Lecture 01-1: Introduction

CS 326E

Elements of Networking

Mikyung Han

Outline

1. Intro
2. Administrivia
3. Why computer networks?
4. Course goals

Please, interrupt and ask questions AT ANY TIME !

Grading

- **Participation: 15%**
  - Pre-class/in-class activities: total available 150 pts/max possible 125 pts
    - Videos, reading, instapoll, kahoot, this and that
    - Extra buffer accounts for sickness, emergency, etc
  - Group discussion participation: 25 pts
    - Peer review

Grading

- Participation: 15%
- Programming Projects and Labs: 25%
  - 2 Socket programming projects (P1: 100 pts, P2: 100 pts)
  - 1 Mininet lab (50 pts)
  - Pair programming
  - All in python3

Grading

- Participation: 15%
- Programming Projects and Labs: 25%
- Hands-on experiments: 8%
  - DNS Dig, traceroute (40 pts each)
  - Pair or solo

Grading

- Participation: 15%
- Programming Projects and Labs: 25%
- Hands-on experiments: 8%
- Exercises 12%
  - 9 of them, 15 pts each
  - Drop the lowest
  - Practice exam questions

Grading

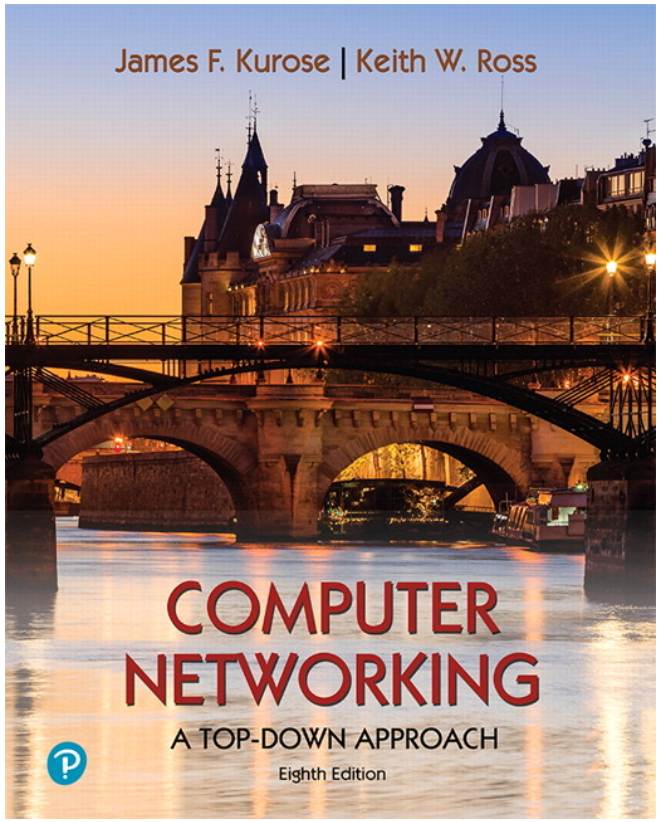
- Participation: 12%
- Programming Projects and Labs: 25%
- Hands-on experiments: 8%
- Exercises 12%
- Exams 40%
  - 2 Exams (200 pts each)
  - Adjustments: Max {Exam1, Exam2} + Avg {Exam1, Exam2})

Exam Scheduled

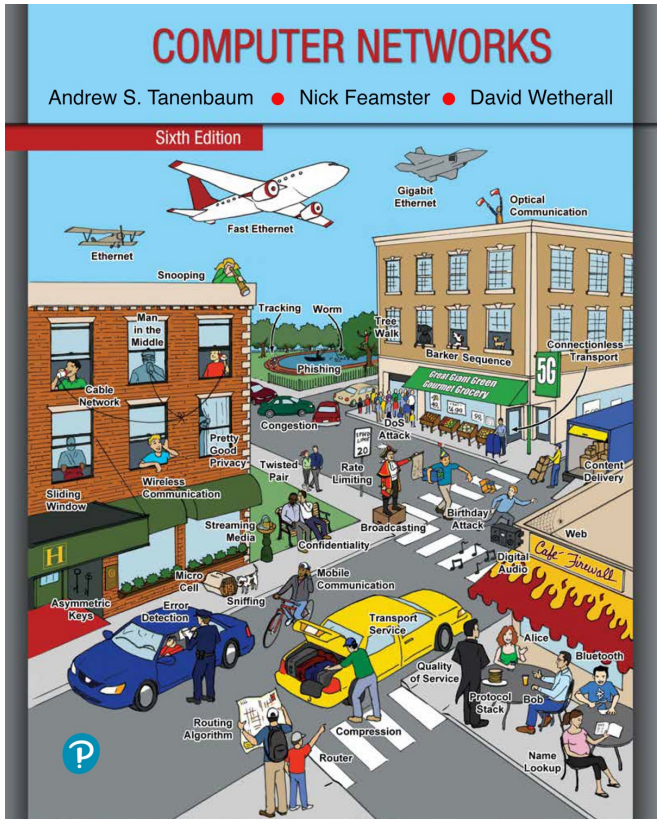
- **Exam 1: 10/25 Tues 6-9 PM**
  - No lecture at 9:30 AM or 12:30 PM
- **Exam 2: 12/1 Thurs 6-9 PM**
  - No lecture at 9:30 AM or 12:30 PM

