

# CSE 124/224: OVERVIEW AND INTRODUCTION

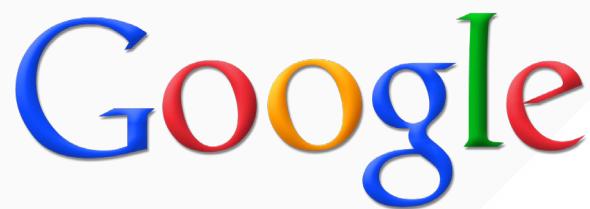
George Porter  
Week 1  
Fall 2020



# ATTRIBUTION

- These slides are released under an Attribution-NonCommercial-ShareAlike 3.0 Unported (CC BY-NC-SA 3.0) Creative Commons license

# OUR LIVES ARE (LARGELY) ONLINE!



Google docs



# NETWORKED SERVICES DRIVEN BY DATA

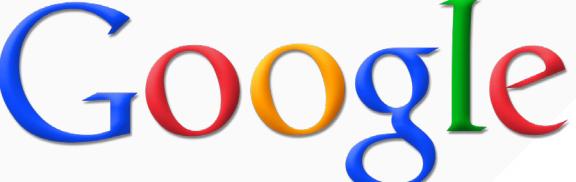
0 1 0 1 0 1 0 0 0 1 1 1  
0 0 1 1 0 1 0 0 1 0 1 1  
0 0 1 1 0 1 0 1 1 1 0 0  
1 0 1      Data      0 0 1  
0 1 1      1 0 0  
1 1 0      1 1 0  
0 1 1 0 0 0 0 0 1 1 1 1  
0 0 0 1 0 1 0 1 1 1 1 1  
1 1 1 0 1 0 1 1 1 0 0 0

+  = Product Recommendations

0 1 0 1 0 1 0 0 0 1 1 1  
0 0 1 1 0 1 0 0 1 0 1 1  
0 0 1 1 0 1 0 1 1 1 0 0  
1 0 1      Data      0 0 1  
0 1 1      1 0 0  
1 1 0      1 1 0  
0 1 1 0 0 0 0 0 1 1 1 1  
0 0 0 1 0 1 0 1 1 1 1 1  
1 1 1 0 1 0 1 1 1 0 0 0

+  Spotify® = Custom Stations

0 1 0 1 0 1 0 0 0 1 1 1  
0 0 1 1 0 1 0 0 1 0 1 1  
0 0 1 1 0 1 0 1 1 1 0 0  
1 0 1      Data      0 0 1  
0 1 1      1 0 0  
1 1 0      1 1 0  
0 1 1 0 0 0 0 0 1 1 1 1  
0 0 0 1 0 1 0 1 1 1 1 1  
1 1 1 0 1 0 1 1 1 0 0 0

+  = Personalized Search

# DATA-DRIVEN, PER-USER CUSTOMIZATION + ML

```

0 1 0 1 0 1 0 0 0 1 1 1
0 0 1 1 0 1 0 0 1 0 1 1
0 0 1 1 0 1 0 1 1 1 0 0
1 0 1 0 0 1 0 0 1 0 0 1
0 1 1 0 1 0 1 1 1 1 1 1
1 1 0 0 1 0 0 0 0 1 1 1 1
0 1 1 0 1 0 1 1 1 1 1 1 1
0 0 0 1 0 1 0 1 1 1 1 1 1
1 1 1 0 1 0 1 1 1 1 0 0 0

```

+ **amazon.com®** = Product Recommendations

```

0 1 0 1
0 0 1 1
0 0 1 1
1 0 1 0

```

App 3

```

0 1 0 1
0 0 1 1
0 0 1 1
1 0 1 0

```

App ...

```

0 1 0 1
0 0 1 1
0 0 1 1
1 0 1 0

```

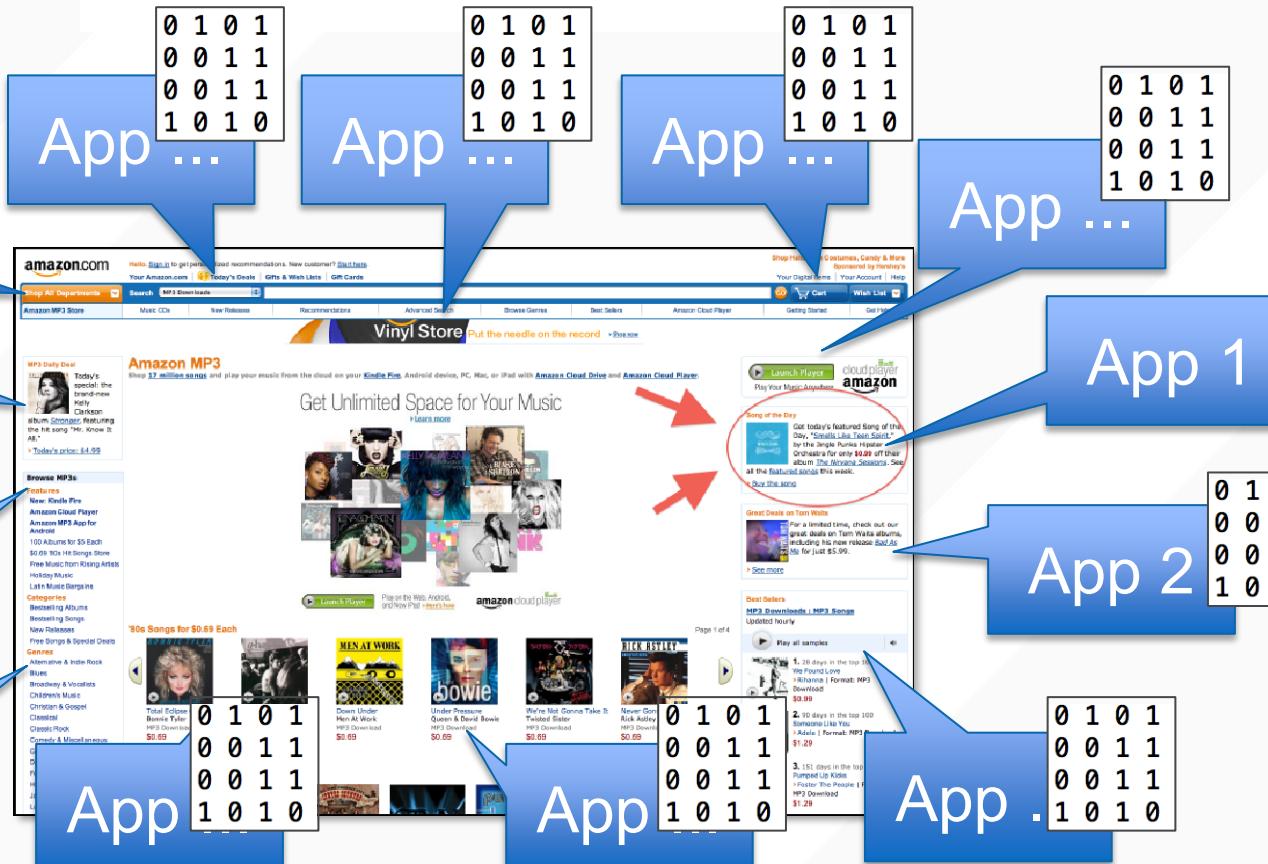
App ...

```

0 1 0 1
0 0 1 1
0 0 1 1
1 0 1 0

```

App ...



