NEIL KLINGENSMITH

CS 310 OPERATING SYSTEMS

https://neilklingensmith.com/teaching/loyola/cs310-s2020/

WHY DO YOU HAVE TO TAKE THIS STUPID CLASS

- **People don't just write programs in one language for one platform anymore. Real projects have lots of parts.**

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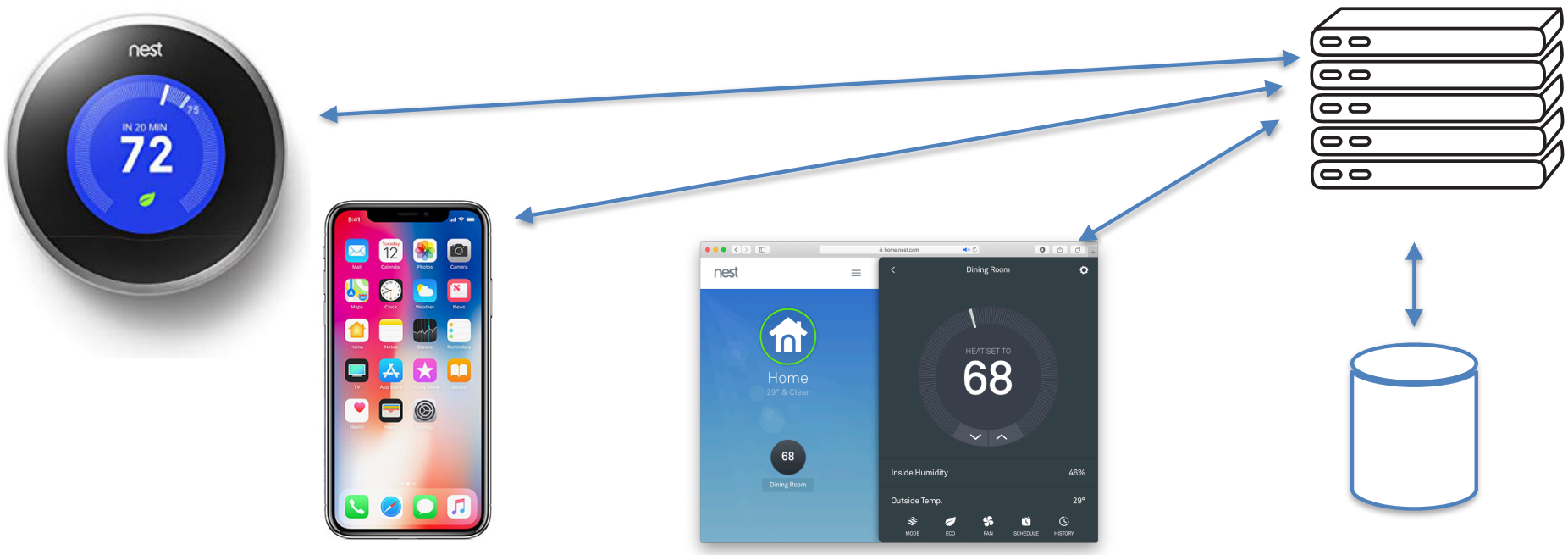
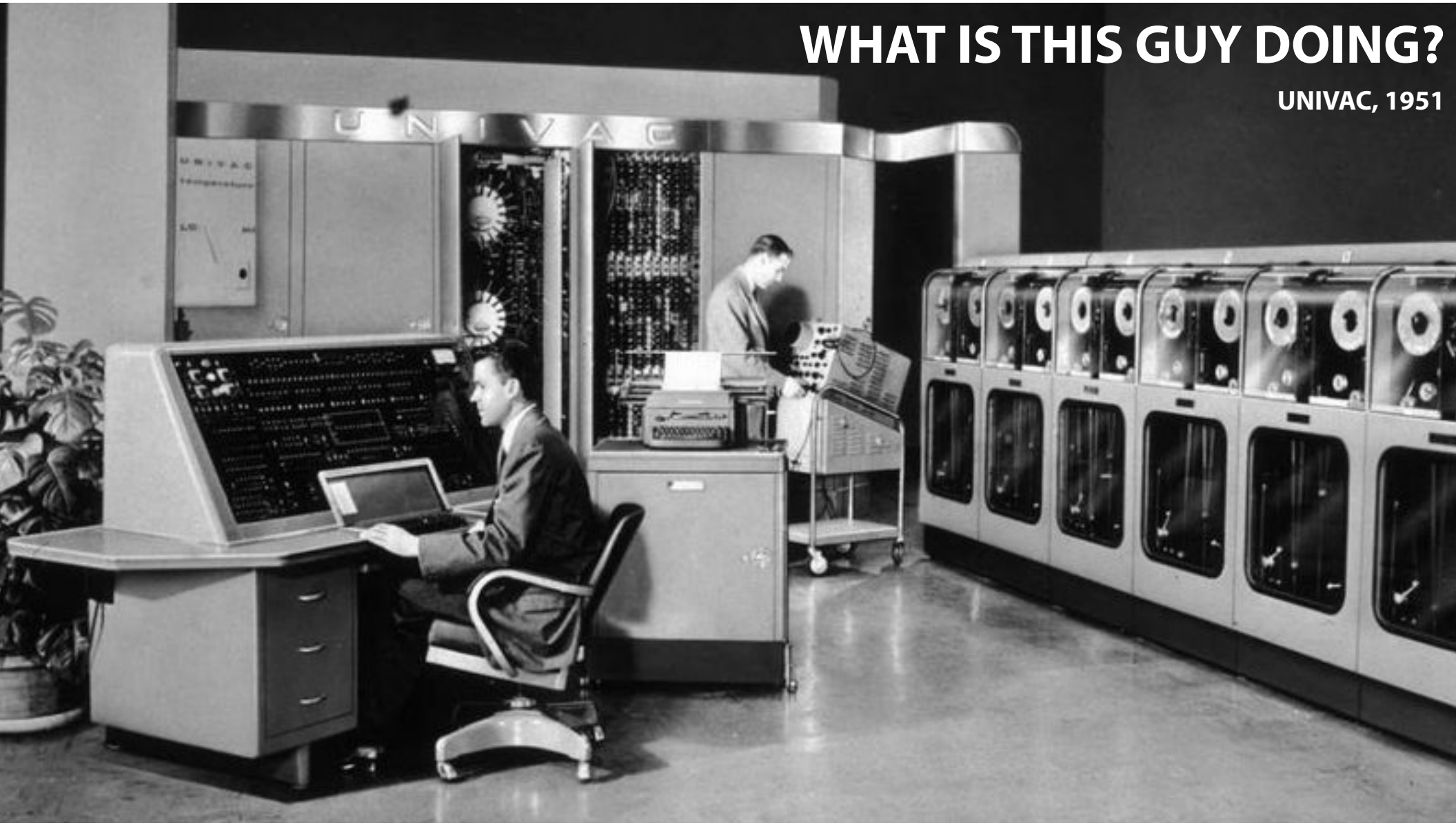