Mark your calendar! Report any conflicts ASAP

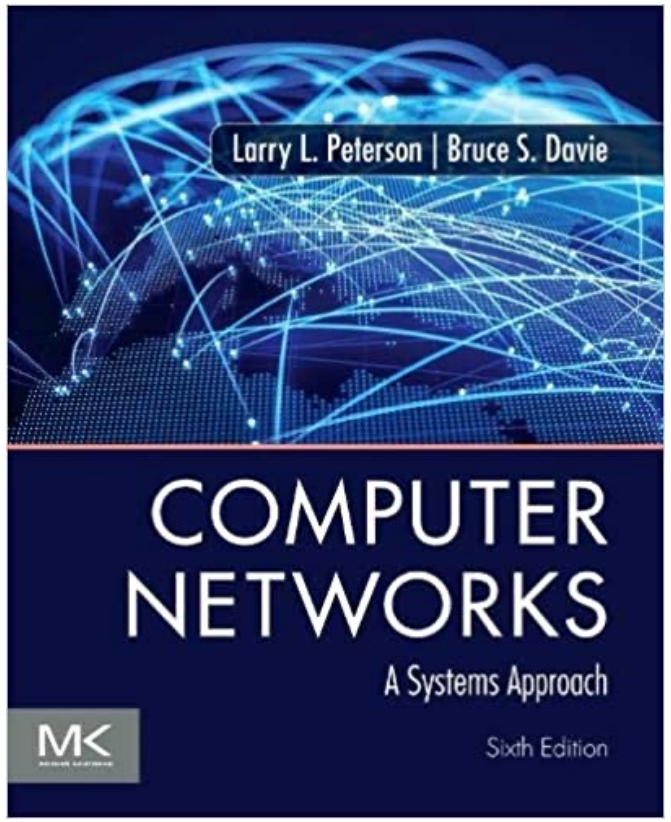
Textbooks



Required, 8th Edition



Recommended, 6th Edition



Optional, Open source

Tentative Plan

- Week 1: Computer Networks Overview
- Week 2-3: Application Layer
- Week 4-6: Transport Layer
- Week 7-9: Network Layer
- Week 10-12: Link Layer and Wireless Networks
- Week 13-14: Network Security
- Week 15: Network Management

Outline

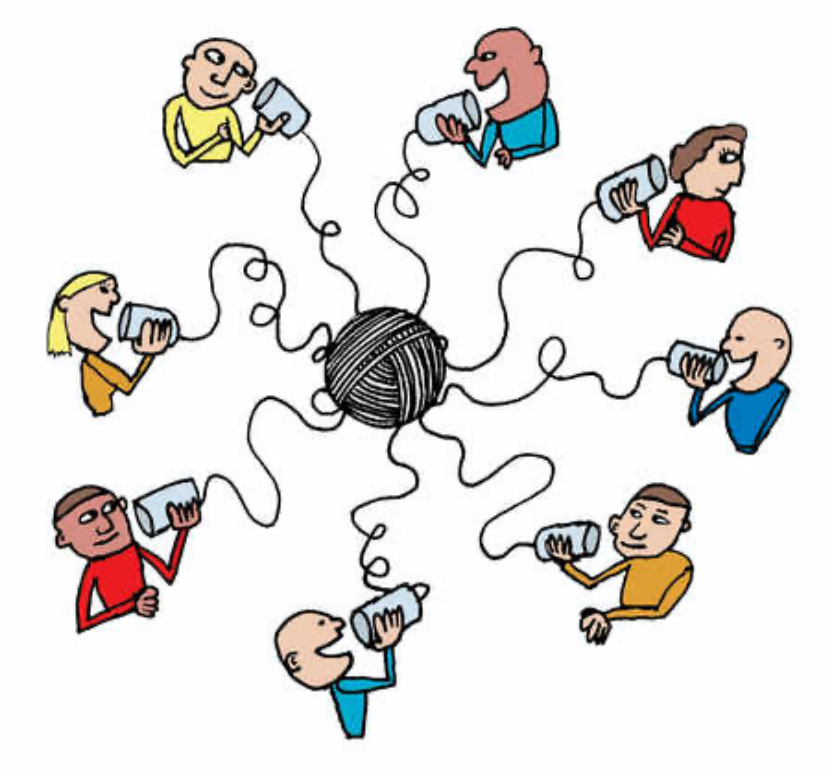
1. Intro
2. Administrivia
3. Why networking?

Why did you pick CS 326E?

