

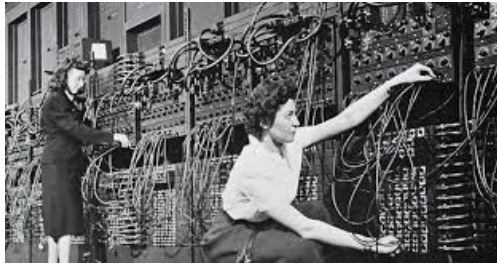
DS2000 – Programming with Data

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# 01. Computers and Python



# The history of computing



Early Electronic Computing  
(1950-1980)



The PC Revolution  
(1980-1995)



The Internet Revolution  
(1995 - 2010)



The Smartphone Revolution  
(2007-present)

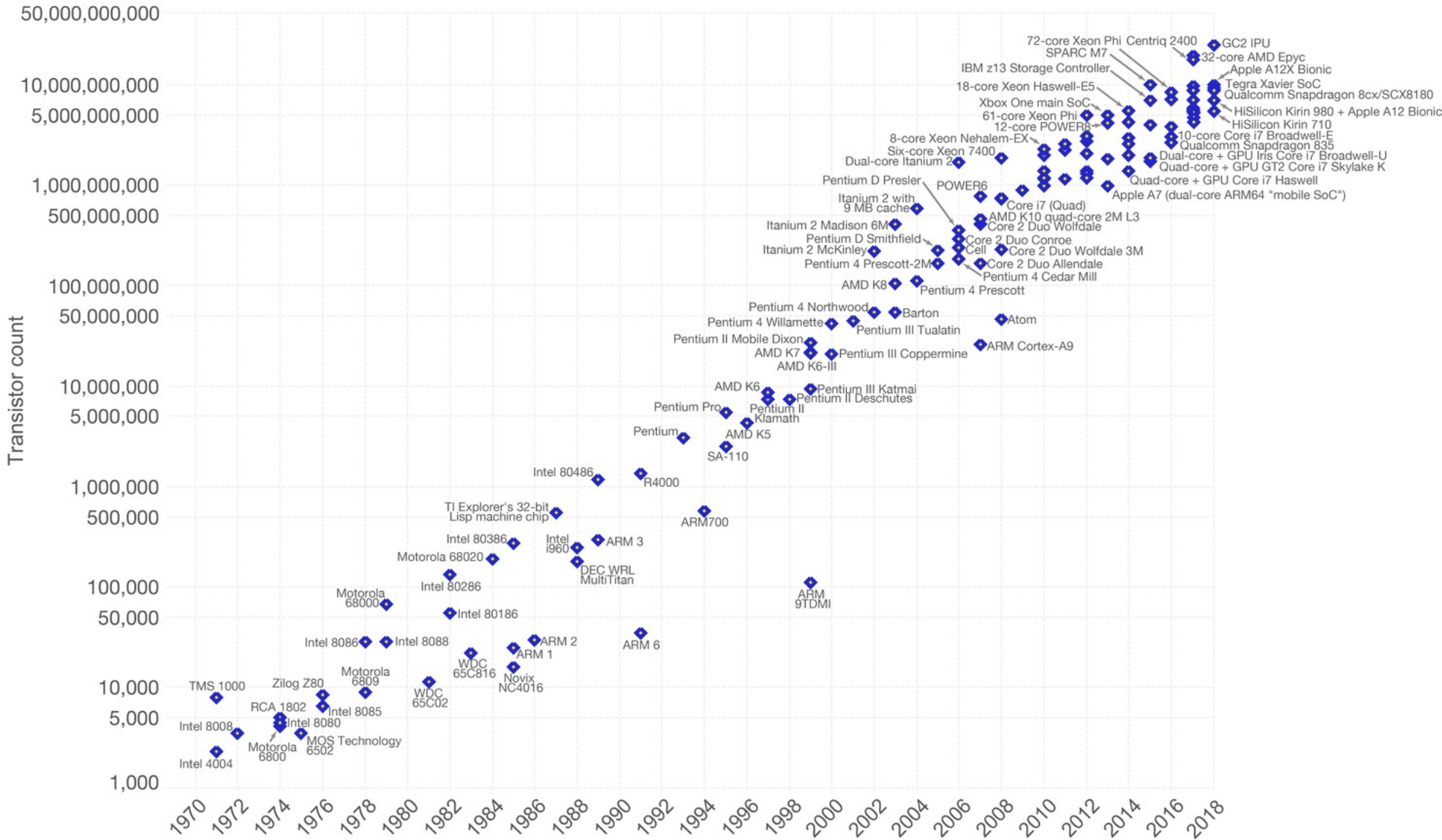


The AI / Cloud / Data Science  
Revolution (2010 - )

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

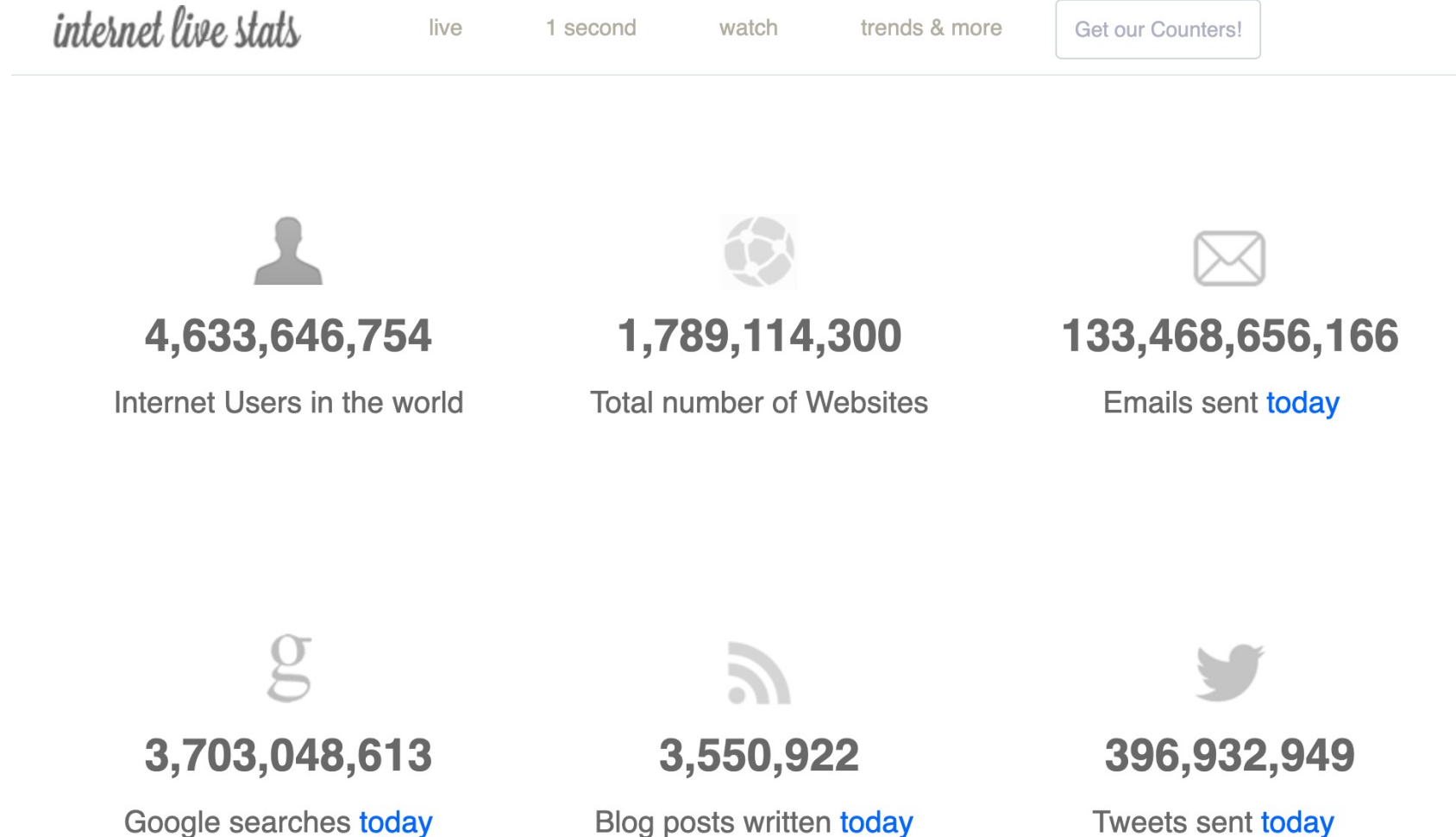


Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are linked to Moore's law.