# DATACENTERS: THE HOME OF ALL THIS COMPUTING AND STORAGE



Microsoft



Google



Facebook

# Google 2012





# Microsoft

# Google



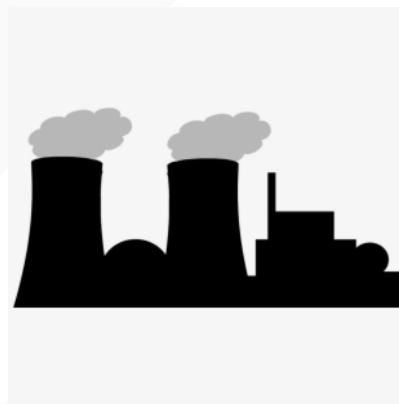


Facebook



# MASSIVE IMPACT

- To build:
  - Google spends about \$3B per year
  - Microsoft spent \$15B in total
- To operate:
  - 1-2% of global energy consumption<sup>1</sup>
  - 91 billion kWh (34 500-MW coal-fired power plants)<sup>2</sup>
- By 2020<sup>2</sup>: (less than a year from now!)
  - 140 billion kWh (50 power plants)
  - \$13 billion in electricity bills
  - 100 metric tons of carbon pollution per year



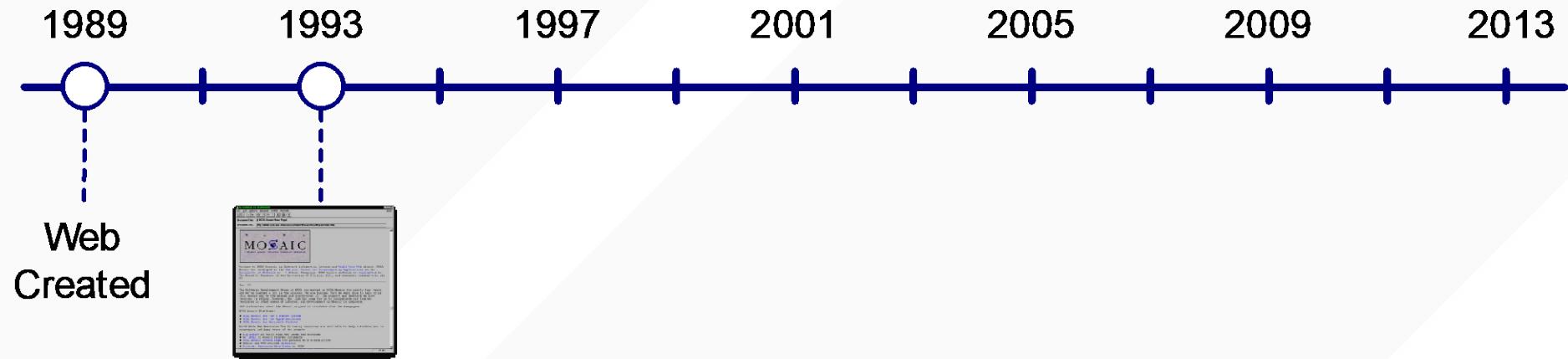
1. LBNL, 2013
2. NRDC report

# THE NETWORK HAS SEEN RAPID GROWTH

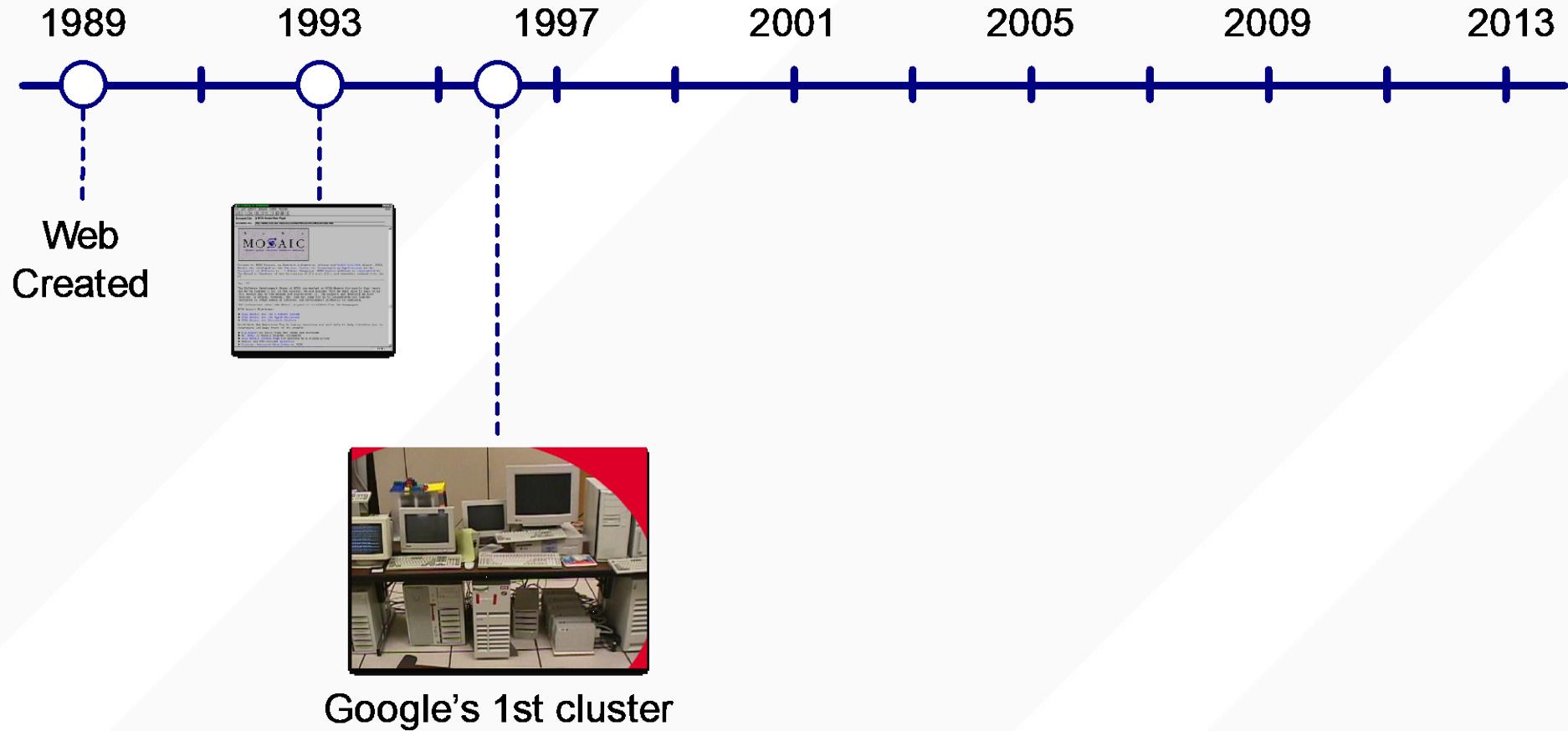
1989      1993      1997      2001      2005      2009      2013