- Turn to your neighbor
- Share your name and major
- Tell why you picked CS 326E among other electives

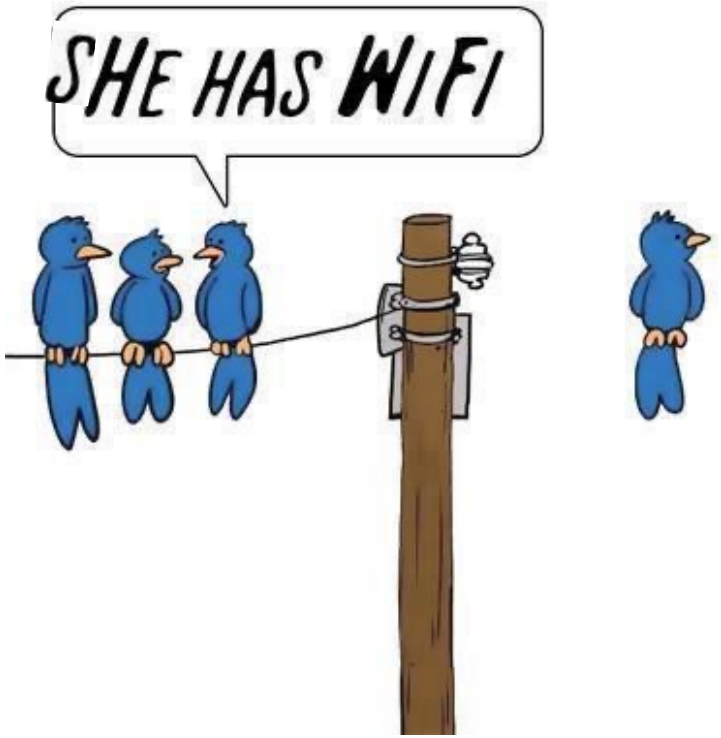
Why did I pick Computer Networks?

At the end of the day…



it's a field that connects people!

Why did I pick Wireless Networks?