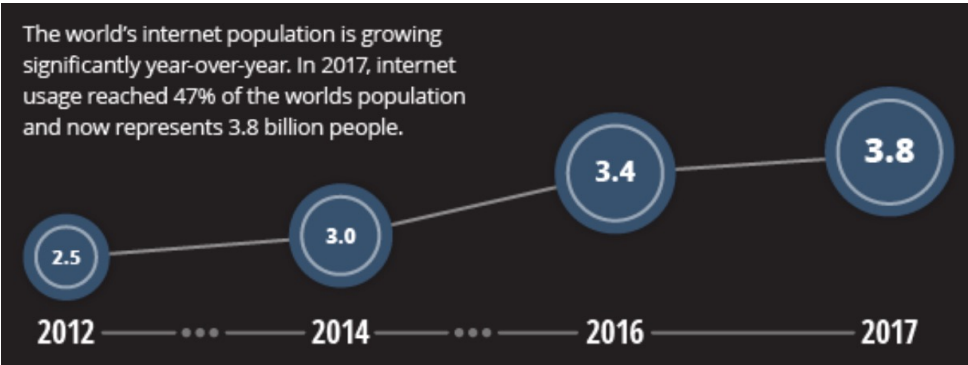




# Internet Stats – Noon on Jul 31<sup>st</sup>, 2020

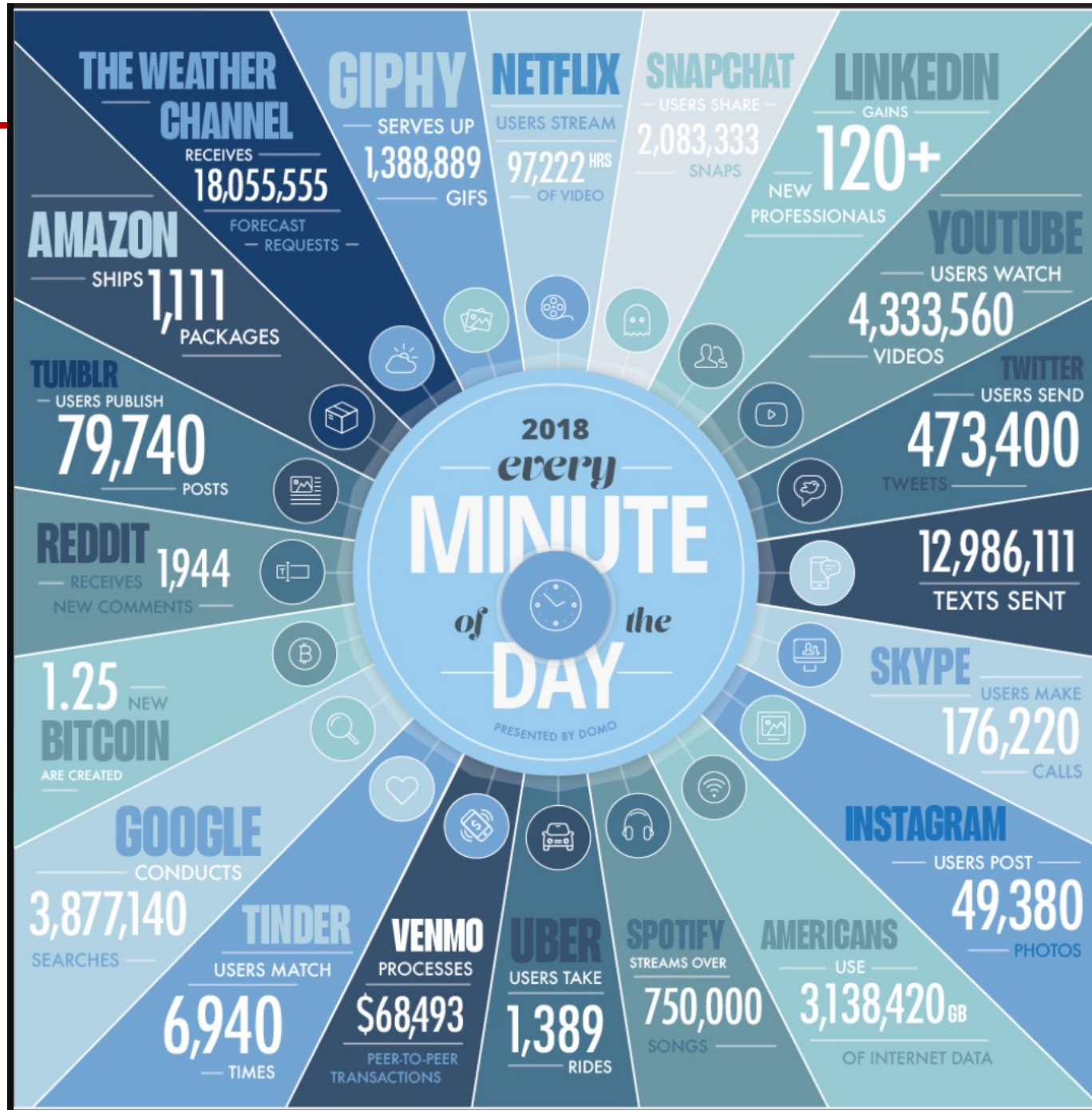


