What is Data Science?

(a personal view)

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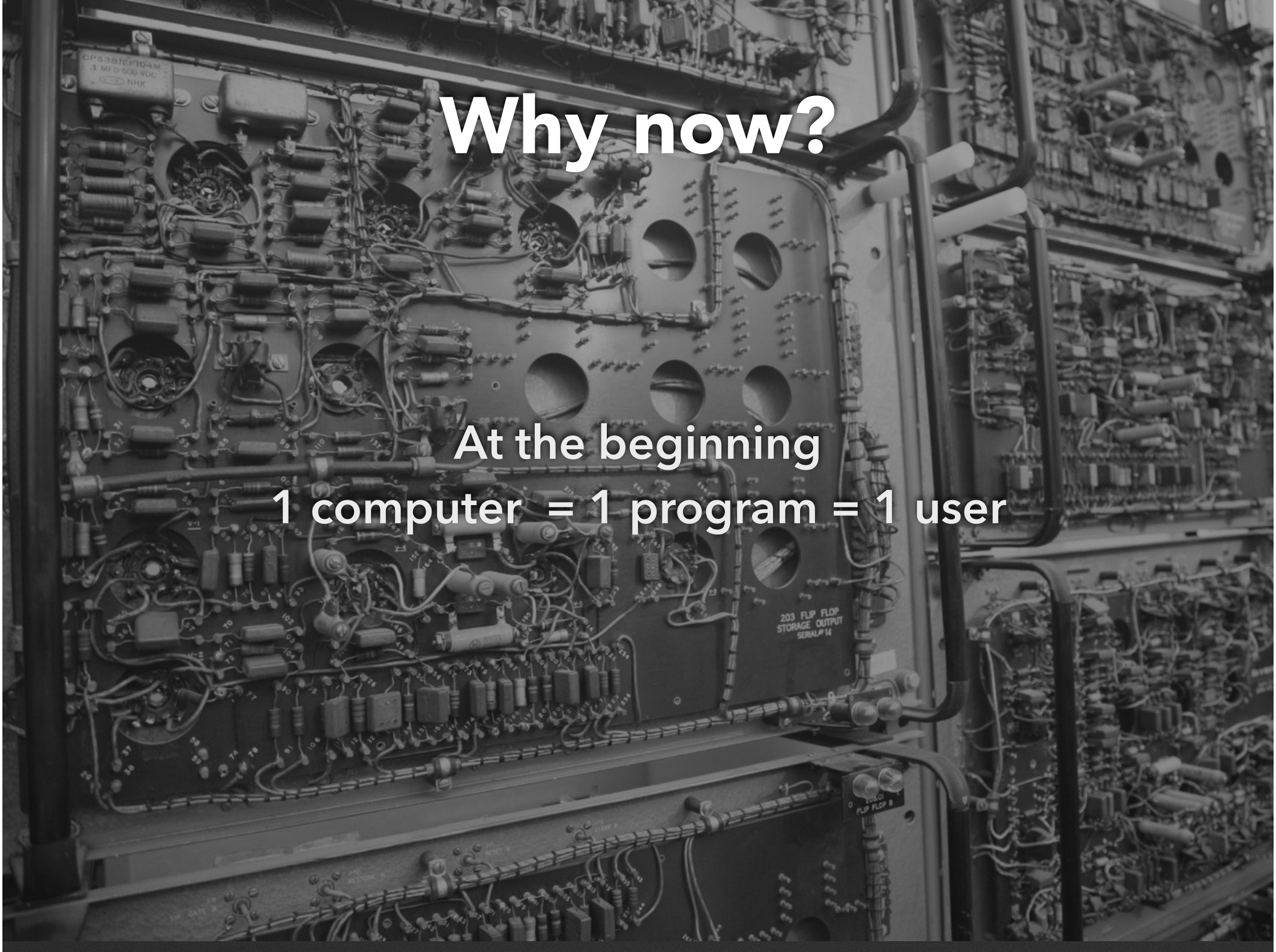
