Going Down the EECS Stack

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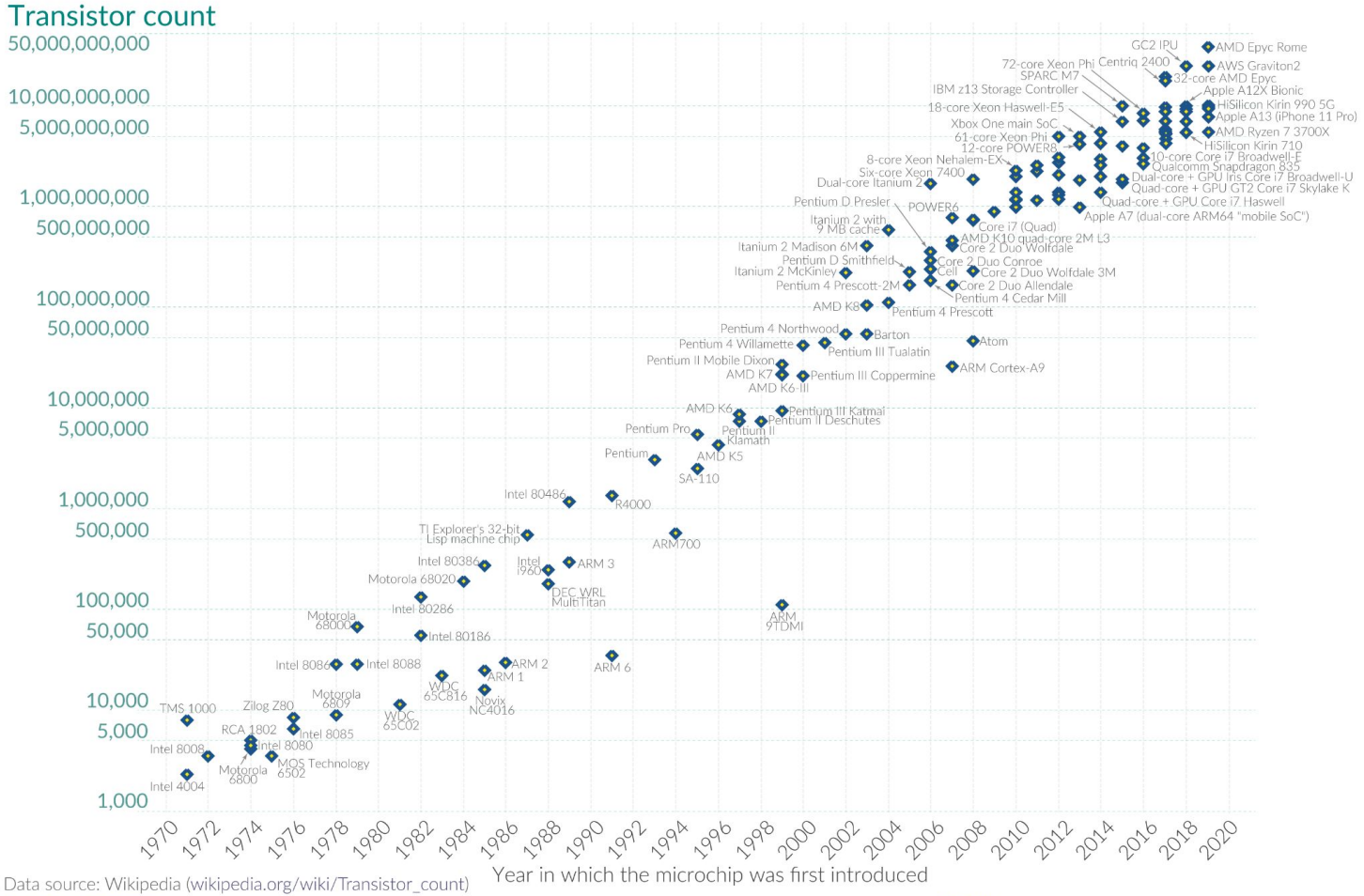