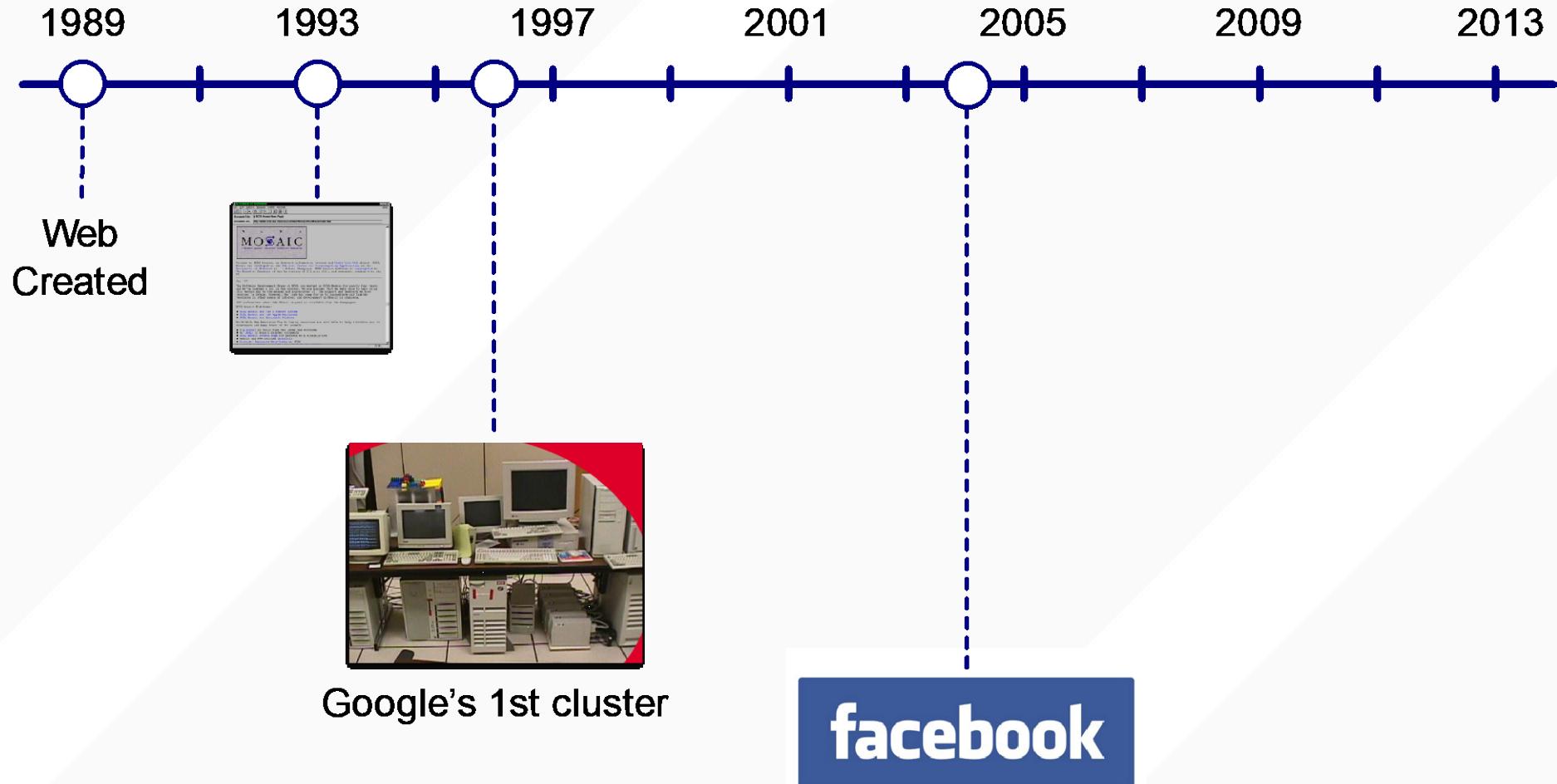
# THE NETWORK HAS SEEN RAPID GROWTH



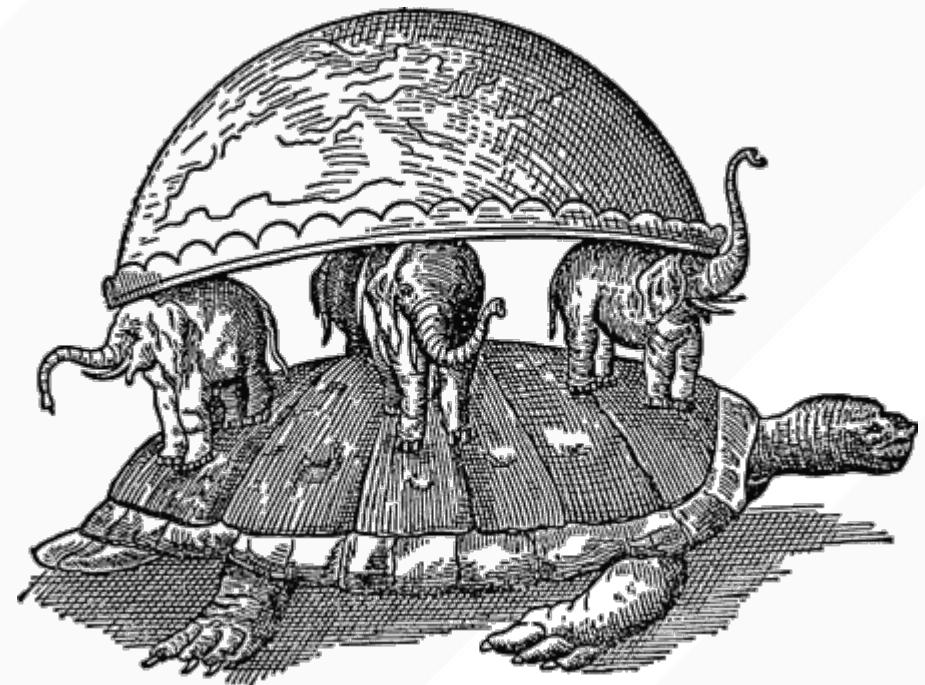
# THE NETWORK HAS SEEN RAPID GROWTH



# THE NETWORK HAS SEEN RAPID GROWTH

