Computer Science E-1

Lecture 3: Internet

From last time...

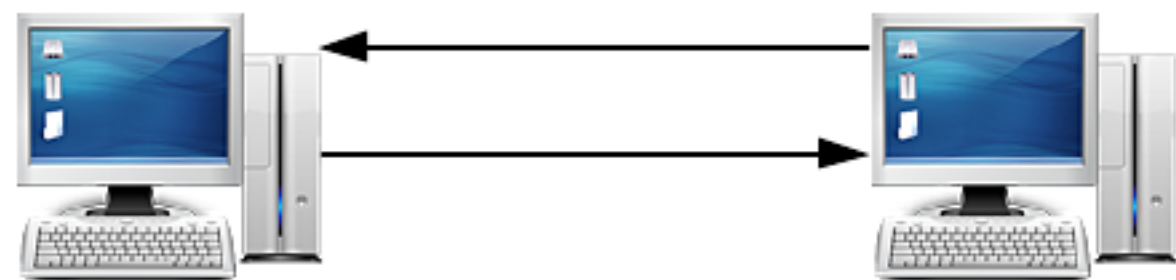http://youtu.be/j84eEjP-RL4
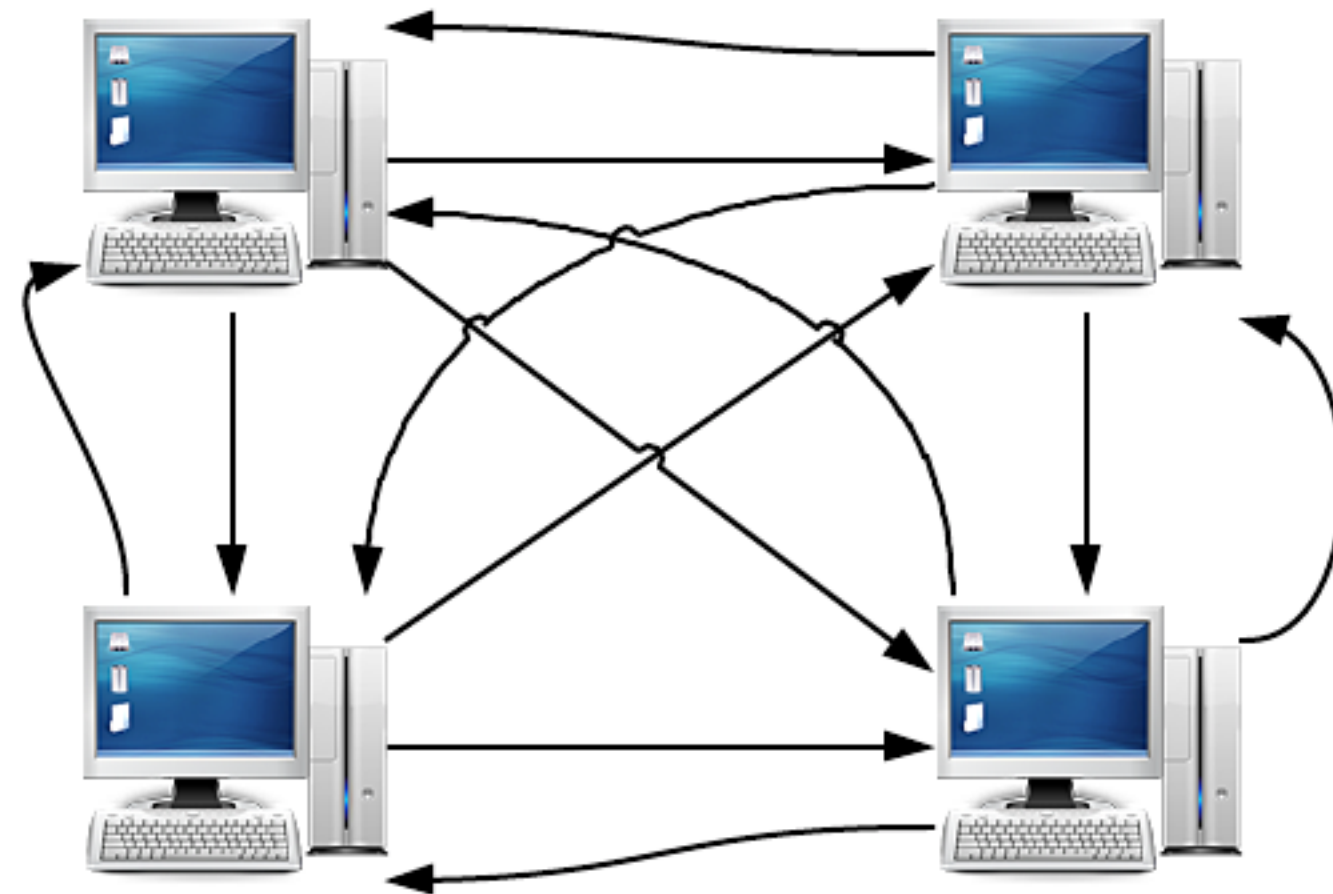
Review: March 4