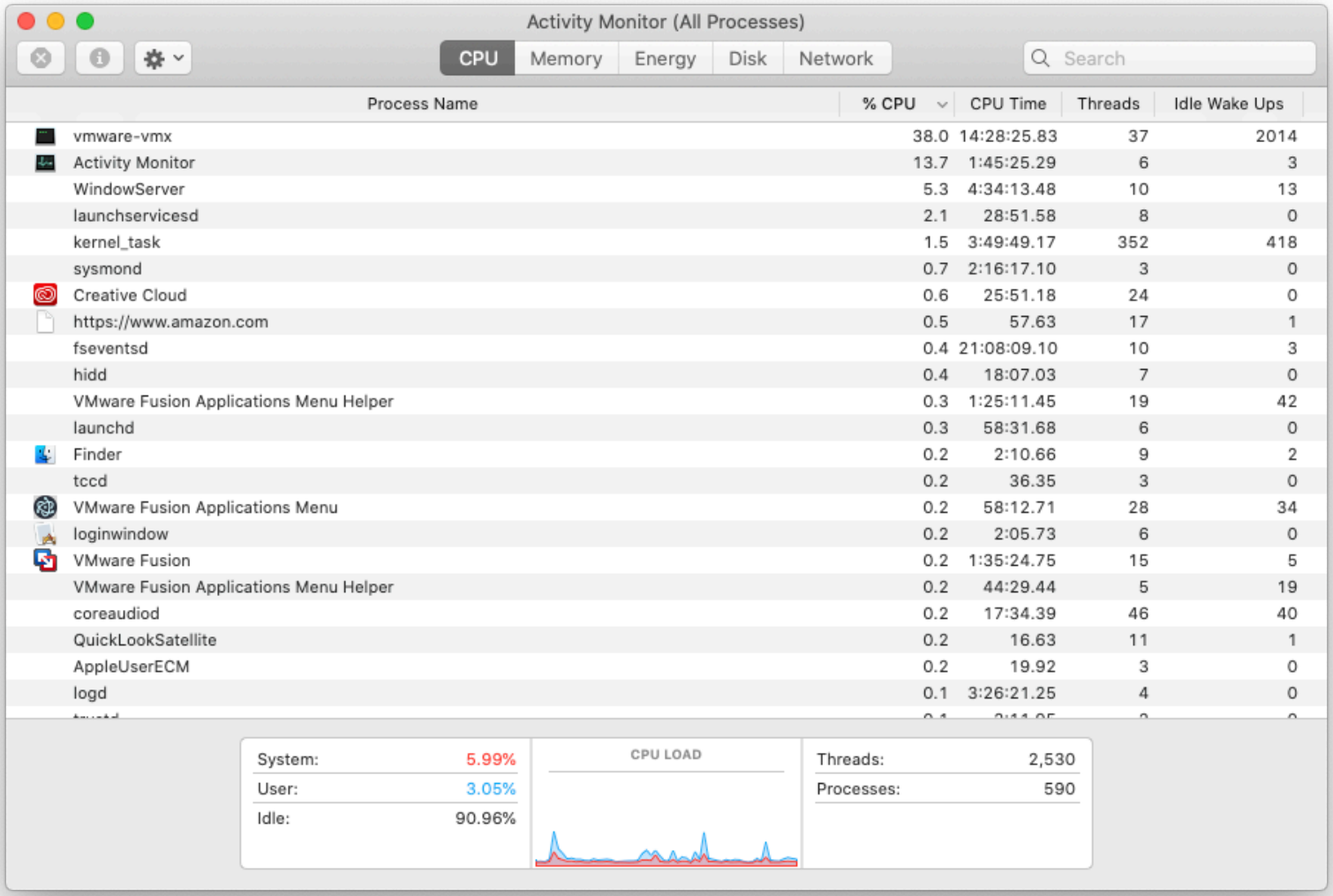
WHY DO YOU HAVE TO TAKE THIS STUPID CLASS