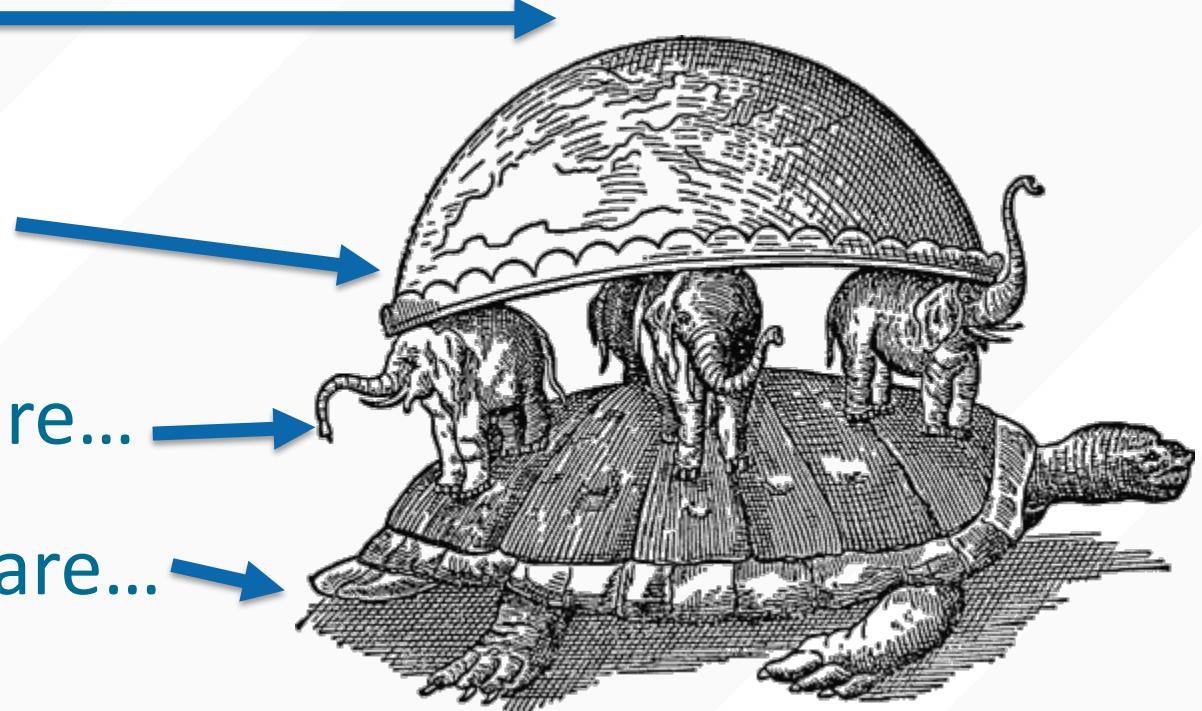


# HOW TO BUILD SUCH LARGE SYSTEMS?



# HOW TO BUILD SUCH LARGE SYSTEMS?

- Systems...
- Built on top of abstractions...
- Built on software...
- Built on hardware...