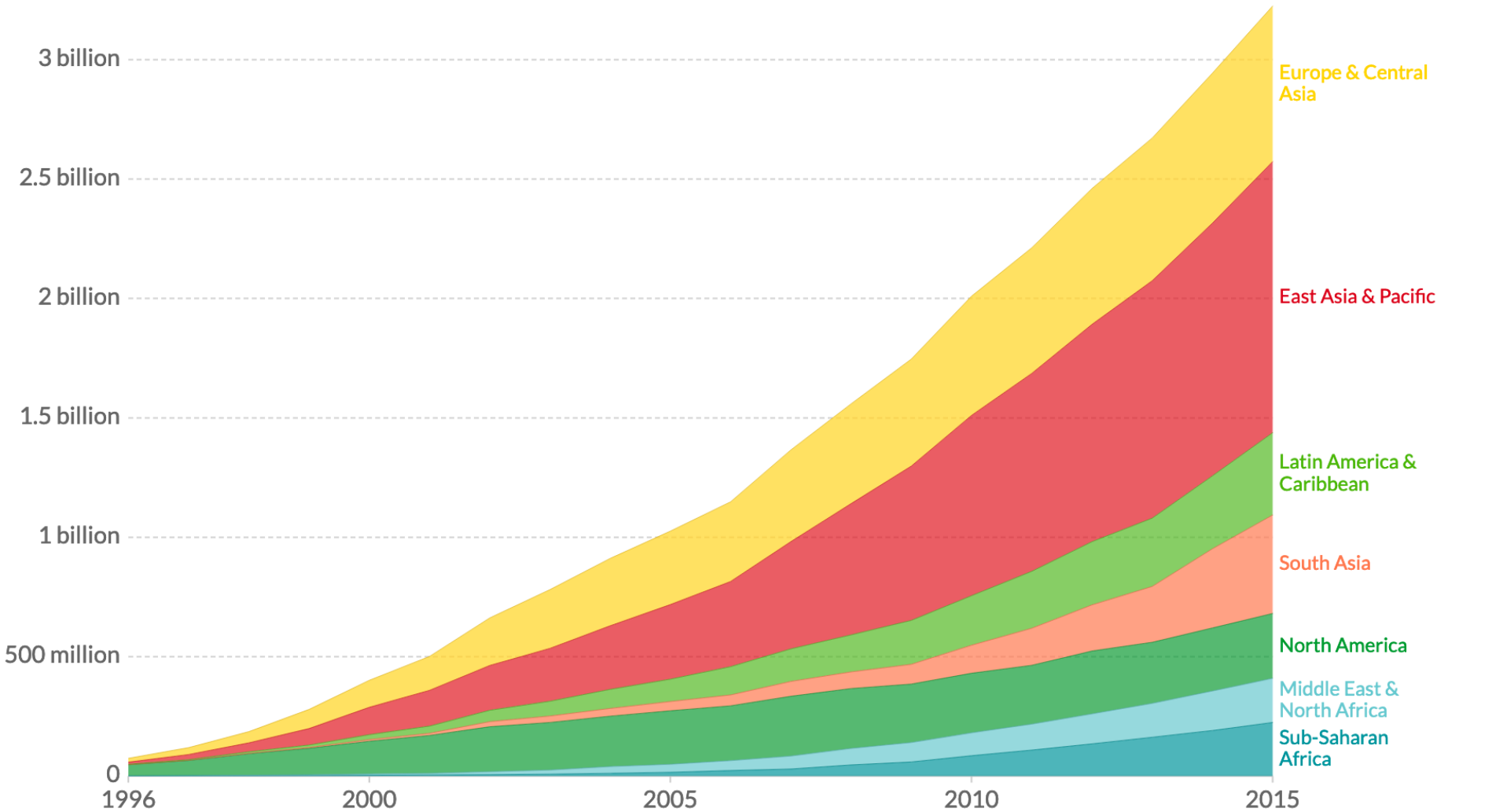


Also, its ever-growing/ever-evolving nature fascinated me

Internet users by world region

Our World in Data

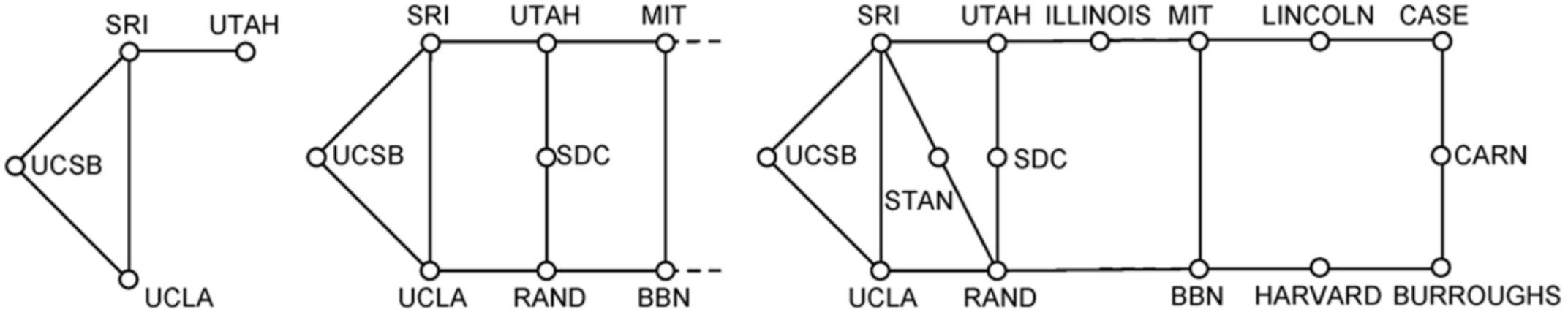
☐ Relative



Source: Science and Technology - World Bank (2016)

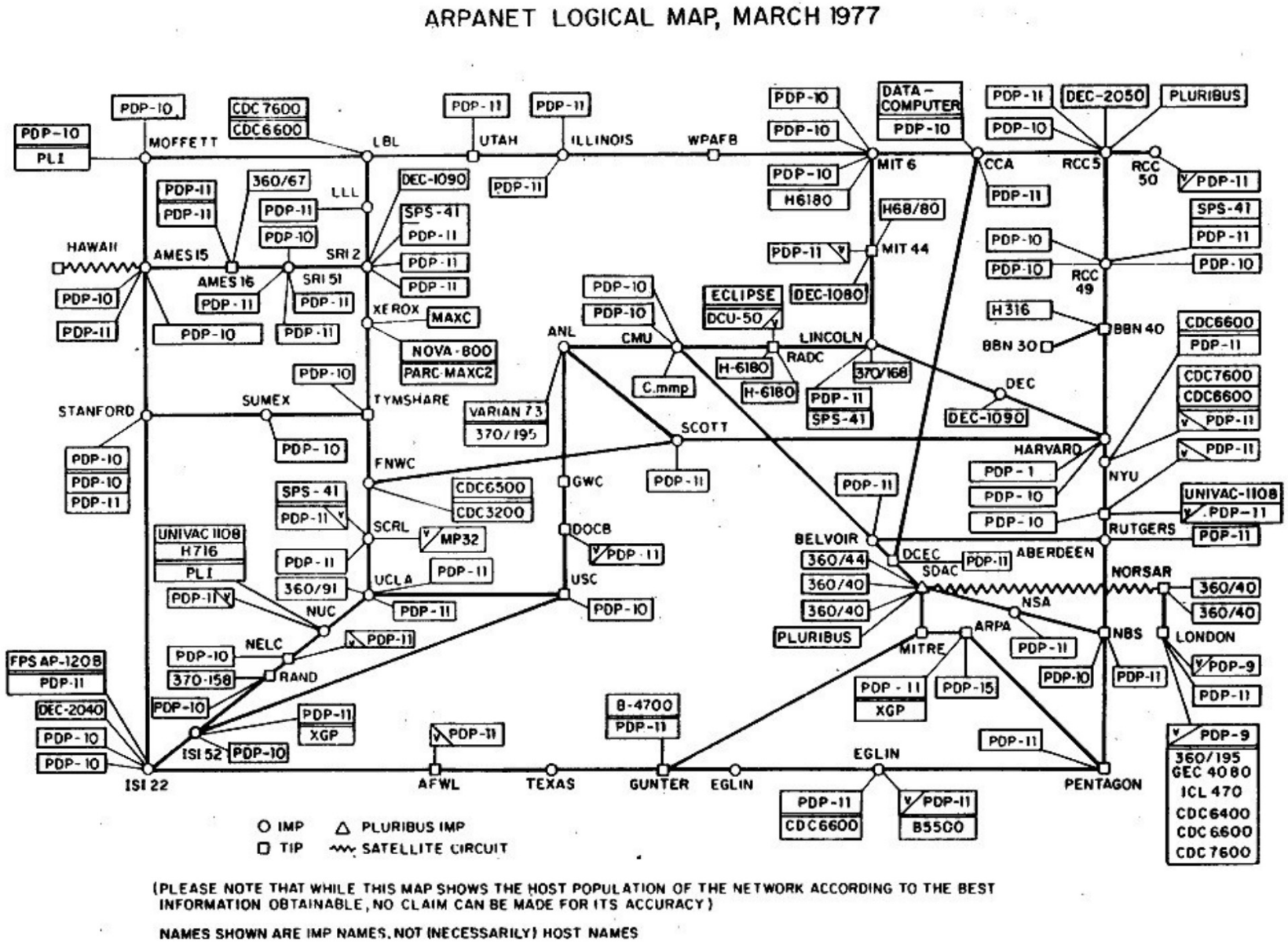
OurWorldInData.org/internet/ • CC BY

From this experimental network (~1970)