- **People don't just write programs in one language for one platform anymore. Real projects have lots of parts.**
- **Computers are changing: parallelism is much more important today than it was in the 90s.**
- **Stuff you learn here will be used in security, OS, etc.**

WHAT IS THIS GUY DOING?

UNIVAC, 1951

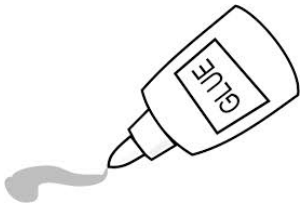



Activity Monitor (All Processes)
CPU
Memory
Energy
Disk
Network
Search
Process Name
% CPU
CPU Time
Threads
Idle Wake Ups
vmware-vmx 38.0 14:28:25.83 37 2014
Activity Monitor 13.7 1:45:25.29 6 3
WindowServer 5.3 4:34:13.48 10 13
launchservicesd 2.1 28:51.58 8 0
kernel_task 1.5 3:49:49.17 352 418
sysmond 0.7 2:16:17.10 3 0
Creative Cloud 0.6 25:51.18 24 0
https://www.amazon.com 0.5 57.63 17 1
fseventsd 0.4 21:08:09.10 10 3
hidd 0.4 18:07.03 7 0
VMware Fusion Applications Menu Helper 0.3 1:25:11.45 19 42
launchd 0.3 58:31.68 6 0
Finder 0.2 2:10.66 9 2
tccd 0.2 36.35 3 0
VMware Fusion Applications Menu 0.2 58:12.71 28 34
loginwindow 0.2 2:05.73 6 0
VMware Fusion 0.2 1:35:24.75 15 5
VMware Fusion Applications Menu Helper 0.2 44:29.44 5 19
coreaudiod 0.2 17:34.39 46 40
QuickLookSatellite 0.2 16.63 11 1
AppleUserECM 0.2 19.92 3 0
logd 0.1 3:26:21.25 4 0
System: 5.99%
User: 3.05%
Idle: 90.96%
CPU LOAD
Threads: 2,530
Processes: 590