**IT'S NOT JUST WEBSITES AND SOCIAL MEDIA  
THOUGH!**

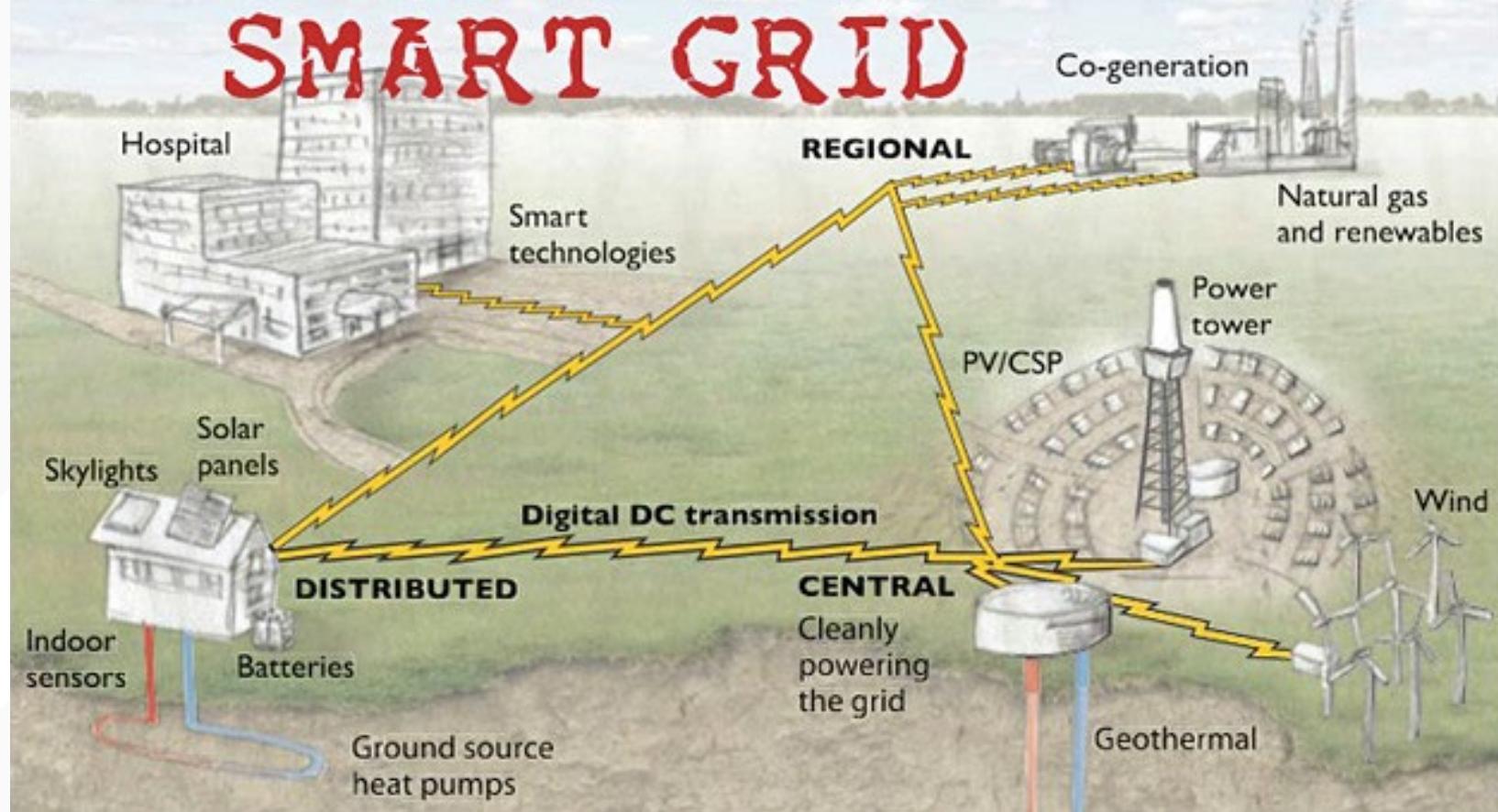
# SELF-DRIVING CARS



# SMART CITIES AND SMART GRIDS

## Smart, cleanly-powered grid

Interconnected grid with: **1.** Distributed, regional, and central generation; **2.** Hybrids (multiple means) of power generation at each scale; **3.** Smart sensors in buildings for efficient use; **4.** Smart technologies to designate critical areas during power losses; **5.** New generation batteries and other storage technologies.



# RESOURCES

- Zoom class
- Canvas
  - <https://canvas.ucsd.edu>
  - Assignments, gradebook, some materials
- Two books (both available for free online)
- TA discussion sections (1x week)
- Piazza message board
  - Piazza.com/ucsd/fall2020/cse124
  - We're using the 124 Piazza for **both** 124/224. 224 is "locked" so use 124 please.
- Each other

# CLASS MEETINGS

- Mostly putting the material that you read into context
  - Examples, live coding demos, activities, some “mini lectures” on algorithms, protocols, etc.
- Designed to be active
  - Mixture of slides, notes, worksheets, demos, etc.
- You’re required for everything that happens during class
  - Will be recorded and available asynchronously
  - Will be asking for feedback on what works and what doesn’t work a lot during the class

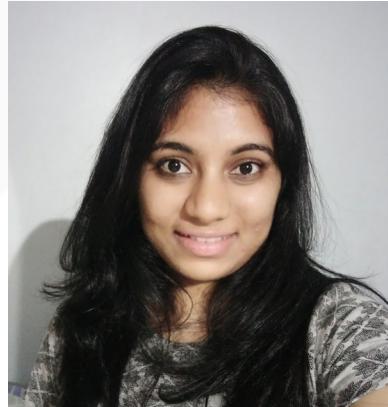
## 124 VS 224

- 124
  - Senior upper-division elective
- 224
  - MS- and non-systems PhD course
  - Please register for the appropriate section
  - Tas, Piazza, projects, etc. shared between the two courses
  - Note: cannot receive credit for both 124 and 224

# TEACHING ASSISTANTS



Sam Crow



Amulya Murthy



Alex Gamero-Garrido



Patrick Liu



Palash Chauhan



Haolan Liu

# BOOKS

Copyrighted Material

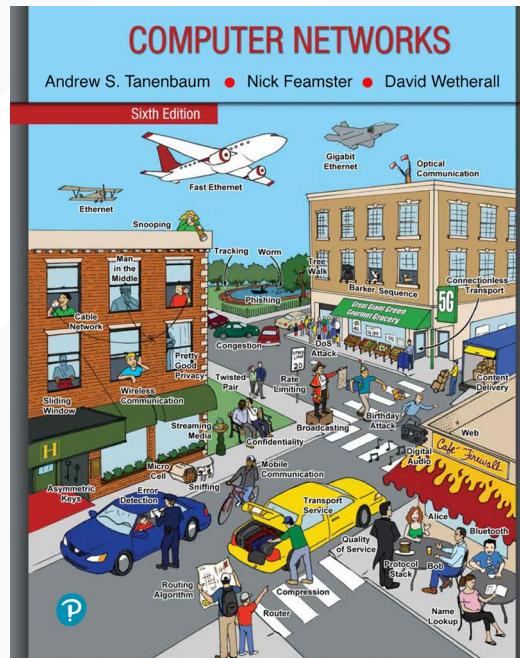
## The Go Programming Language

Alan A. A. Donovan  
Brian W. Kernighan



Copyrighted Material

ADDISON-WESLEY PROFESSIONAL COMPUTING SERIES



Note: **all are free** if accessed online (in particular through the UCSD library)



MORGAN & CLAYPOOL PUBLISHERS

## The Datacenter as a Computer

*An Introduction to the Design of Warehouse-Scale Machines*  
Second Edition

Luiz André Barroso  
Jimmy Clidaras  
Urs Hözle

SYNTHESIS LECTURES ON  
COMPUTER ARCHITECTURE

Mark D. Hill, Series Editor

# PROGRAMMING SKILLS FOR THIS CLASS

- We'll be using the "Go" language
  - [golang.org](http://golang.org)
  - Designed at Google in 2007
  - Goals: improve programming productivity in an era of multicore, networked machines, and large codebases
  - Kernighan (of 'C' fame) co-created
- Why?
  - Simple, readable, no mem allocation (similar to Python)
  - High-performance networking
  - Concurrency/parallelism
  - Static typing and efficient runtime
  - Industry-quality and deployed at massive scale



# MODULES

1. Introduction to the cloud
  - Deploy code to the cloud and measure the performance
2. Network programming fundamentals
  - Write your own custom web server!
3. Remote procedures and physical/logical time
  - Implement a “Dropbox” file sharing service called SurfStore
4. Replication and fault tolerance
  - Ensure that your SurfStore can survive server and network failures
5. Designing for scale
  - Ensure that your SurfStore can scale to handle millions of users

# GRADING

- Modules: 70%
  - Module 1: 10%
  - Module 2: 20%
  - Module 3: 15%
  - Module 4: 12.5%
  - Module 5: 12.5%
- Exams: 30%
  - Midterm: 12.5%
  - Final: 17.5%