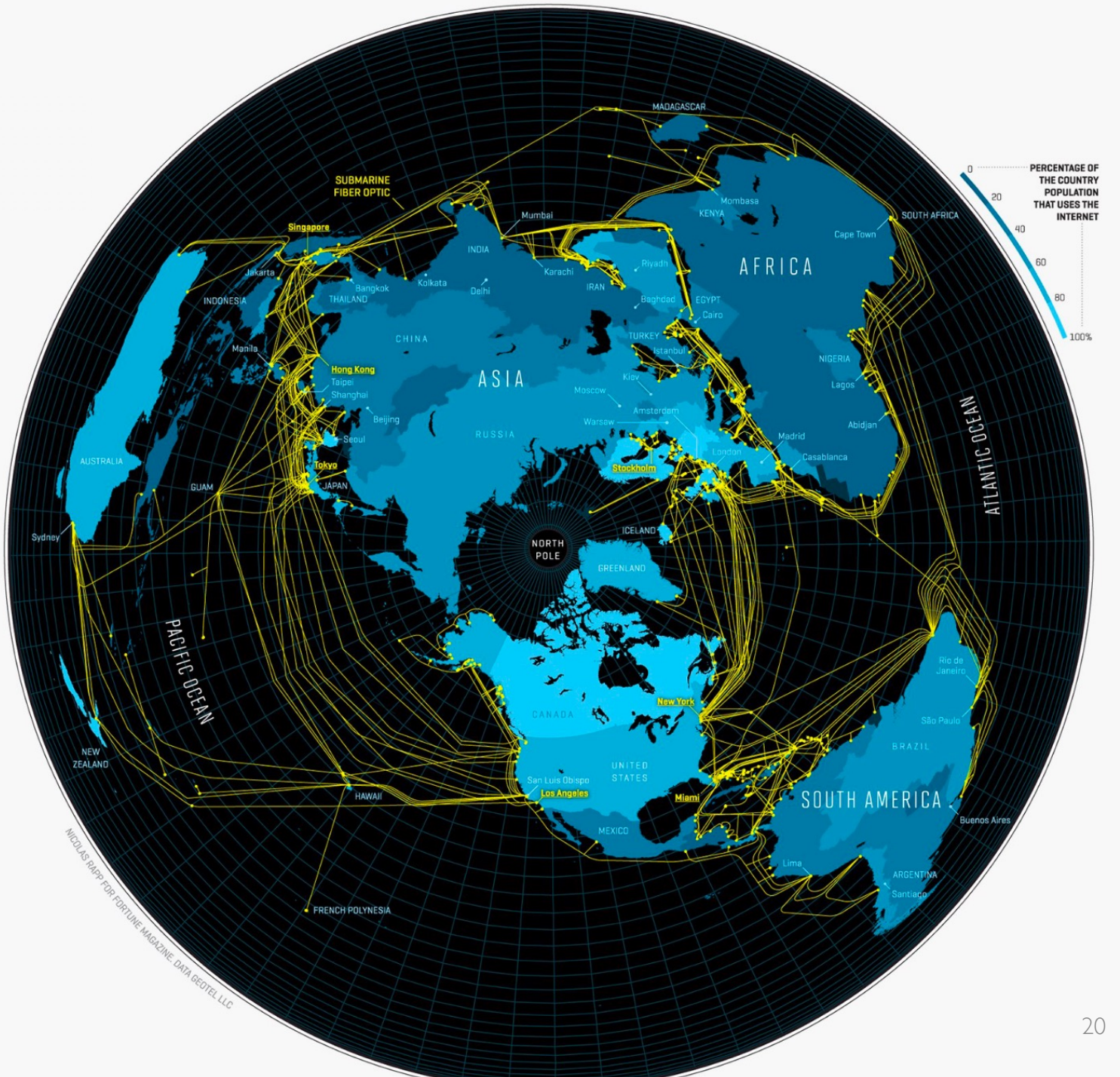


(a) Dec. 1969. (b) July 1970. (c) March 1971.