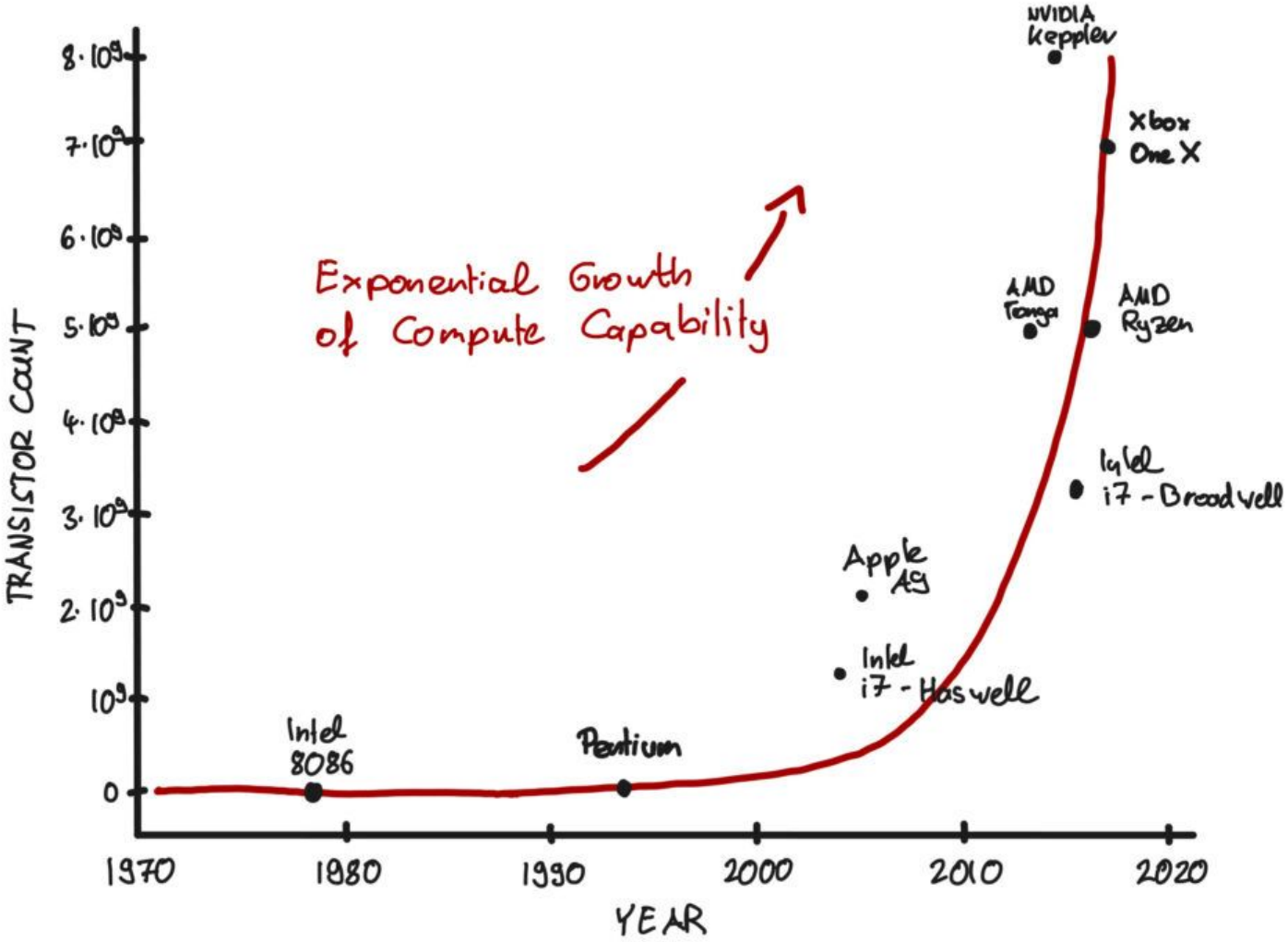
Moore's Law: The number of transistors on microchips doubles every two years