# AMAZON CLOUD SERVICES

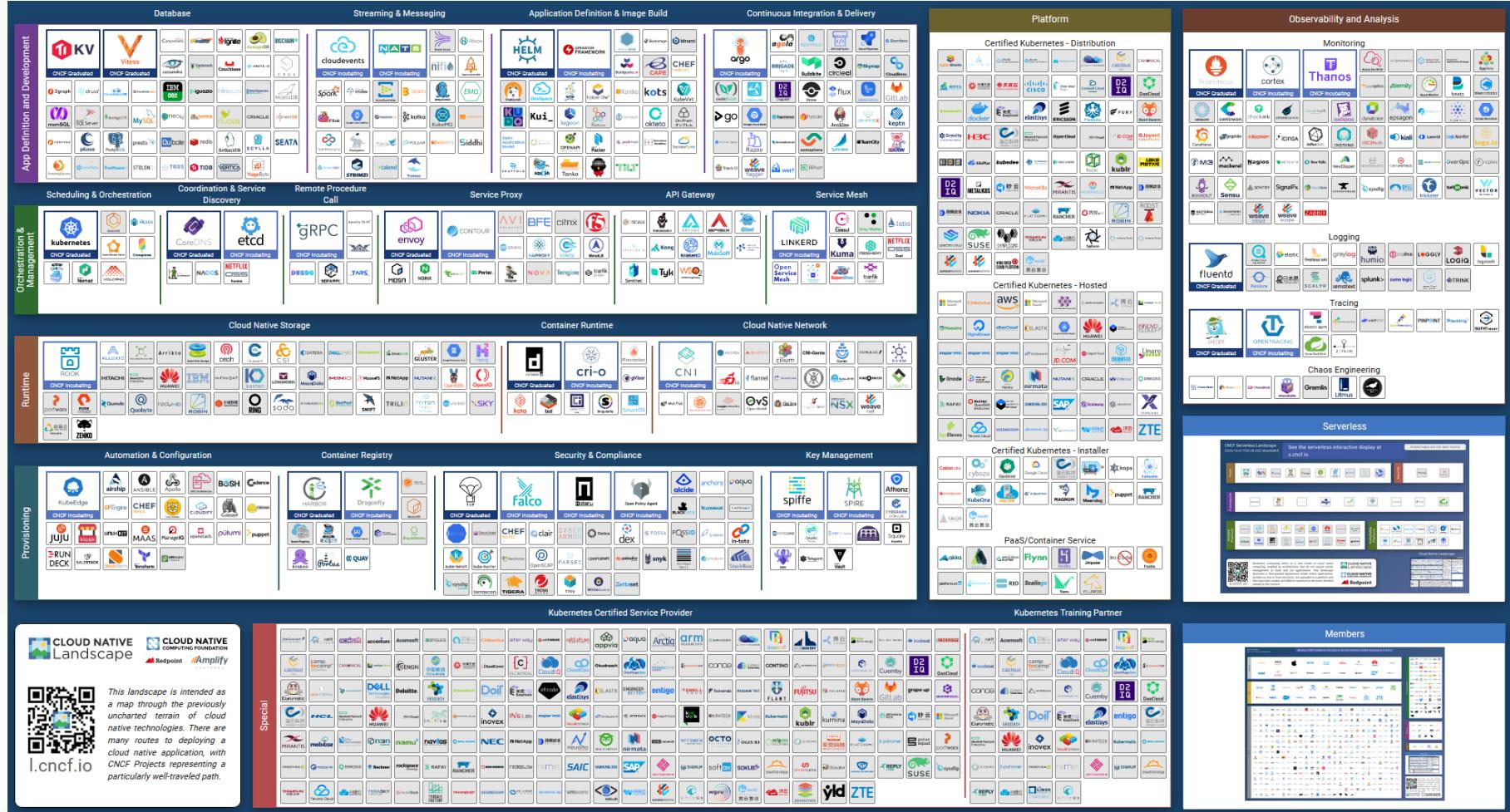


- Deploy your code on Amazon AWS to datacenters on five continents
  - Mumbai, India; Dublin Ireland; Sao Paulo Brazil; Seoul, Korea, California

# YOUR SERVER IN THE CLOUD

- Every student gets about \$50 in free credit for the Amazon cloud
- Can develop/run your code there
- Can develop on your own computer if you prefer to do that, but make sure it runs correctly on your cloud machine

# FULL CLOUD NATIVE LANDSCAPE



# CLOUD NATIVE LANDSCAPE IN A 10-WEEK QUARTER



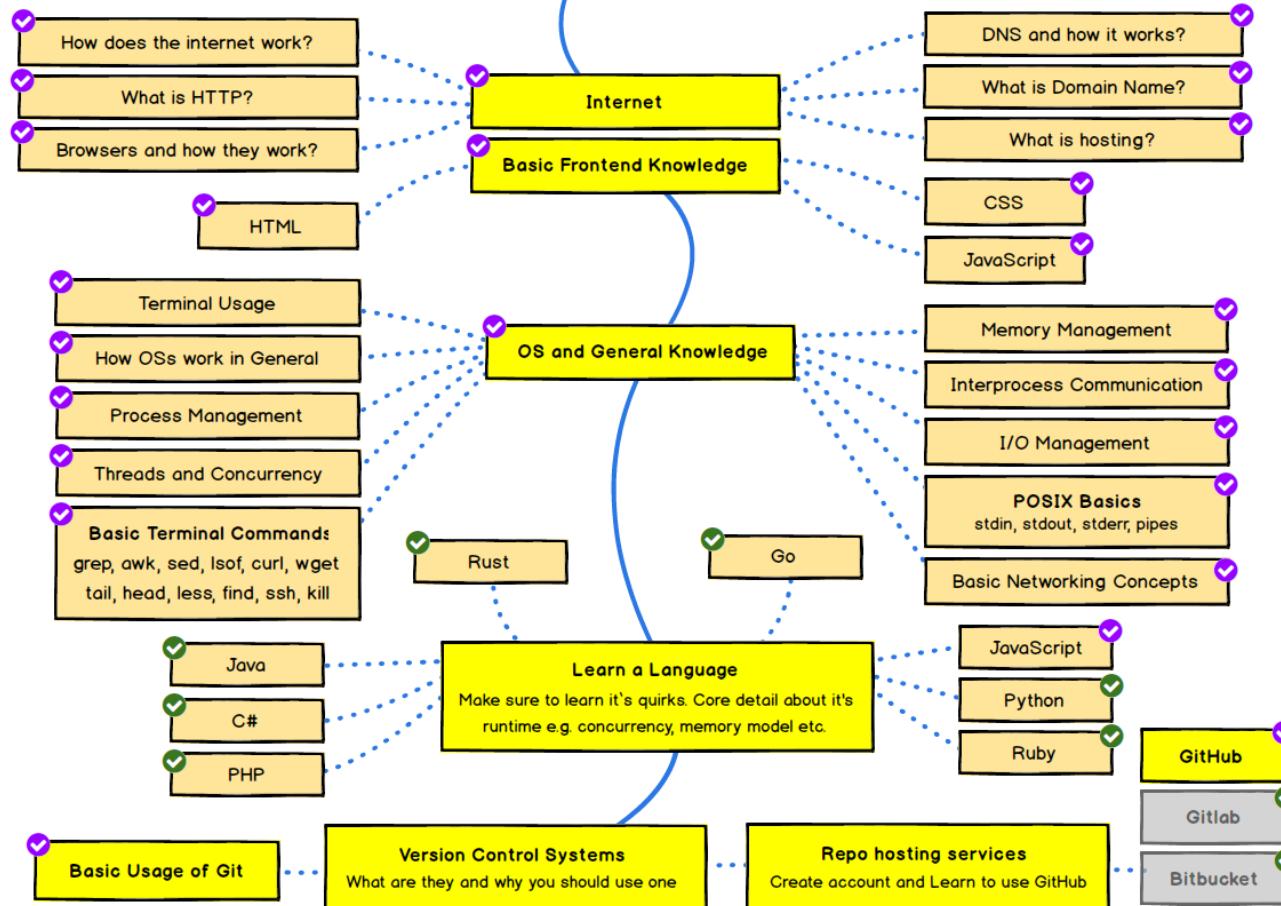
# BACKEND DEVELOPMENT ROADMAP

- ✓ Personal Recommendation / Opinion
- ✓ Alternative Option - Pick this or purple
- ✓ Order in roadmap not strict (Learn anytime)
- I wouldn't recommend