To this

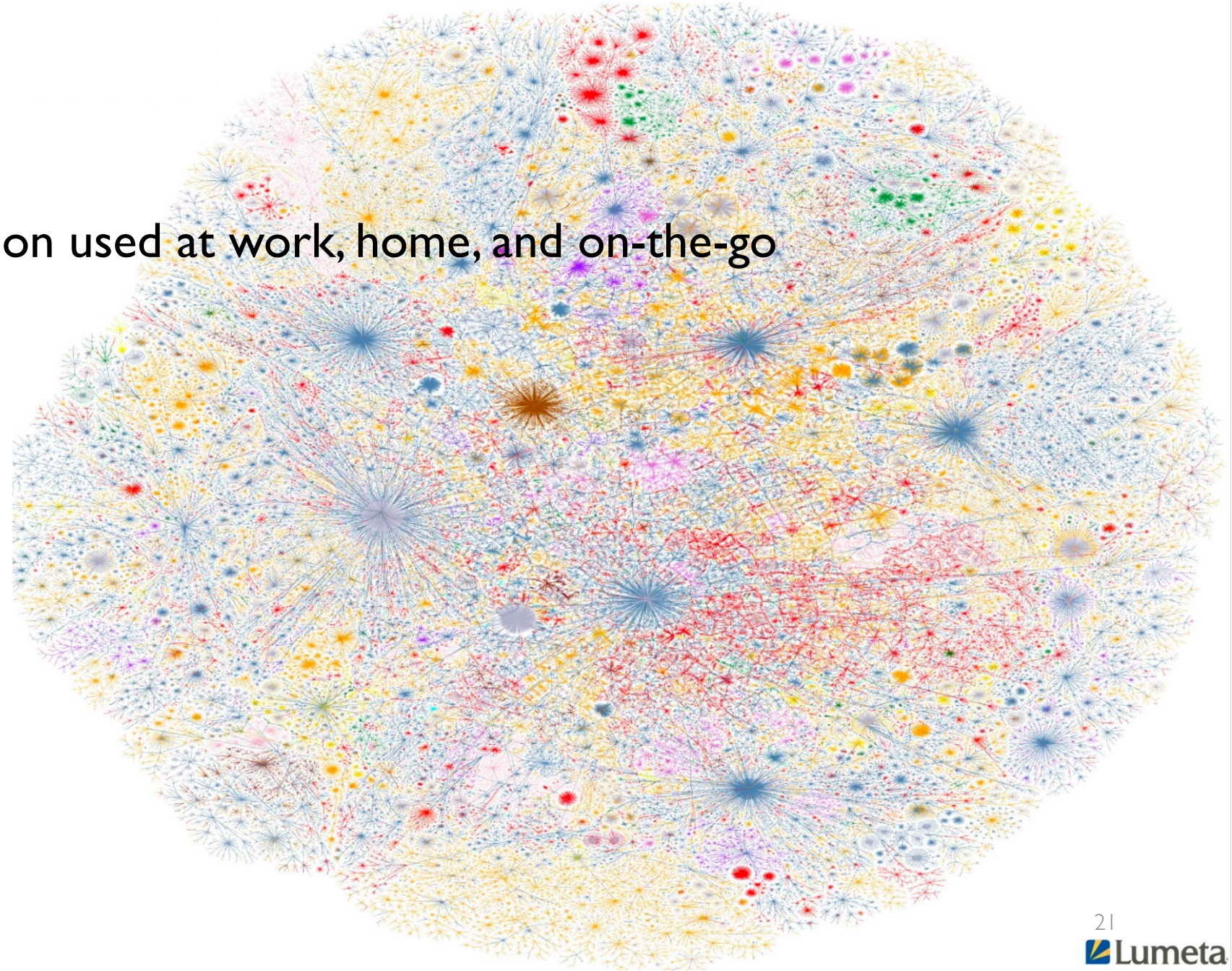

ARPANET LOGICAL MAP, MARCH 1977
MOFFETT
LBL
UTAH
ILLINOIS
WPAFB
MIT 6
CCA
RCC 5
RCC 50
HAWAII
AMES 15
AMES 16
SRI 2
SRI 51
XEROX
MAXC
NOVA-800
PARC-MAXC2
LLL
360/67
DEC-1090
SPS-41
ANL
CMU
C.mmp
ECLIPSE
DCU-50
DEC-1080
LINCOLN
RADC
H-6180
370/168
MIT 44
H68/80
DATA-COMPUTER
PDP-10
PDP-11
DEC-2050
PLURIBUS
H6180
H316
BBN 30
BBN 40
RCC 49
CDC6600
CDC7600
CDC6500
CDC3200
STANFORD
SUMEX
TYMSHARE
VARIAN 73
370/195
SCOTT
DEC
DEC-1090
HARVARD
NYU
RUTGERS
PDP-1
UNIVAC-1108
FNWC
GWC
SCRL
MP32
DOCB
UNIVAC 1108
H716
PLI
360/91
UCLA
USC
NUC
NELC
RAND
370-158
FPS AP-120B
DEC-2040
ISI 22
ISI 52
AFWL
TEXAS
GUNTER
EGLIN
8-4700
BELVOIR
360/44
360/40
PLURIBUS
DCEC
SDAC
ABERDEEN
NORSAR
NSA
ARPA
MITRE
XGP
PDP-15
NBS
LONDON
PDP-9
360/195
GEC 4080
ICL 470
CDC6400
CDC6600
CDC7600
B5500
PENTAGON
IMP
TIP
PLURIBUS IMP
SATELLITE CIRCUIT
(PLEASE NOTE THAT WHILE THIS MAP SHOWS THE HOST POPULATION OF THE NETWORK ACCORDING TO THE BEST INFORMATION OBTAINABLE, NO CLAIM CAN BE MADE FOR ITS ACCURACY)
NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