http://youtu.be/9ntPxdWAWq8

traceroute cnn.com

Clients v. Servers

Routers

Network
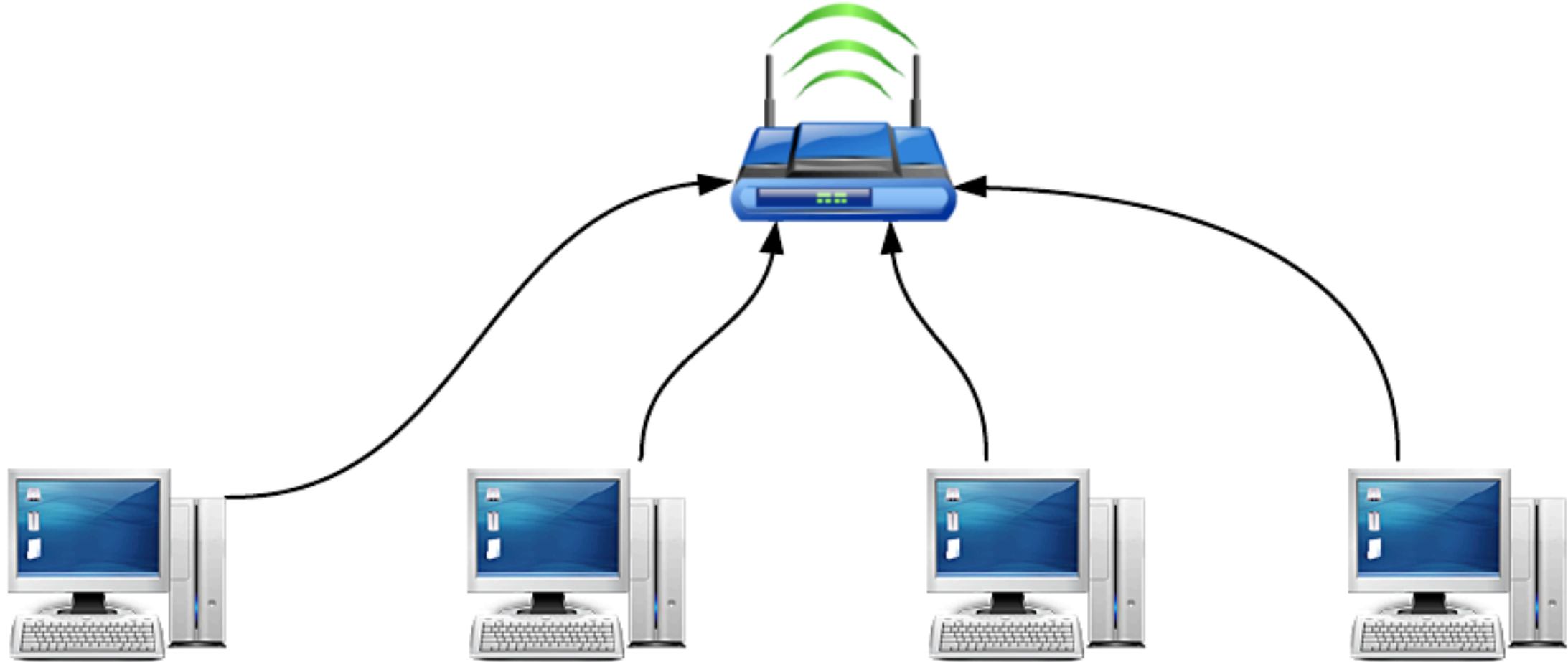