Our World in Data

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



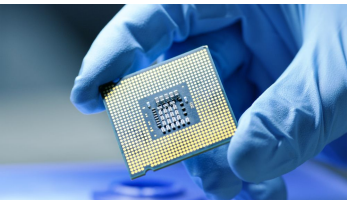
Data source: Wikipedia (wikipedia.org/wiki/Transistor_count)


TRANSISTOR COUNT
8·10⁹
7·10⁹
6·10⁹
5·10⁹
4·10⁹
3·10⁹
2·10⁹
10⁹
0
1970
1980
1990
2000
2010
2020
YEAR
Exponential Growth of Compute Capability
Intel 8086
Pentium
Intel i7 - Haswell
Apple A9
Intel i7 - Broadwell
AMD Ryzen
AMD Tonga
Xbox One X
NVIDIA Kepler

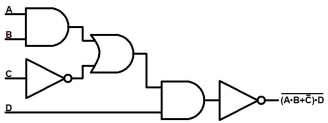
128 meters

How tall humans would be at 16 years old if humans grew according to Moore’s Law.

Map of Electrical Engineering and Computer Science



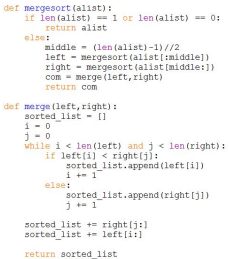
Physics + semiconductors



Digital Logic and Circuits

Computer Architecture

Programming languages, compilers, operating systems



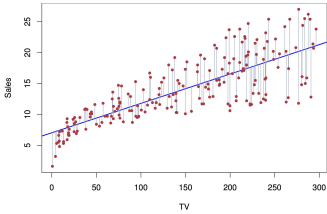
```
def mergesort(alist):
    if len(alist) == 1 or len(alist) == 0:
        return alist
    else:
        middle = (len(alist)-1)//2
        left = mergesort(alist[:middle])
        right = mergesort(alist[middle:])
        com = merge(left,right)
        return com

def merge(left,right):
    sorted_list = []
    i = 0
    j = 0
    while i < len(left) and j < len(right):
        if left[i] < right[j]:
            sorted_list.append(left[i])
            i += 1
        else:
            sorted_list.append(right[j])
            j += 1

    sorted_list += right[j:]
    sorted_list += left[i:]

    return sorted_list
```

Software engineering, algorithms



Data science, machine learning, artificial intelligence

New materials beyond silicon, quantum computers, improve the sustainability of chip manufacturing

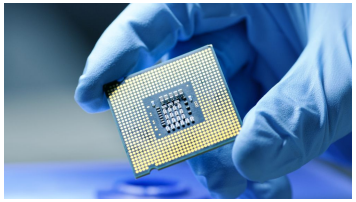
Make circuits smaller and faster, make circuits that are more flexible, custom circuitry for special applications (e.g. devices for the human body)

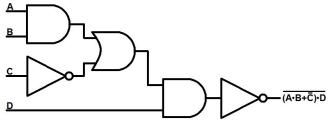
Computers that are optimized for AI performance, parallel processing, more energy efficient

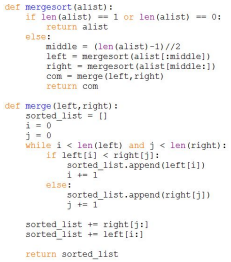
Run code faster, programming languages for specialized tasks (e.g. robotics)

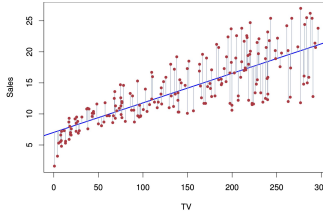
Code that prevents computers from cyber attacks, algorithms for quantum computers, software to solve problems in every field and industry

Trustworthy & unbiased AI, aligning AI with human interest, using data science to solve problems in climate, health, social science & more!









Physics + semiconductors

Digital Logic and Circuits

Computer Architecture

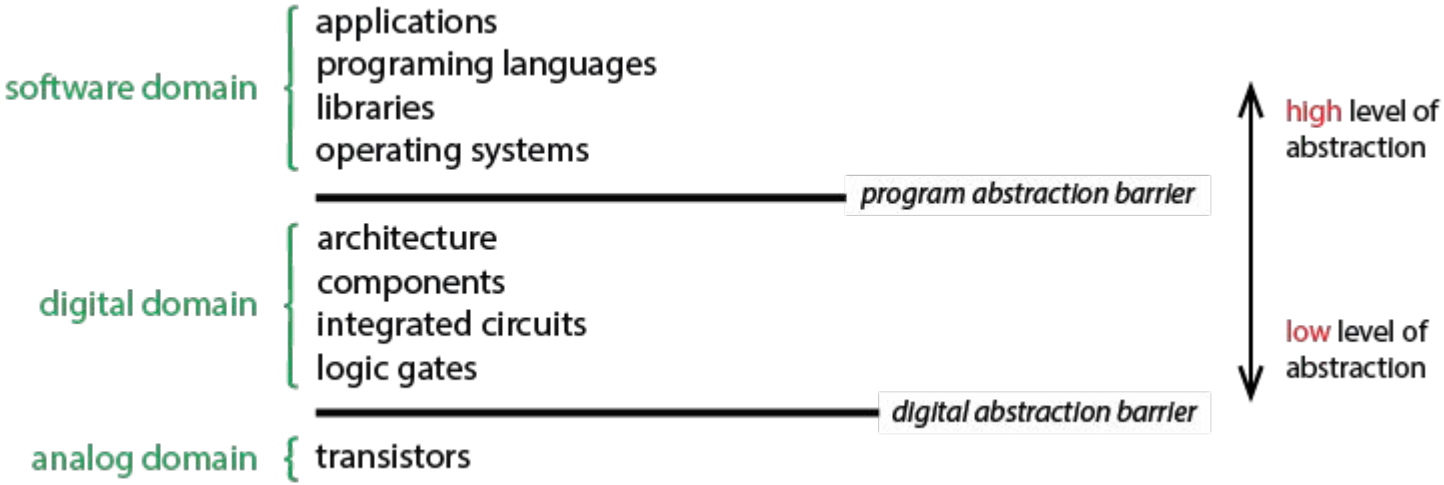
Programming languages, compilers, operating systems