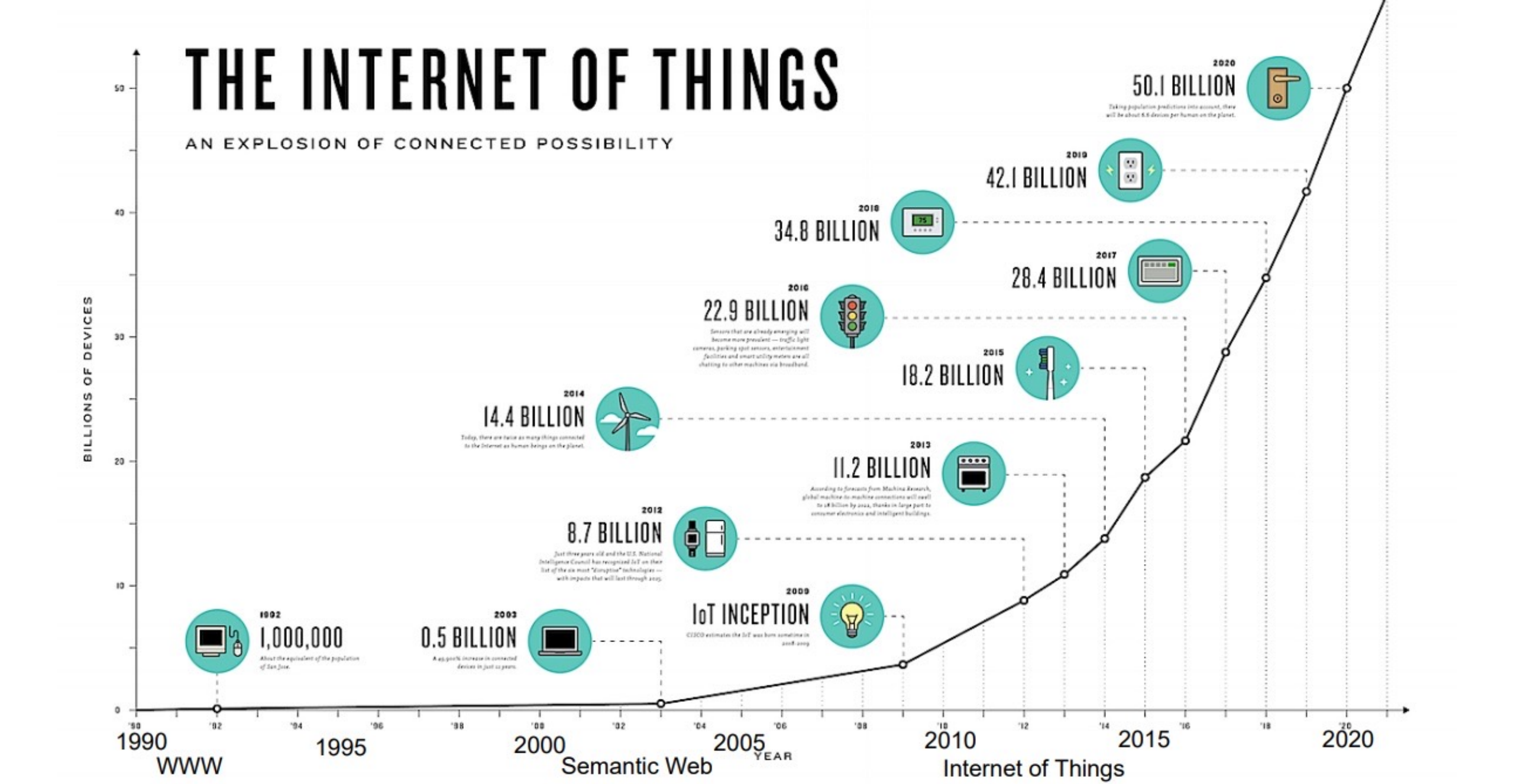
To this! (2011)


SUBMARINE FIBER OPTIC
PERCENTAGE OF THE COUNTRY POPULATION THAT USES THE INTERNET
0
20
40
60
80
100%
MADAGASCAR
Mombasa
KENYA
SOUTH AFRICA
Cape Town
AFRICA
Singapore
Mumbai
INDIA
Karachi
Riyadh
Jakarta
Bangkok
THAILAND
Kolkata
Delhi
IRAN
Baghdad
EGYPT
Cairo
INDONESIA
CHINA
TURKEY
Istanbul
Manila
Hong Kong
Taipei
Shanghai
ASIA
Kiev
Moscow
NIGERIA
Lagos
Amsterdam
Warsaw
Beijing
Abidjan
RUSSIA
Madrid
Seoul
London
Casablanca
AUSTRALIA
Tokyo
Stockholm
JAPAN
GUAM
ATLANTIC OCEAN
ICELAND
Sydney
NORTH POLE
GREENLAND
Rio de Janeiro
New York
CANADA
São Paulo
PACIFIC OCEAN
BRAZIL
NEW ZEALAND
UNITED STATES
San Luis Obispo
Los Angeles
Miami
HAWAII
SOUTH AMERICA
Buenos Aires
MEXICO
Lima
ARGENTINA
Santiago
FRENCH POLYNESIA
NICOLAS RAPP FOR FORTUNE MAGAZINE. DATA GEOTEL LLC