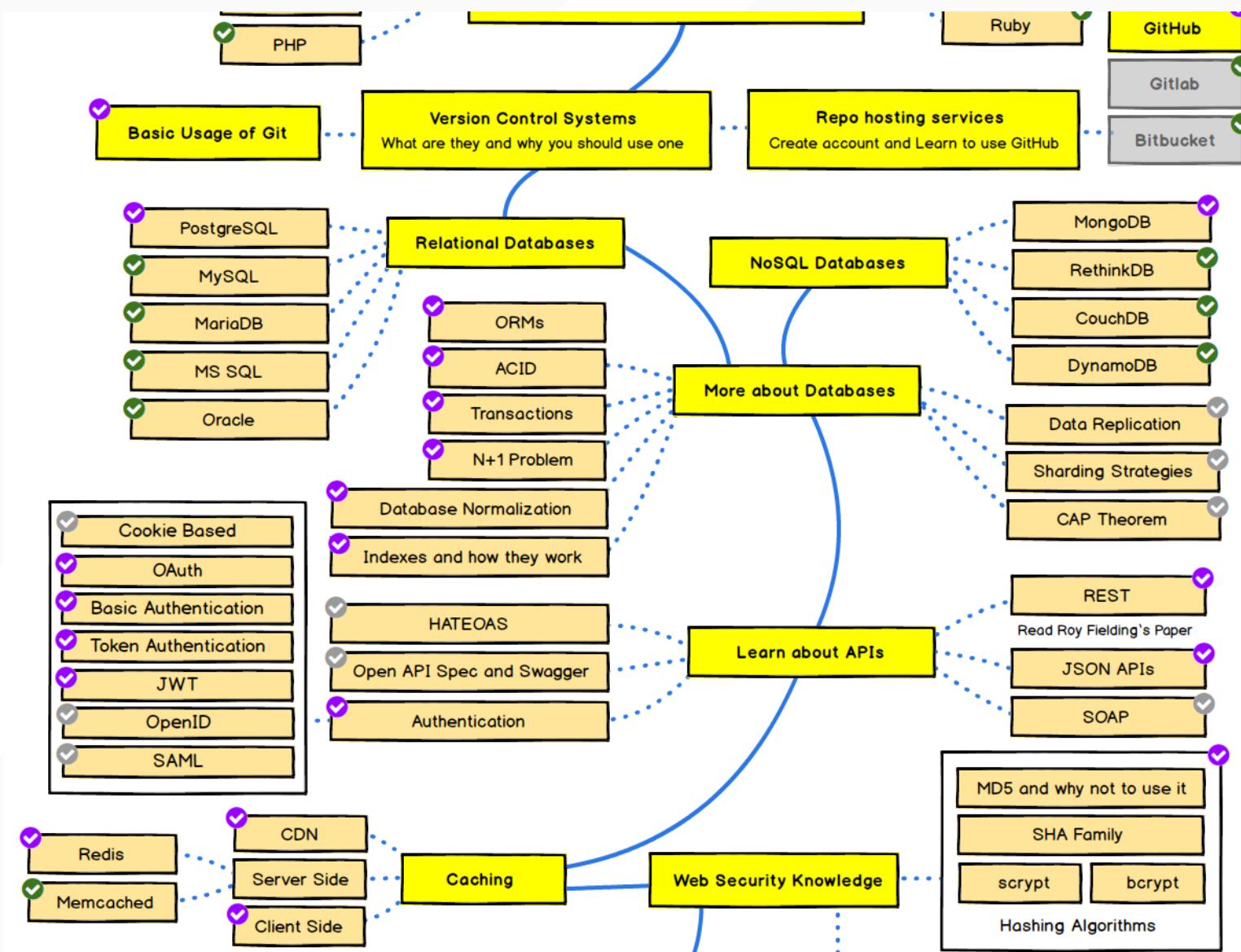
Find the detailed version of this roadmap along with resources and other roadmaps