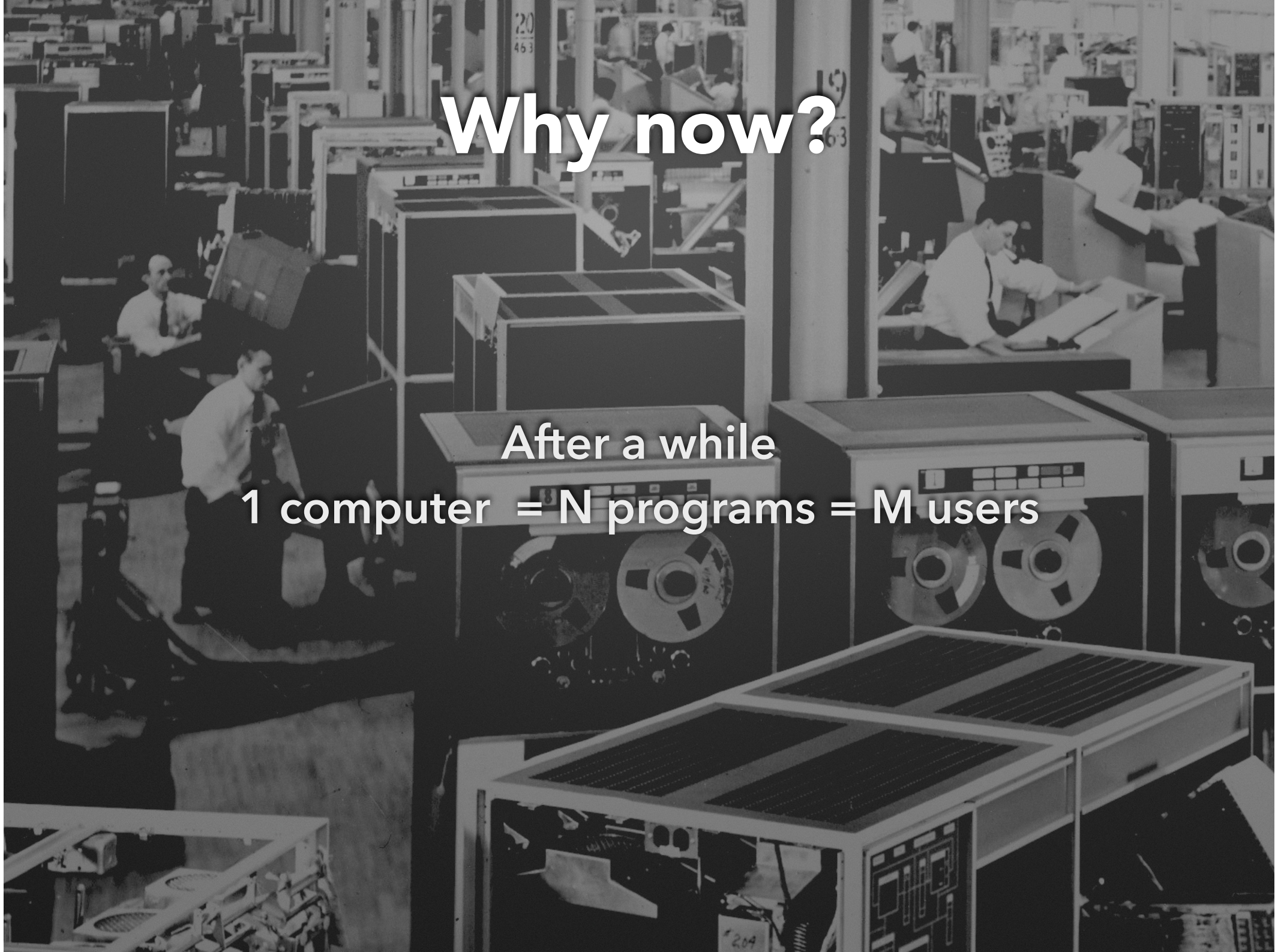
Data Science
Big Data

Taking (big)data-based decisions is not new but now it is easier.