Internet Service Provider

Router

Router

Modem

ISP
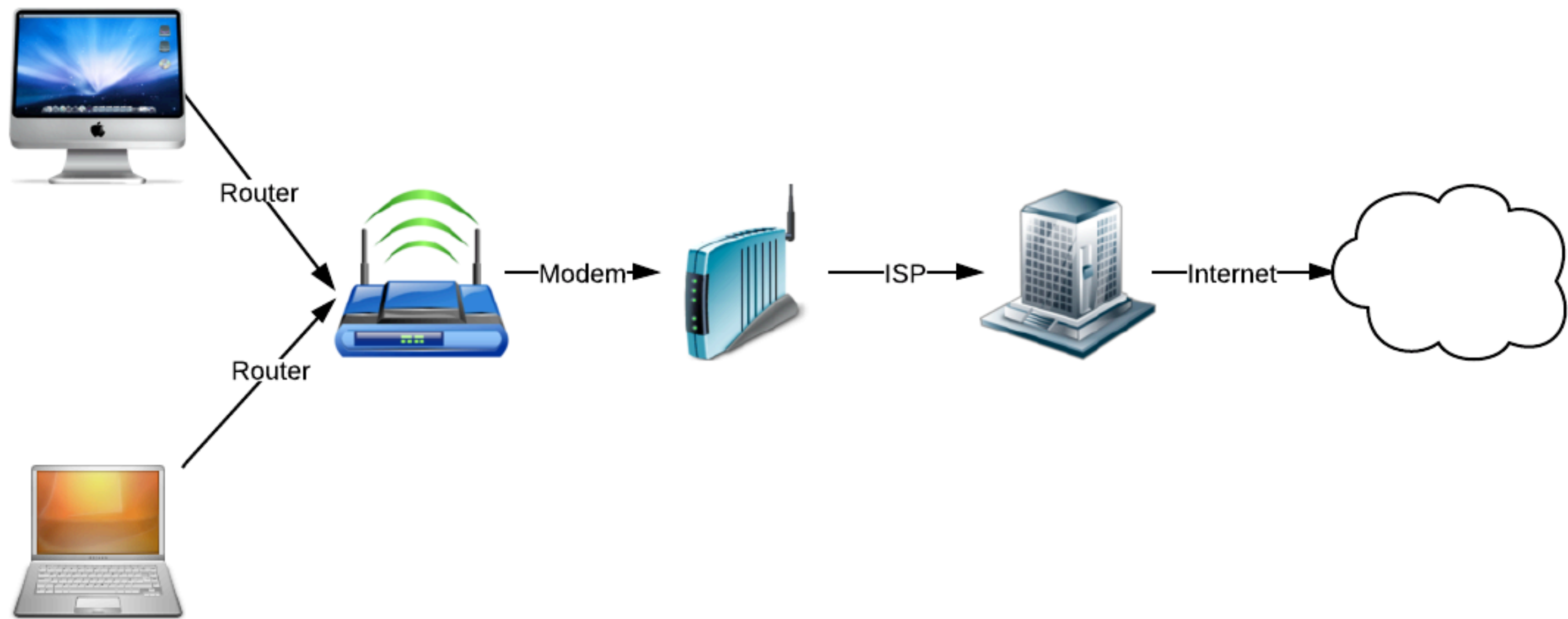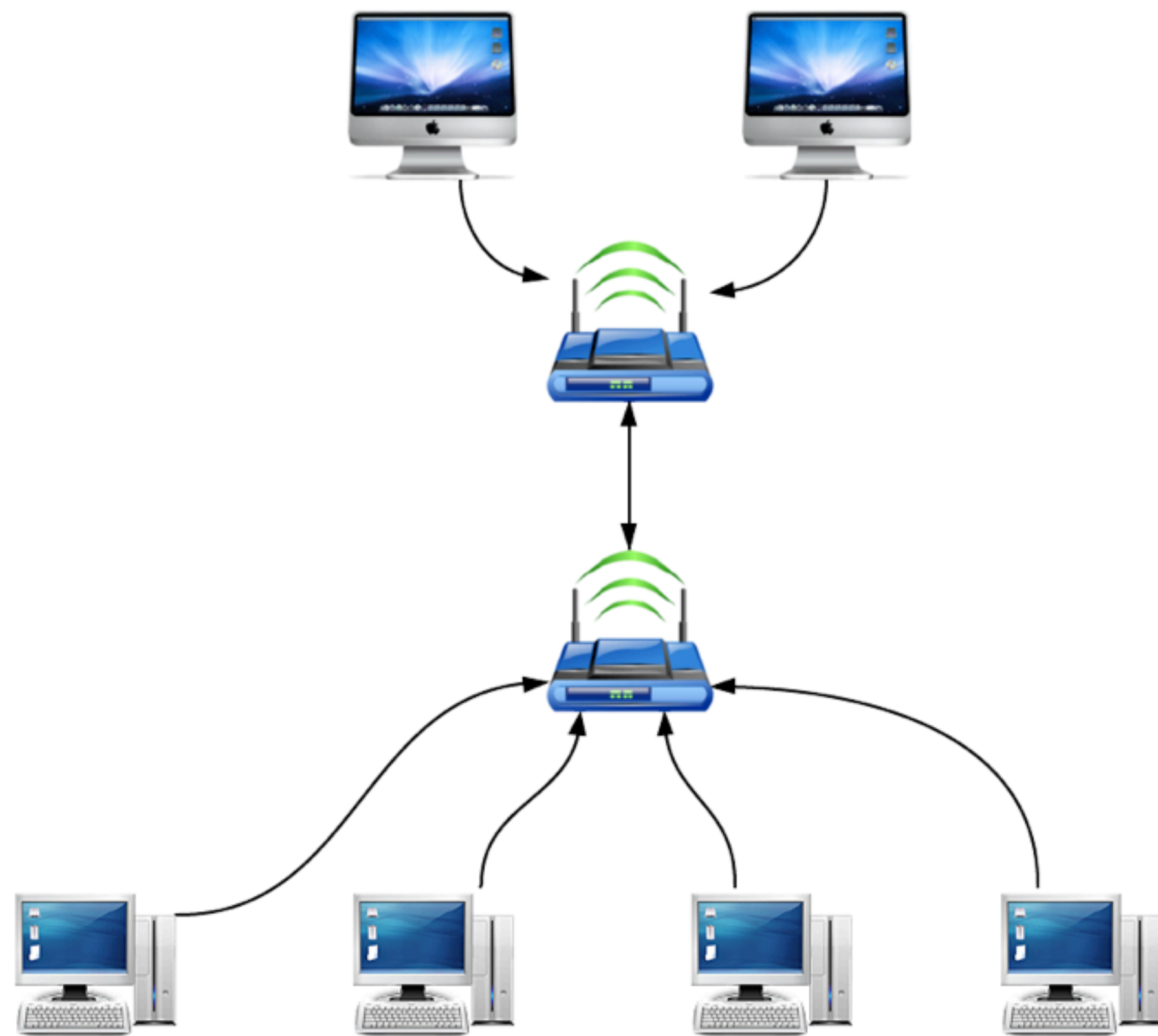
Internet