To this! (2015)

- An everyday institution used at work, home, and on-the-go
- millions of servers
  - Red = .com,
  - Yellow= .org
- 3 billion+ people
- 50 billion+ devices





70's: TCP/IP
80's: Internet

By Blake Irving: Based on CISCO Data

Finally, the Internet has many interesting and practical problems to solve! ☺

- Each agent knows its own state only (must infer other's state)
- Heterogenicity on links, hosts, and applications
- High availability and scalability
- Security and privacy
- Possibility of errors at any point adds a significant level of difficulty

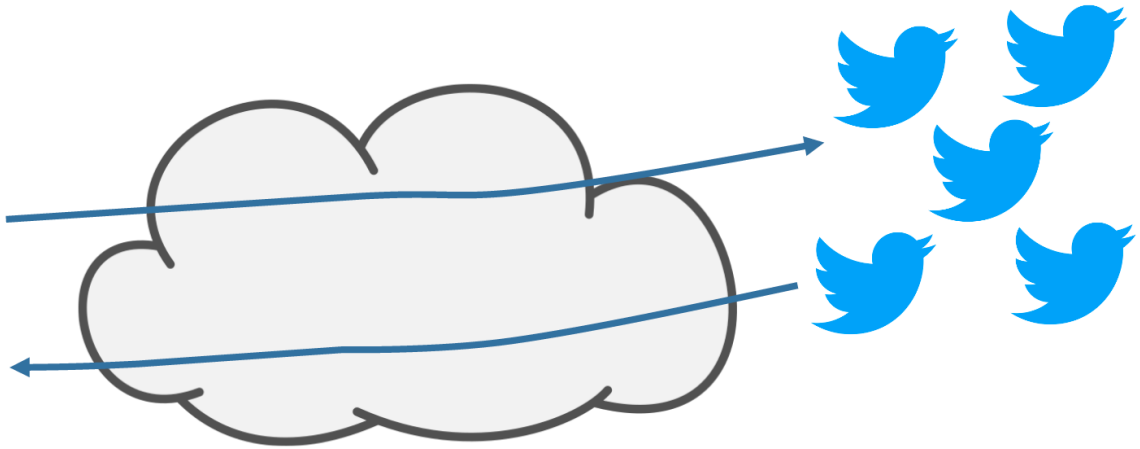
Sounds like a LOT of job/paper/market opportunities!

Outline

1. Intro
2. Administrivia
3. Why computer networks?
4. Course goals
5. Reminders

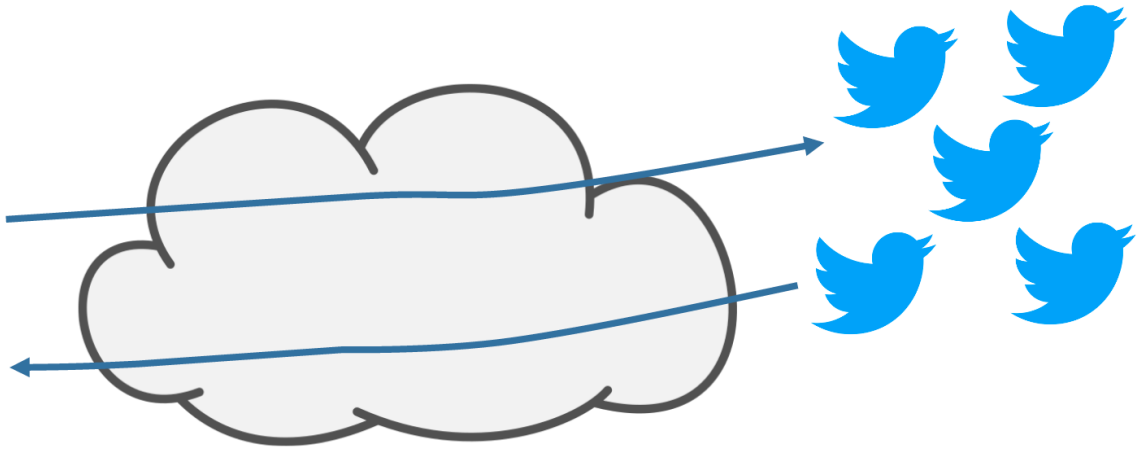
BTS Jungkook's post reached 1M people in just 10 min!

Video of Jeon Jungkook singing Lauv's "Never Not" via Twitter (@BTS_twt)



One: Learn HOW Internet works

Video of Jeon Jungkook singing Lauv's "Never Not" via Twitter (@BTS_twt)



What really happened before/after JK clicked the "tweet" button?

Two: Understand WHY behind the Internet design

Internet Reference Model

Example Protocols		Responsible for
FTP, HTTP, SMTP	Application	application specific needs
TCP, UDP	Transport	process to process data transfer
IP	Network	host to host data transfer across different network
Ethernet, WiFi	Link	data transfer between physically adjacent nodes
802.3 PHY	Physical	bit-by-bit or symbol-by-symbol delivery

Three: Know the fundamentals of computer networks

- Today's Internet is different from yesterday's
- Tomorrow's will be different again

But the fundamentals remain the same!

Any questions regarding the course?