What is an Operating System?

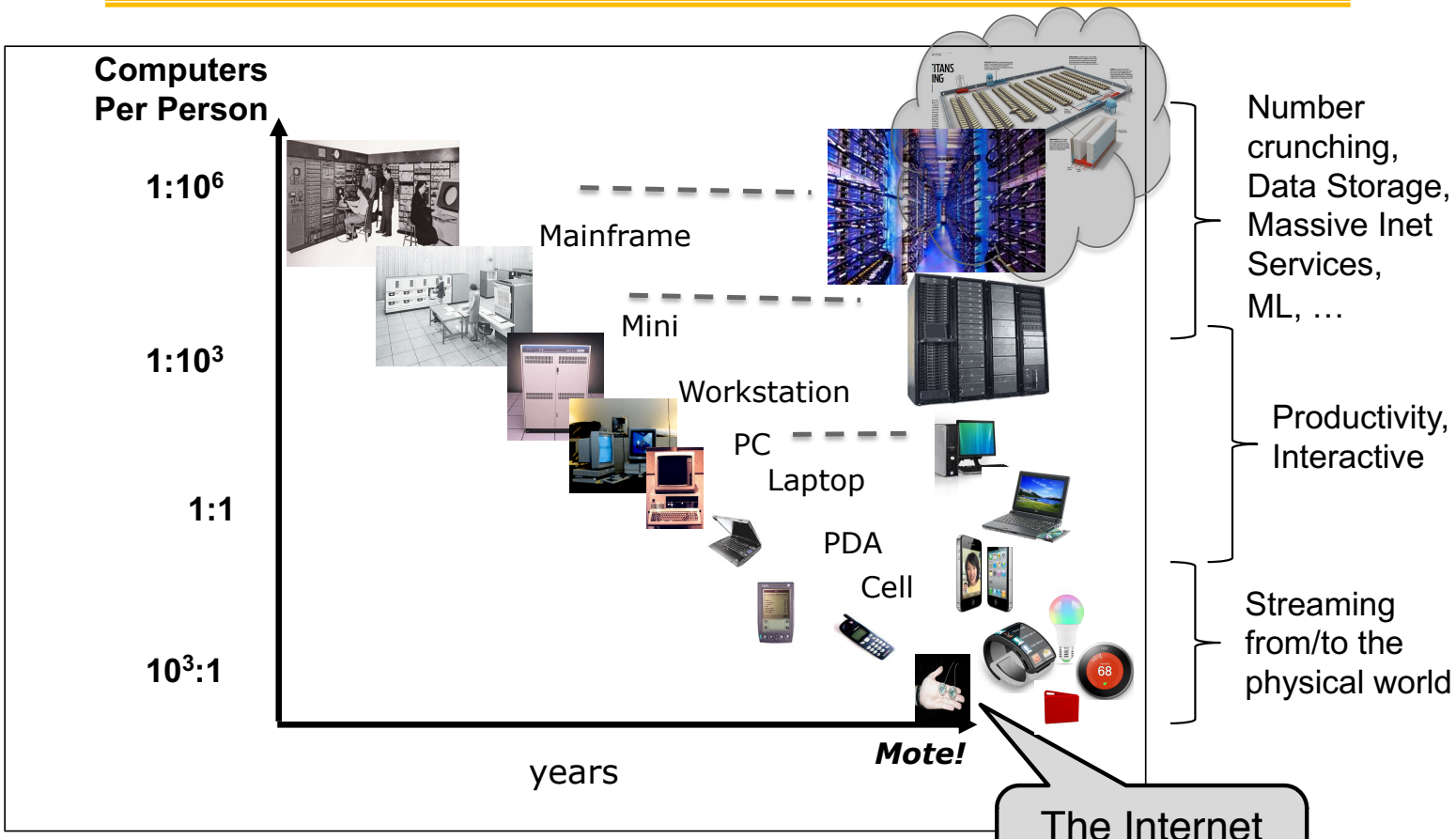
- **Referee**
  - Manage sharing of resources, Protection, Isolation
    - » Resource allocation, isolation, communication
- **Illusionist**