# More data every minute



Source:

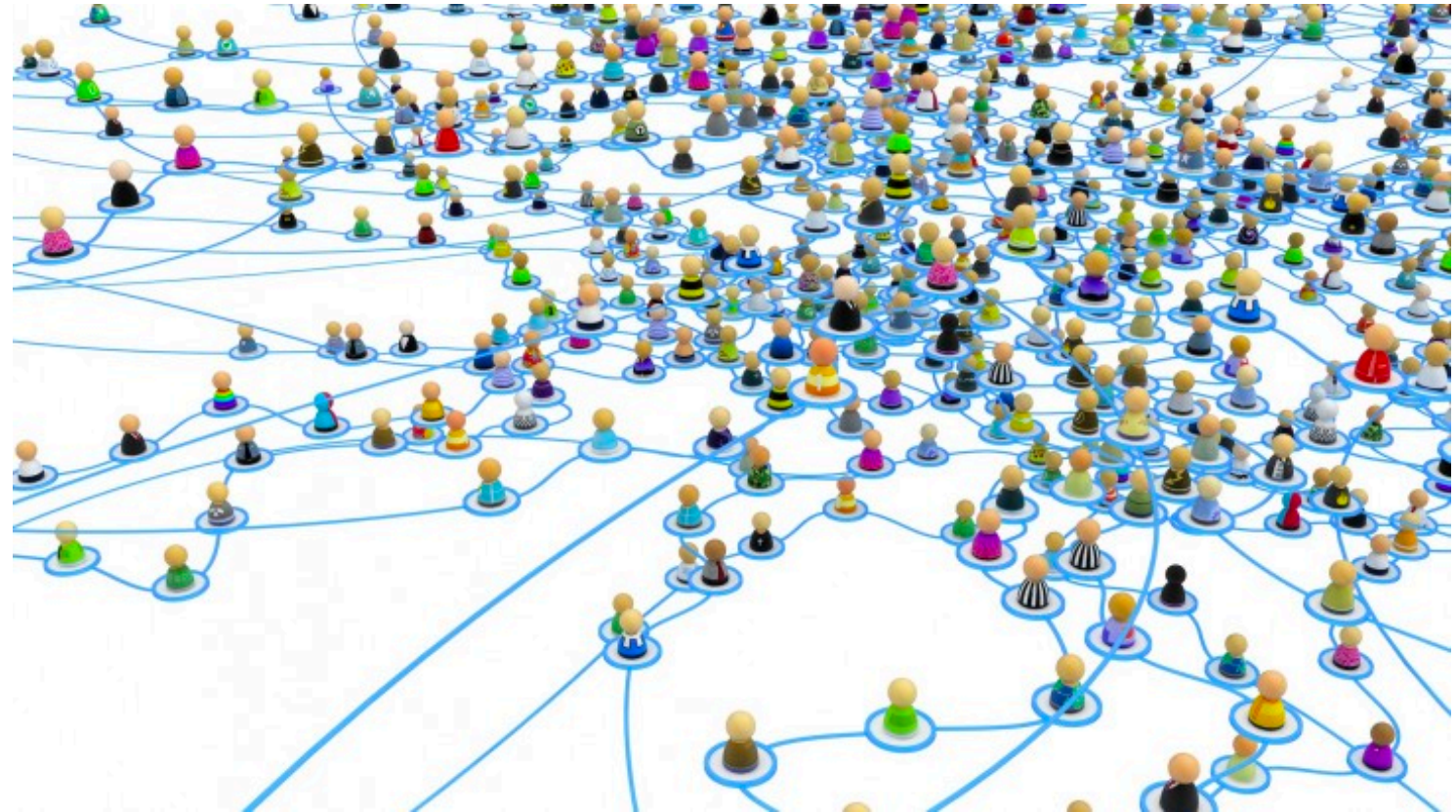
<https://www.domo.com/learn/data-never-sleeps-6>