LAN

WAN

traceroute reddit.com

IP Address

10.251.202.239

4,294,967,296

"640K ought to be enough for anybody"

IPv4

IPv6

http://www.worldipv6launch.org/

2001:0db8:85a3:0042:
1000:8a2e:0370:7334

340,282,366,920,938,463,463,374,607,431,768,211,456

http://samsclass.info/ipv6/
exhaustion.htm

http://www.google.com/ipv6/statistics.html#tab=ipv6-adoption

Private IP Address

10.*.*.*

172.16.*.*

192.168.*.*

NAT

Device	Private IP	Public IP	Source Port
Macbook	10.0.0.1	74.125.26.228	1000
iPhone	10.0.0.2	74.125.26.228	1001
iPad	10.0.0.3	74.125.26.228	1002

NAT Request

- request from 10.0.0.1 reaches router

NAT Request

- request from 10.0.0.1 reaches router

- router looks up source port for 10.0.0.1

NAT Request

- request from 10.0.0.1 reaches router

- router looks up source port for 10.0.0.1

- router changes source IP to 74.125.26.228, adds source port 1000

NAT Request

- request from 10.0.0.1 reaches router

- router looks up source port for 10.0.0.1

- router changes source IP to 74.125.26.228, adds source port 1000

- router sends modified request to destination

NAT Response

- router receives response to 74.125.26.228 with source port 1000

NAT Response

- router receives response to 74.125.26.228 with source port 1000

- router looks up IP address for source port 1000

NAT Response

- router receives response to 74.125.26.228 with source port 1000

- router looks up IP address for source port 1000

- router forwards response to original client

http://www.whatismyip.com/

DHCP

DHCP

- Client broadcasts "I would like to join"