<http://roadmap.sh>

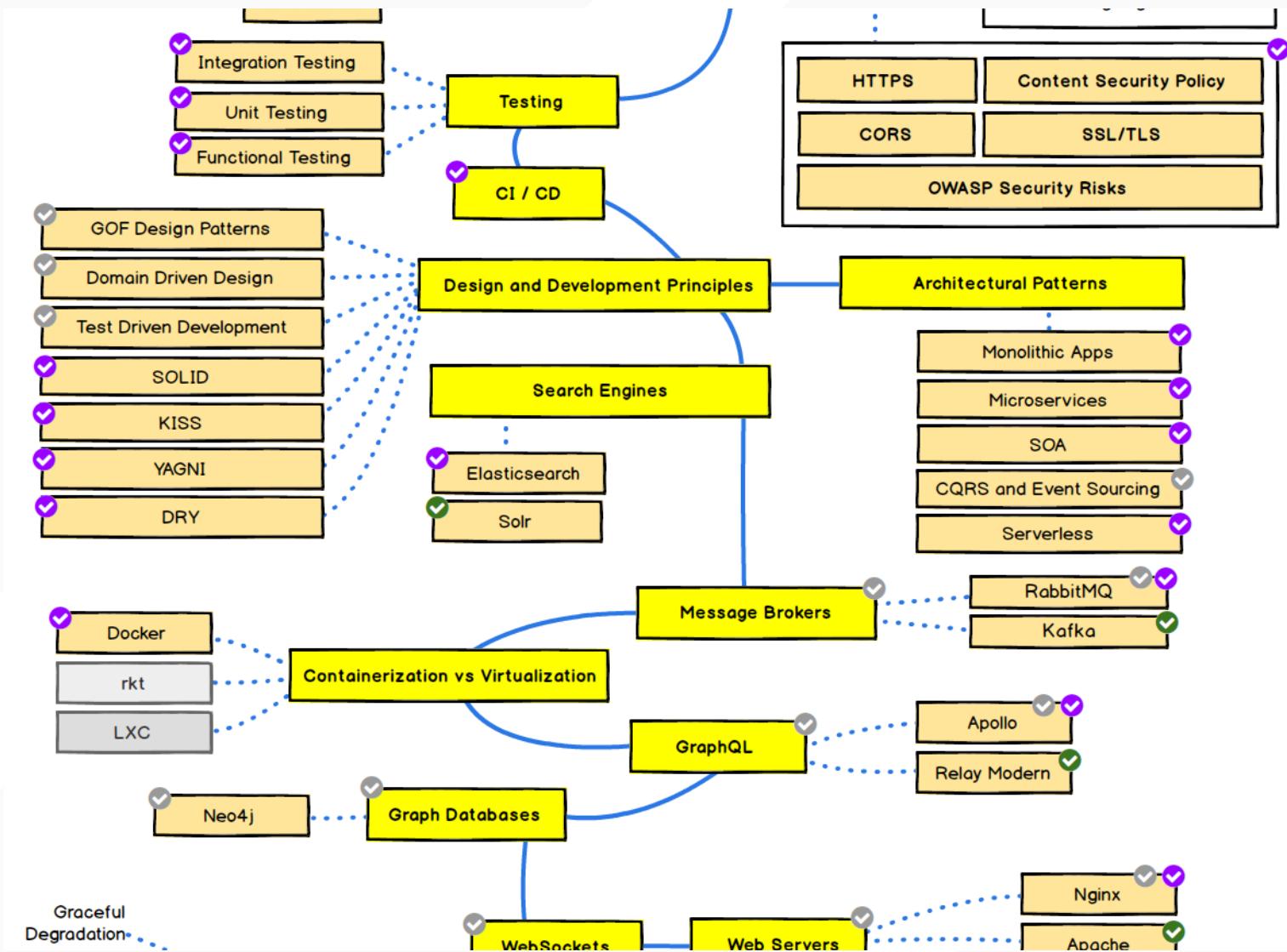
## Backend



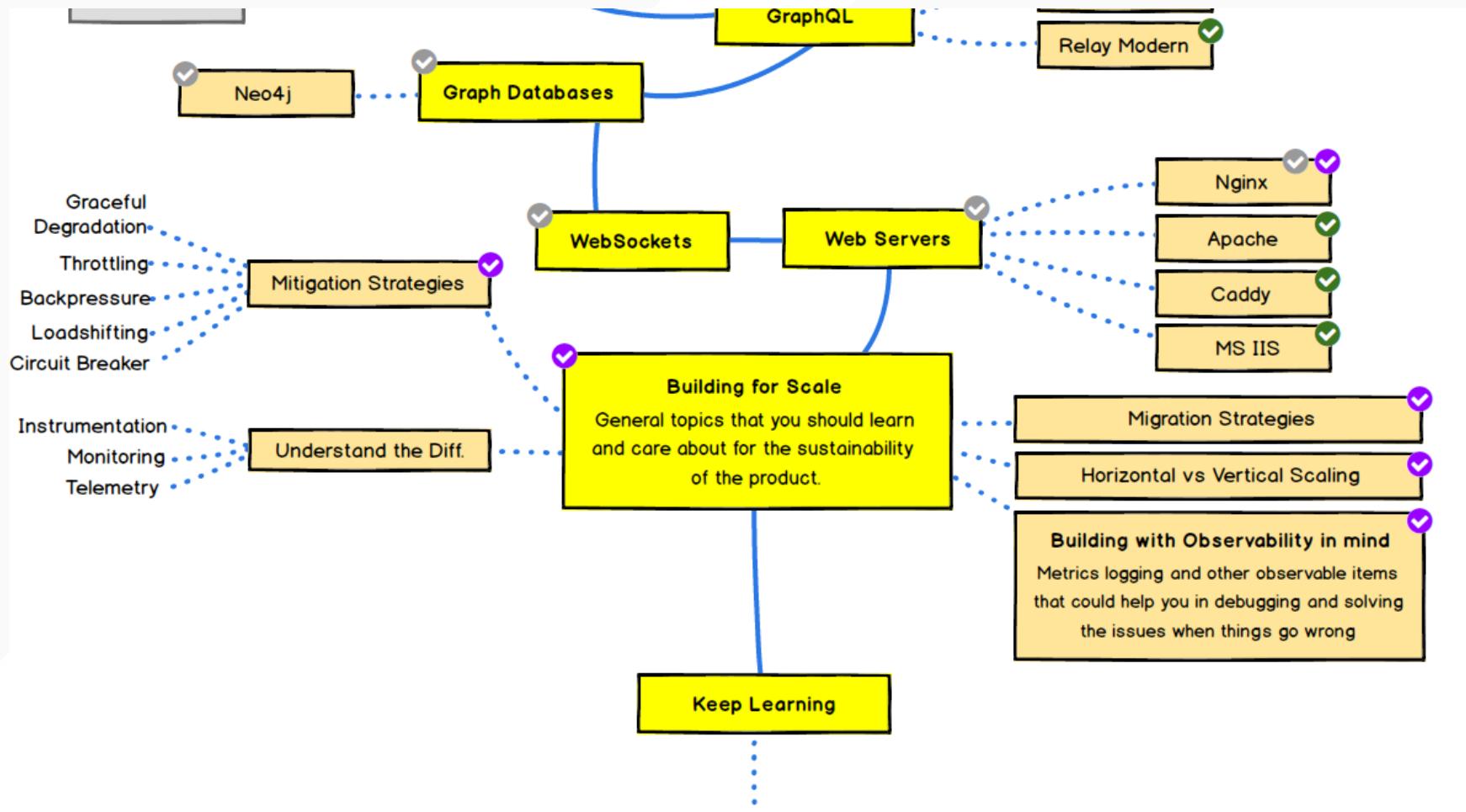
# BACKEND DEVELOPMENT ROADMAP



# BACKEND DEVELOPMENT ROADMAP



# BACKEND DEVELOPMENT ROADMAP



# THE COVID-19 PANDEMIC AND 124/224

RETURN TO LEARN

UC San Diego

About ▾   Return to Campus ▾   News & Updates ▾   Info For ▾   Resources ▾   CA COVID Notify Program   Search ▾

## TOGETHER, WE CAN HELP FIGHT COVID-19.

CA COVID Notify uses the Exposure Notifications System from Google and Apple to alert you when you may have been exposed to COVID-19.

ADD CA COVID NOTIFY



CAMPUS STATUS

UC San Diego continues to monitor the spread of COVID-19, working closely with local, state and national officials. For the latest updates to the campus community, visit the [Current Campus Status page »](#)

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