# You are worth \$82 to Facebook...

**facebook**

Connecting  
the world  
takes every  
one of us.

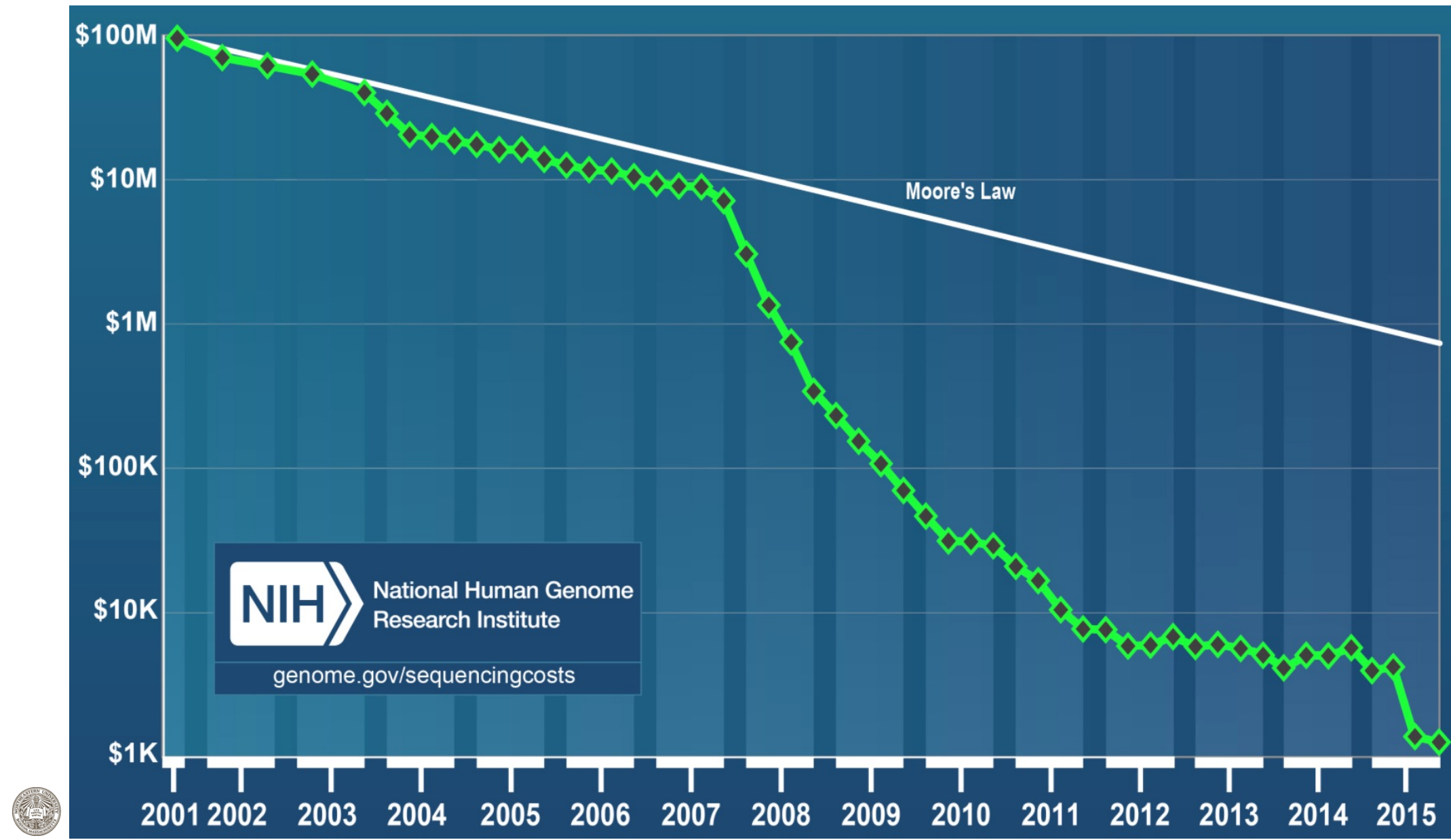


...how much is Facebook worth to you?





# Cost to sequence a single human genome.

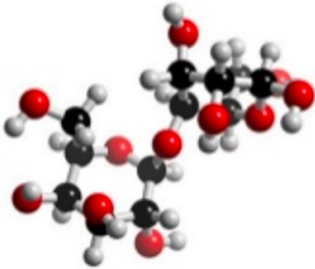


# Data Science and Bioinformatics

## *Sequences*



## *Structure*

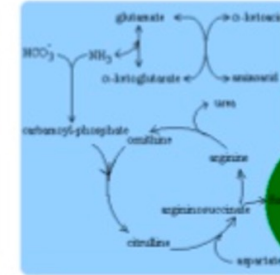


## *Genome*

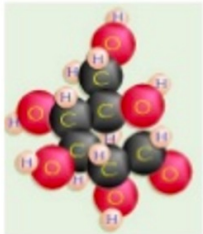
Complete Genome of  
*Arabidopsis thaliana*