Software engineering, algorithms

Data science, machine learning, artificial intelligence

The Magic of Abstraction

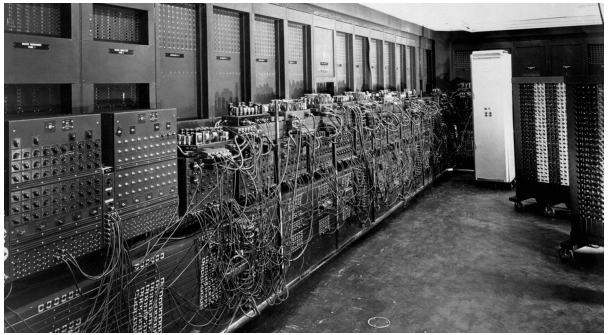
- You don’t need to understand circuits to write a computer program
- You don’t need to know merge sort to do data science



What Might We Witness in Our Lifetime?

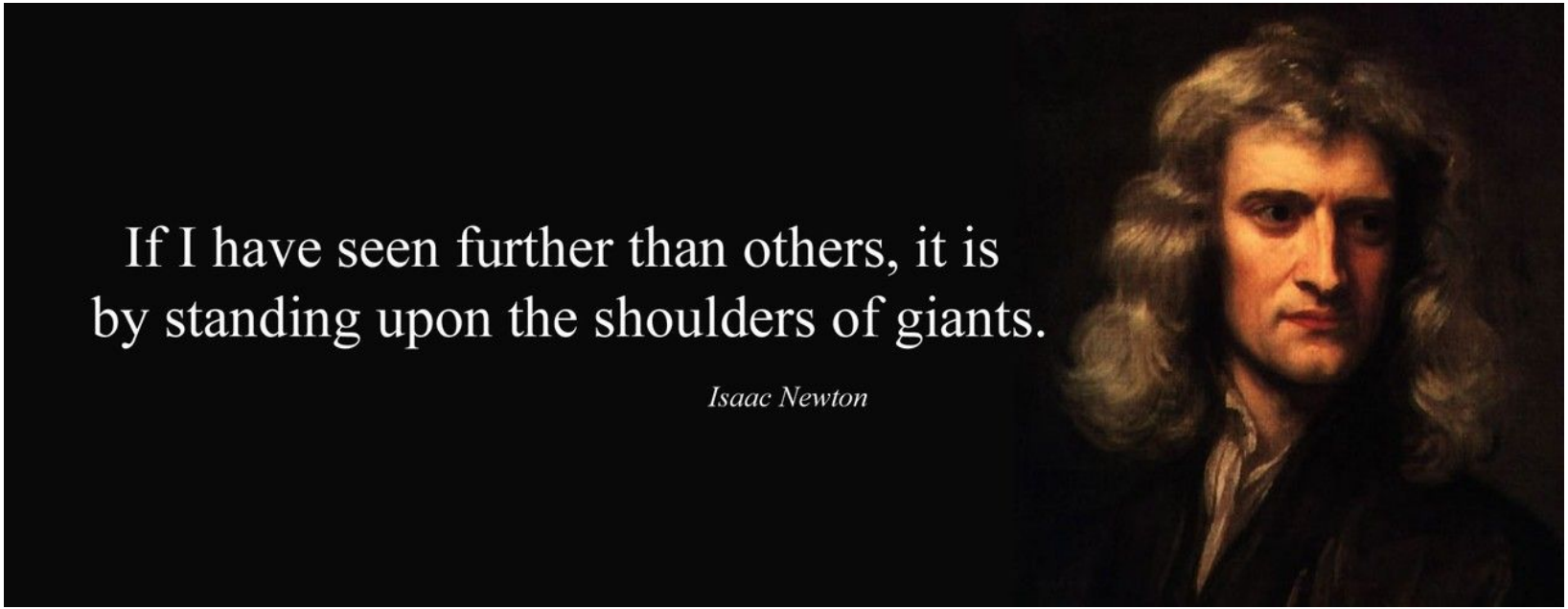
- A person born in 1900 saw the first flight in the world at age 3, and at age 69 saw man land on the moon.
- A person born in 1942 saw the first computer at age 3, and at age 65 saw the first iPhone
- **In our lifetime, what will humans invent? Will it help humanity thrive or cause new harm?**






Stand on the shoulders of giants!

- The world needs smart people who build technology with ethics, empathy, and the common good in mind.



Further Reading

- Map of Computer Science Youtube Video
- nand2tetris: building a general-purpose computer system and a modern software hierarchy from the ground up
- Computational and Inferential Thinking, a good introductory data science textbook