DHCP

- Client broadcasts "I would like to join"

- Server responds "I can help"

DHCP

- Client broadcasts "I would like to join"

- Server responds "I can help"

- Client requests an IP address

DHCP

- Client broadcasts "I would like to join"

- Server responds "I can help"

- Client requests an IP address

- Server offers client an IP address

DHCP

- Client broadcasts "I would like to join"

- Server responds "I can help"

- Client requests an IP address

- Server offers client an IP address

- Client confirms IP address

LOCAL

PUBLIC DATA NETS

HP DEC FORD CSC DDN-RVN

234 235 236 239 240 241 254 255

GENERAL ELECTRIC XEROX BELL LABS APPLE MIT DISA

233 232 237 238 243 242 253 252

BB&N INC BB&N INC DoD INTEL DISA CABLE TV UK MOD

MULTICAST

230 231 226 225 244 247 248 251

ARMY AISC IBM VPNs DSI DISA

229 228 227 224 245 246 249 250

SITA MERC CAP DEBIS CCS NORSK MERIT

218 219 220 ASIA-PACIFIC ASIA-PACIFIC LATIN AMERICA & CARIBBEAN US & VARIOUS

USPS BOEING duPONT DLA HALLIBURTON PSI

217 EUROPE NORTH AMERICA SOMETHING 221 NORTH AMERICA AFRICA

EUROPE UK SOCIAL SECURITY BB&N INC INTEROP ELI LILY APNIC

US DEPARTMENT OF DEFENSE NORTH AMERICA EUROPE

DUNET EUROPE PRUDENTIAL BELL NORTH HAM RADIO JAPAN INET EUROPE

ASIA-PACIFIC JAPAN PRIVATE (RFC 1918) VARIOUS

GOOGLE FLICKR LOOPBACK JAPAN TAPAN LATIN AMERICA & CARIBBEAN

USA ASIA-PACIFIC

DIGG SLASHDOT EBAY CRAIGSLIST ORIGINAL

CANADA NORTH AMERICA

EUROPE (UNUSED) VARIOUS SONY

EUROPE REGISTRARS

Connection Speeds

Performance	20 Mbps	✓ CONSTANT GUARD™ ❓	✓ XFINITY CONNECT ❓	• More than 3,500 live games on xfinity.com/espn3	Special Offer! $34⁹⁹/mo for the first 6 months BEST PRICE	Add to Cart
› Learn More						

Blast!®	50 Mbps	✓ CONSTANT GUARD™ ❓	✓ XFINITY CONNECT ❓	• More than 3,500 live games on xfinity.com/espn3	Special Offer! $59⁹⁹/mo for the first 6 months	Add to Cart
› Learn More						

Extreme 105	105 Mbps	✓ CONSTANT GUARD™ ❓	✓ XFINITY CONNECT ❓	• More than 3,500 live games on xfinity.com/espn3	Special Offer! $89⁹⁹/mo for the first 6 months	Add to Cart
› Learn More						

Performance Starter	6 Mbps	✓ CONSTANT GUARD™ ❓	✓ XFINITY CONNECT ❓	• More than 3,500 live games on xfinity.com/espn3	$49⁹⁵/mo	Add to Cart
› Learn More						