## *Pathways*



## *Lipids, Carbohydrates*



## *Literature*



**Primary Database:** Direct experimental results

**Secondary Database:** Derived databases from transformation & analysis

Source: <https://www.slideshare.net/shwetakagliwal/biological-databases-11267007>





# Data Science and Medicine: Electronic Medical Records

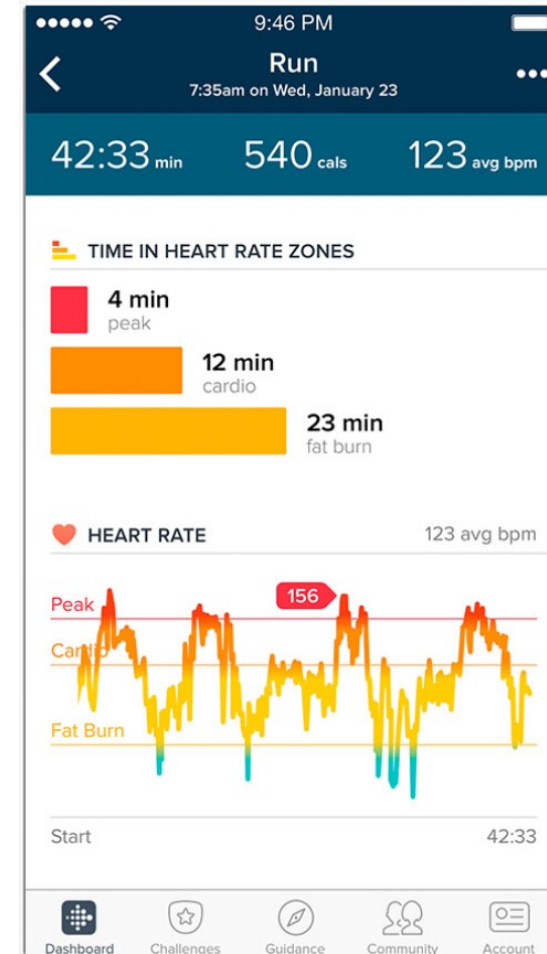


- Patient Demographics
- Doctors
- Insurance
- Medical history
- Allergies
- Procedures / Measurements (BP, Temp, O<sub>2</sub>)
- Order Lab Tests ➡ Lab Results
- Dr. Notes