  - Provide clean, easy to use abstractions of physical resources
    - » Infinite memory, dedicated machine
    - » Higher level objects: files, users, messages
    - » Masking limitations, virtualization
- **Glue**



  - Common services
    - » Storage, Window system, Networking
    - » Sharing, Authorization
    - » Look and feel

Across incredibly diversity



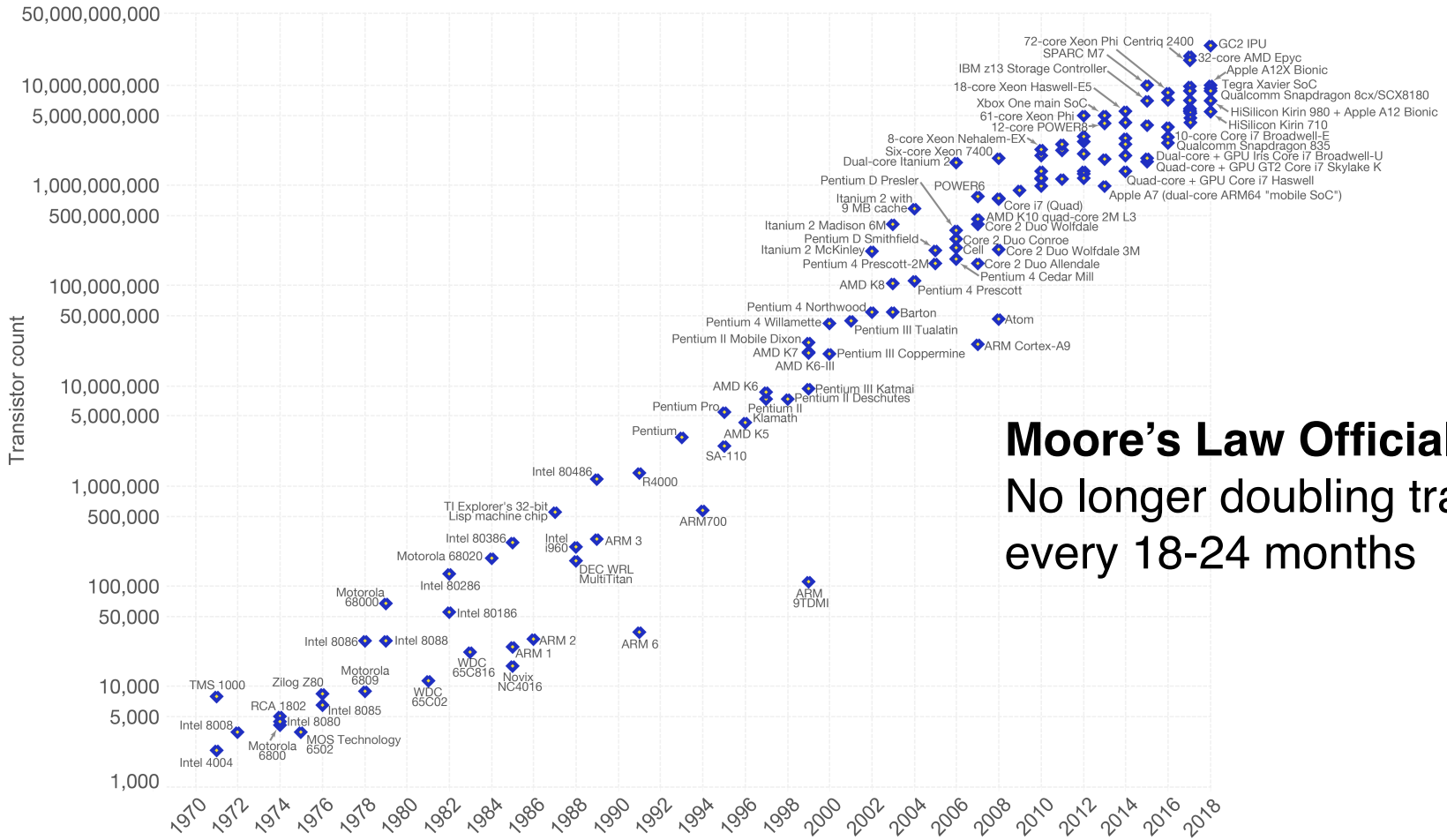
Bell's Law: new computer class per 10 years