Compare our High Speed Internet Plans

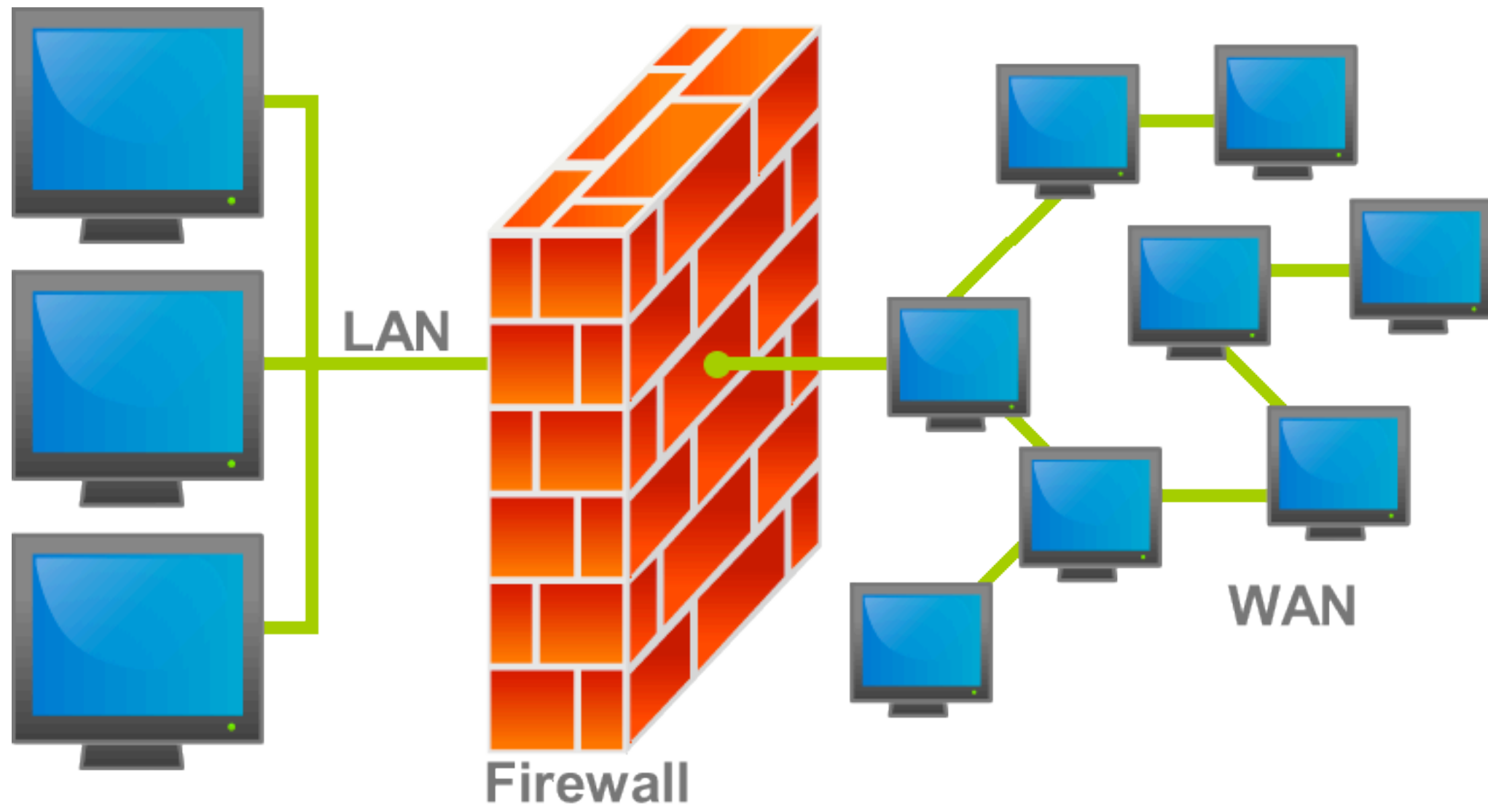| .5 to 1 Mbps Download 768 Kbps Upload	1.1 to 3 Mbps Download 768 Kbps Upload	3.1 to 7 Mbps Download 768 Kbps Upload	7.1 to 15 Mbps Download 768 Kbps Upload

Wireless Networks

WEP, WPA, WPA2

3G, 4G

Firewall

LAN

Firewall

WAN

VPN

Domains

DNS

HOSTS.TXT

DNS Server

Root DNS Server

root-servers.org

TLD DNS Server

Authoritative Name Server

Domain Resolution

- hosts file?

Domain Resolution

- hosts file?

- cache DNS server?

Domain Resolution

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- cache DNS server?

- root DNS server

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Domain Resolution

- hosts file?

- cache DNS server?