Next time you get a physical, notice how much time your doctor spends at a computer terminal!



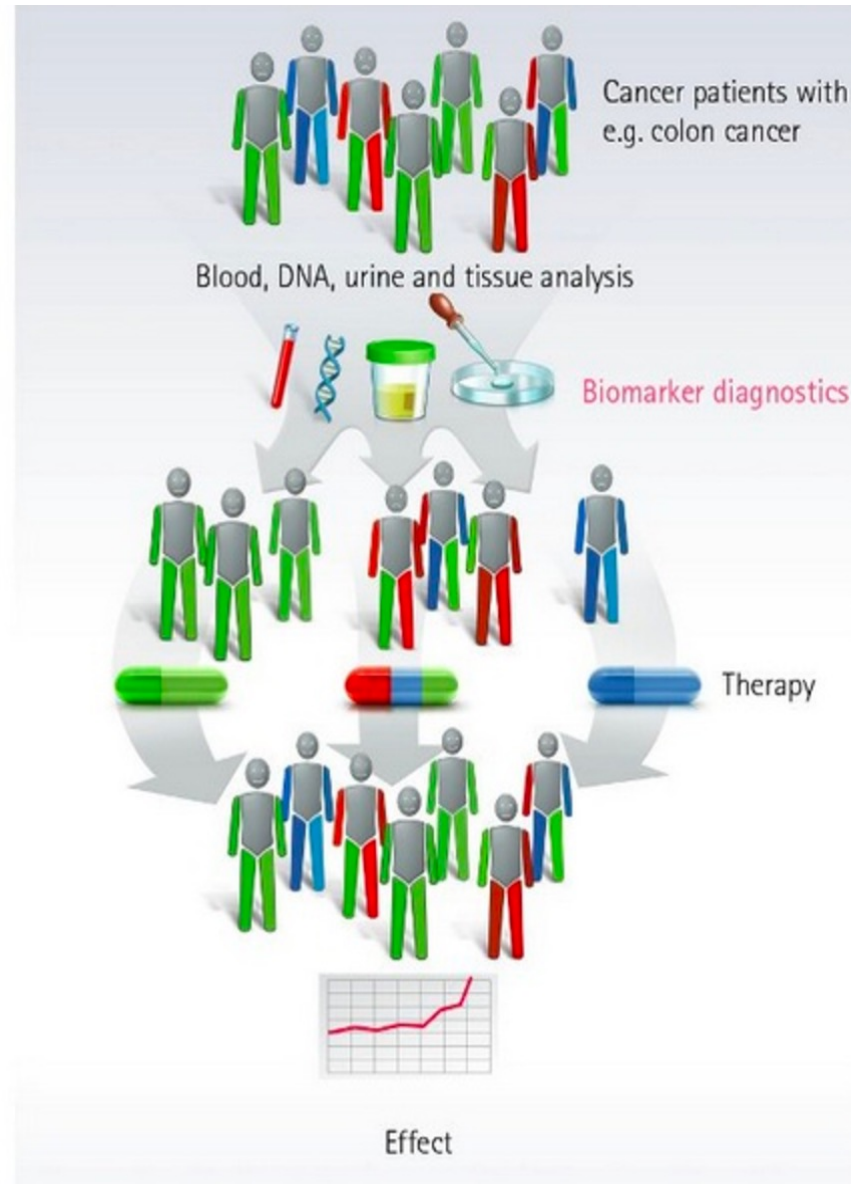
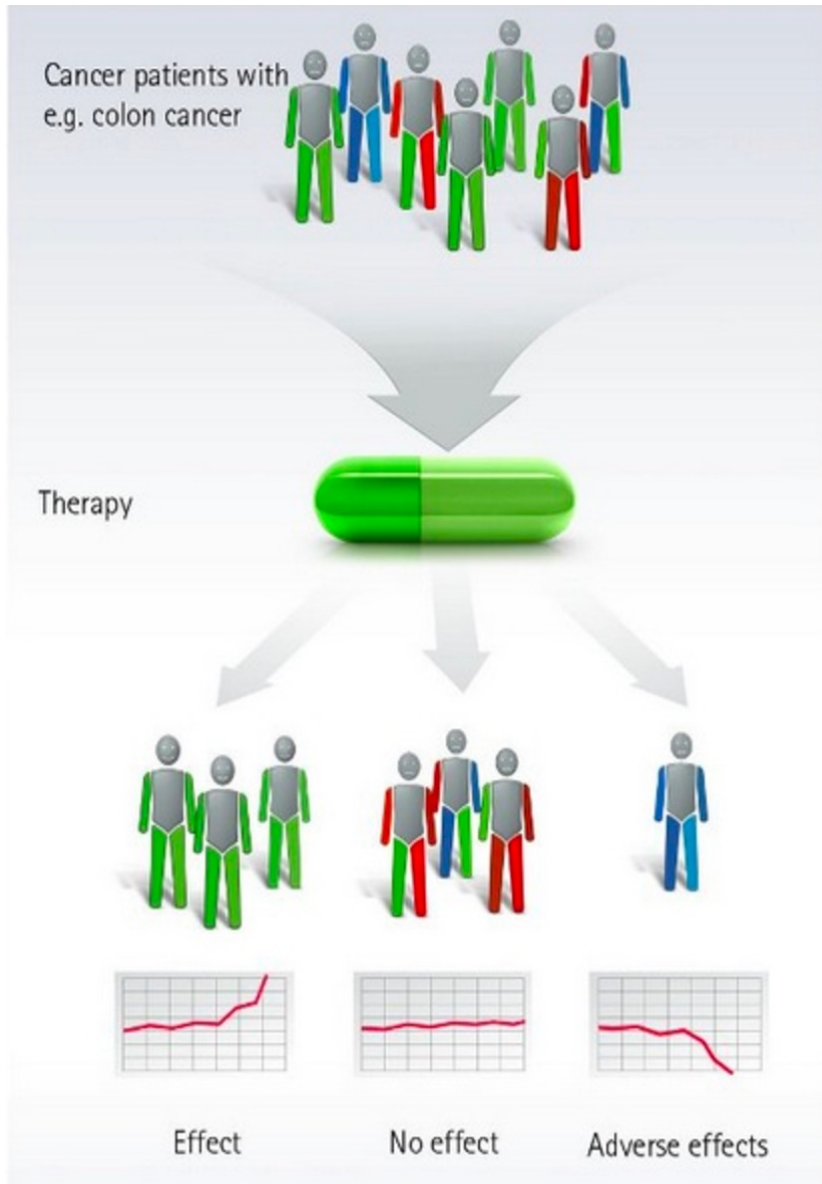
# Data Science and Wearable Sensors for better health



<https://finance.yahoo.com/news/exclusive-fitbits-6-billion-nights-sleep-data-reveals-us-110058417.html>



# Data Science and personalized medicine



The promise of personalized medicine:

- Improved efficacy
- Reduced adverse side-effects
- Reduced “trial-and-error” delays in the treatment of time-critical diseases such as cancer.



# Astronomical Data Science: Understanding our place in the Universe

## LSST: By the numbers



3 billion pixel  
digital camera  
(largest in the world)



3  
mirror construction



30  
terabytes  
of data per night

NSF's Large Synoptic Survey Telescope will image the entire visible sky a few times each week for 10 years and is expected to see first light in 2019.

The LSST will be an 8-meter wide-field survey telescope that will image the entire visible sky a few times each week for 10 years, providing an unprecedented amount of information while transforming the emerging discipline of data-enabled science. It is expected to see first light in 2019 and begin full operation in 2022.