The Internet of Things!

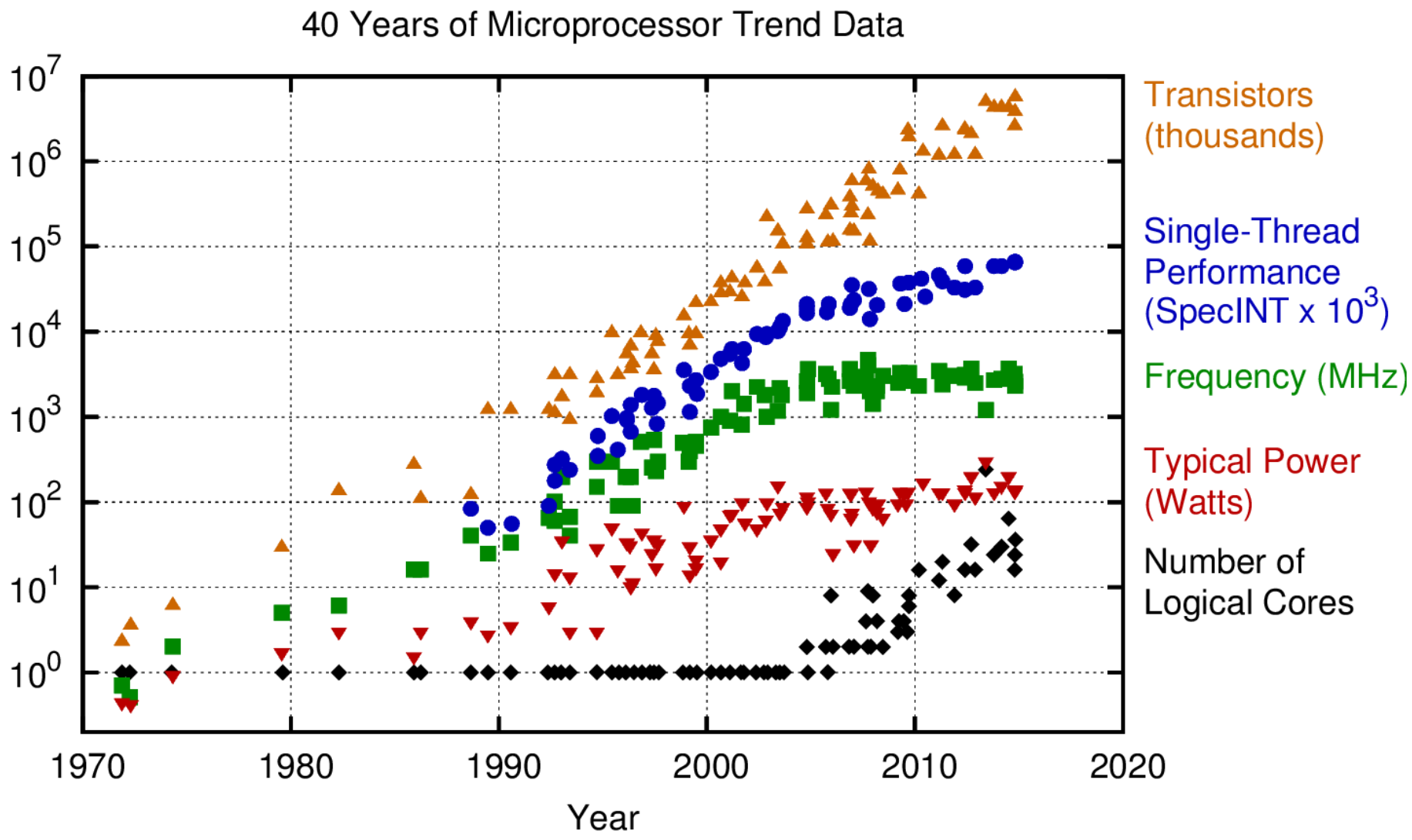
Moore’s Law – The number of transistors on integrated circuit chips (1971-2018)

