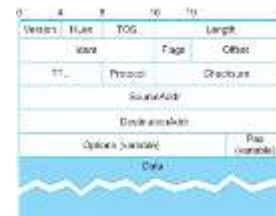


Applications
(Ch. 9)



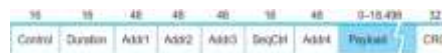
TCP packet

End-to-End Protocols (Ch. 5)



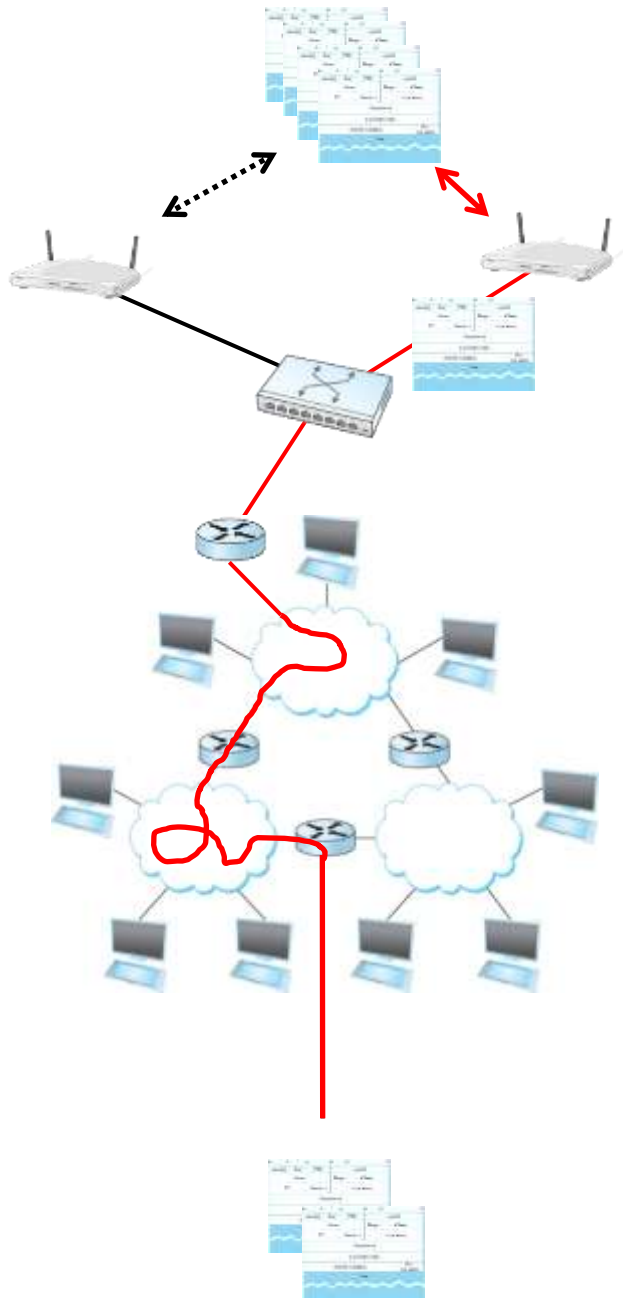
IP packet

Internetworking
(Ch. 3)



802.11 frame format

Getting Connected
(Ch. 2)



How do the packets find their way through the network?

- Internetworking (Ch. 3)
- Advanced internetworking (Ch. 4)
- Congestion Control (Ch. 5)

What if my packets contain secrets?

- Network security (Ch. 8)