- root DNS server

- TLD DNS server

- authoritative name server

http://www.simpledns.com/lookup-dg.aspx

www.feross.orgz

SEARCH WEB

⚠ **Sorry, we can't find "www.feross.orgz". We suggest that you check the spelling of the web address or search above.**

Narrow Your Search

Ross

Ross.com

Ross Dress for Less

Ross Clothing Store

Ross Store

Ross Department Store

Ross Discount Store

Ross Store Location

Ross Clothing

Ross Clothes

Search Results for www.feross.orgz

powered by YAHOO! SEARCH

Get More Out c

Download the M
for Free ($120 v

Watch TV online

Find out what is

Check your voic

Upgrade Your

Upgrade to fast

Talk as long as
for one low price

Comcast gives
anyone. Upgrad

Net Neutrality

http://www.popsci.com/technology/article/2010-07/order-seven-cyber-guardians-around-world-now-hold-keys-internet

Configuring DNS

SOA Record

Primary DNS	Email	Default TTL	Refresh Rate	Retry Rate	Expire Time	Options
ns1.linode.com		Default	Default	Default	Default	Settings

NS Records

Name Server	Subdomain	TTL	Options
ns1.linode.com	cse1.net	Default	~~Edit~~ | ~~Remove~~
ns2.linode.com	cse1.net	Default	~~Edit~~ | ~~Remove~~
ns3.linode.com	cse1.net	Default	~~Edit~~ | ~~Remove~~
ns4.linode.com	cse1.net	Default	~~Edit~~ | ~~Remove~~
ns5.linode.com	cse1.net	Default	~~Edit~~ | ~~Remove~~

Add a new NS record

MX Records

Mail Server	Preference	Subdomain	TTL	Options
ASPMX.L.GOOGLE.COM	1		3600 (1 hour)	Edit | Remove
ALT2.ASPMX.L.GOOGLE.COM	5		3600 (1 hour)	Edit | Remove
ALT1.ASPMX.L.GOOGLE.COM	5		3600 (1 hour)	Edit | Remove
ASPMX2.GOOGLEMAIL.COM	10		3600 (1 hour)	Edit | Remove
ASPMX3.GOOGLEMAIL.COM	10		3600 (1 hour)	Edit | Remove

Add a new MX record

A/AAAA Records

Hostname	IP Address	TTL	Options
	66.228.37.113	Default	Edit | Remove
www	66.228.37.113	Default	Edit | Remove

Add a new A record

CNAME Records

Hostname	Aliases to	TTL	Options
mail	ghs.google.com	Default	Edit | Remove

Add a new CNAME record

DNS Records

- NS: name servers

- MX: email

- A: IPv4 address

- AAAA: IPv6 address

- CNAME: domain alias

TLDs

TLD	Usage
.com	Companies
.edu	Education
.gov	US Government
.info	Information
.mil	US Military
.net	Networks
.org	Organizations

ccTLDs

ccTLDs

- bit.ly: Libya

- about.me: Montenegro

- del.icio.us: US

- nic.tm: Turkmenistan

http://gtldresult.icann.org/

Registrars

URL

http://username:password@foo.example.com:1234/cs/e1/is.html?fun=yes&boring=no#awesome

Scheme

http://username:password@ foo.example.com:1234/cs/e1/is.html ?fun=yes&boring=no#awesome

Authentication

http://**username:password**@foo.example.com:1234/cs/e1/is.html?fun=yes&boring=no#awesome

http://username:password@
foo.example.com:1234/cs/e1/is.html
?fun=yes&boring=no#awesome

Domain

http://username:password@
foo.example.com:**1234**/cs/e1/is.html
?fun=yes&boring=no#awesome

Port

http://username:password@ foo.example.com:1234**/cs/e1/is.html** ?fun=yes&boring=no#awesome

Path

http://username:password@
foo.example.com:1234/cs/e1/is.html
?fun=yes&boring=no#awesome

Query String

http://username:password@
foo.example.com:1234/cs/e1/is.html
?fun=yes&boring=no#awesome

Fragment

Key-Value Pairs

query=cse1&page=3

- client

  - the **query** I want is **cse1**

  - the **page** I want is **3**

- server

  - what **query** and **page** should I look for?

q=e&1?

URL Encoding

q=e%261%3F

URI

http://cse1.net/psets/pset3.pdf

API

http://developer.mbta.com/lib/rthr/red.json

https://developers.facebook.com/tools/explorer/

http://youtu.be/Ve7_4ot-Dzs

Summary

Networking

- router
- IP address
- ISP
- network
- WAN, LAN
- IPv6
- private IP address

- NAT
- DHCP
- 802.11n
- 3G, 4G
- mbps
- firewall
- VPN

Domain Name System

- DNS

- domains

- hosts file

- root DNS server

- TLD DNS server

- authoritative name server

- net neutrality

- A record

- CNAME record

- TLD, ccTLD

- registrar

- URL

- URI

- API

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