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are linked to Moore's law.

Our World in Data

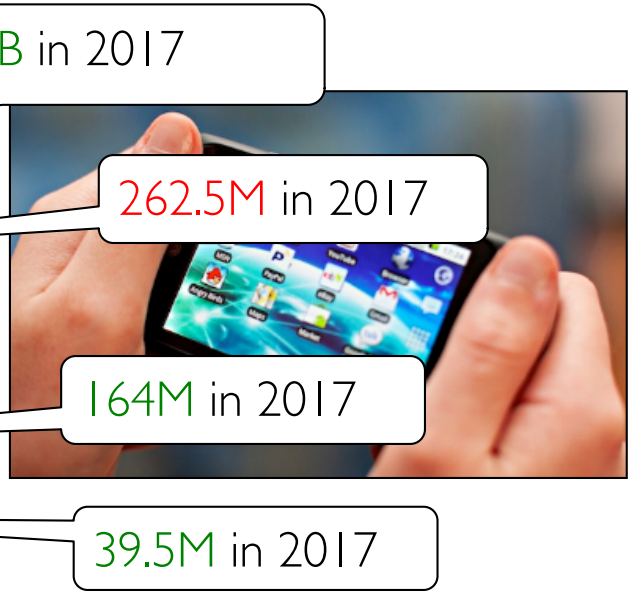


Moore’s Law Officially Ended in 2016:
No longer doubling transistor density every 18-24 months


40 Years of Microprocessor Trend Data
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0
1970
1980
1990
2000
2010
2020
Year
Transistors (thousands)
Single-Thread Performance (SpecINT x 10^3)
Frequency (MHz)
Typical Power (Watts)
Number of Logical Cores

Not Only PCs connected to the Internet

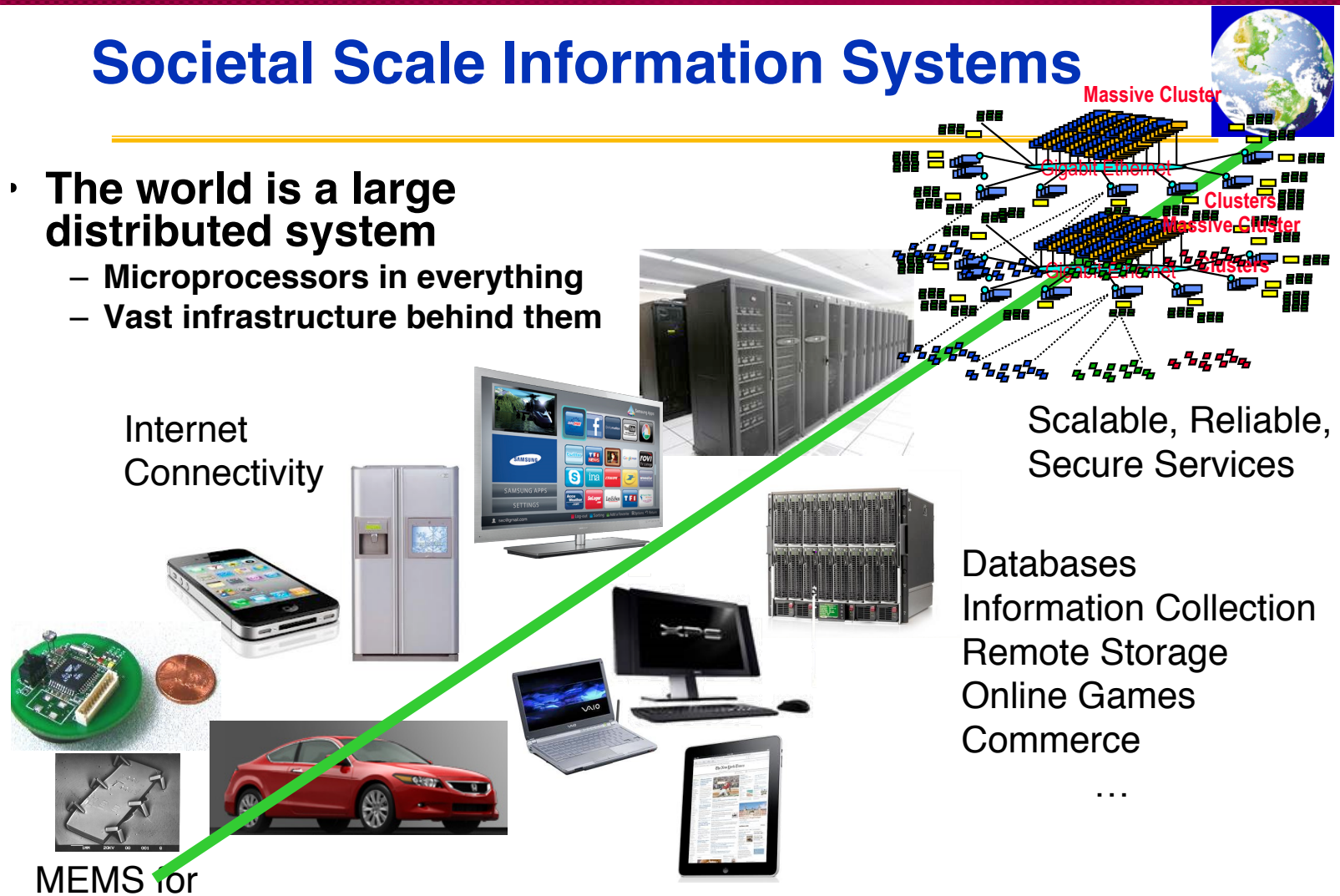
- **In 2011, smartphone shipments exceeded PC shipments!**
- **2011 shipments:**
  - **487M smartphones**
  - **414M PC clients**
    - » **210M notebooks**
    - » **112M desktops**
    - » **63M tablets**
  - **25M smart TVs**



- **4 billion phones in the world → smartphones over next few years**
- **Then…**

Societal Scale Information Systems

- **The world is a large distributed system**
  - **Microprocessors in everything**
  - **Vast infrastructure behind them**



TURNING IN ASSIGNMENTS:

- **We will use GitHub Classroom. See course webpage for link.**
-

CODING GUIDELINES:

- **Make sure you test code a bit at a time—split into functions.**
- **Build pieces one at a time.**
- **Plan first.**

LABS:

- **2 hour lab session in Doyle 314 from 4-6PM Thursdays.**
- **Get help with homework.**

READING GROUP:

- **Grad students have required weekly reading assignments posted on the course webpage.**
- **Reading and reviewing papers is extra credit for undergrads.**
- **Extra credit reading group discussion at 4PM Thursdays at the beginning of lab.**

PAPER REVIEWS:

- **Email to Neil the night before class.**
- **Format:**
  1. **3-4 sentence summary of paper, including problem it's trying to solve, objectives, assumptions.**
  2. **Feedback for authors: shortcomings, etc.**

GRADING

- **No quizzes or exams. Your whole grade is based on homework and final project.**
- **No partial credit for code that doesn't compile.**
- **Start homework on Tuesday/ Wednesday so you can get help on Thursday in lab if you get stuck.**

Category	Weight
Homework	30%
Participation	10%
Progress	10%
Final Project	40%

PROJECT

- You will work in teams of 3-4 for your final project
- Everyone should do work and have clear responsibilities.
- You will evaluate your team mates at the end of the project.
- Communicate with TA/instructor:
  - What is the team's plan?
  - What is each team member's responsibility?
  - Short progress reports are required.