Why now?

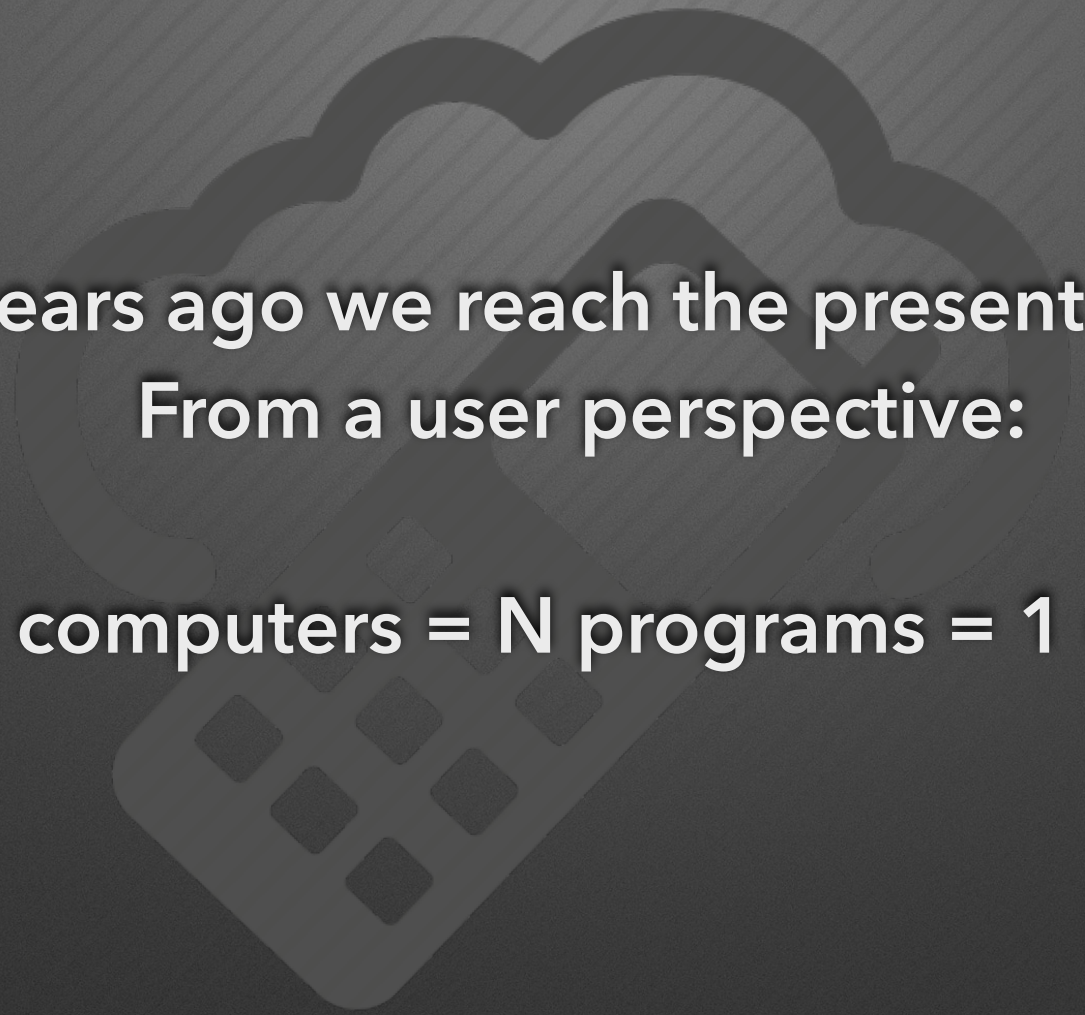
At the beginning
1 computer = 1 program = 1 user


Why now?
After a while
1 computer = N programs = M users


Why now?
Then
1 computer = N programs = 1 user

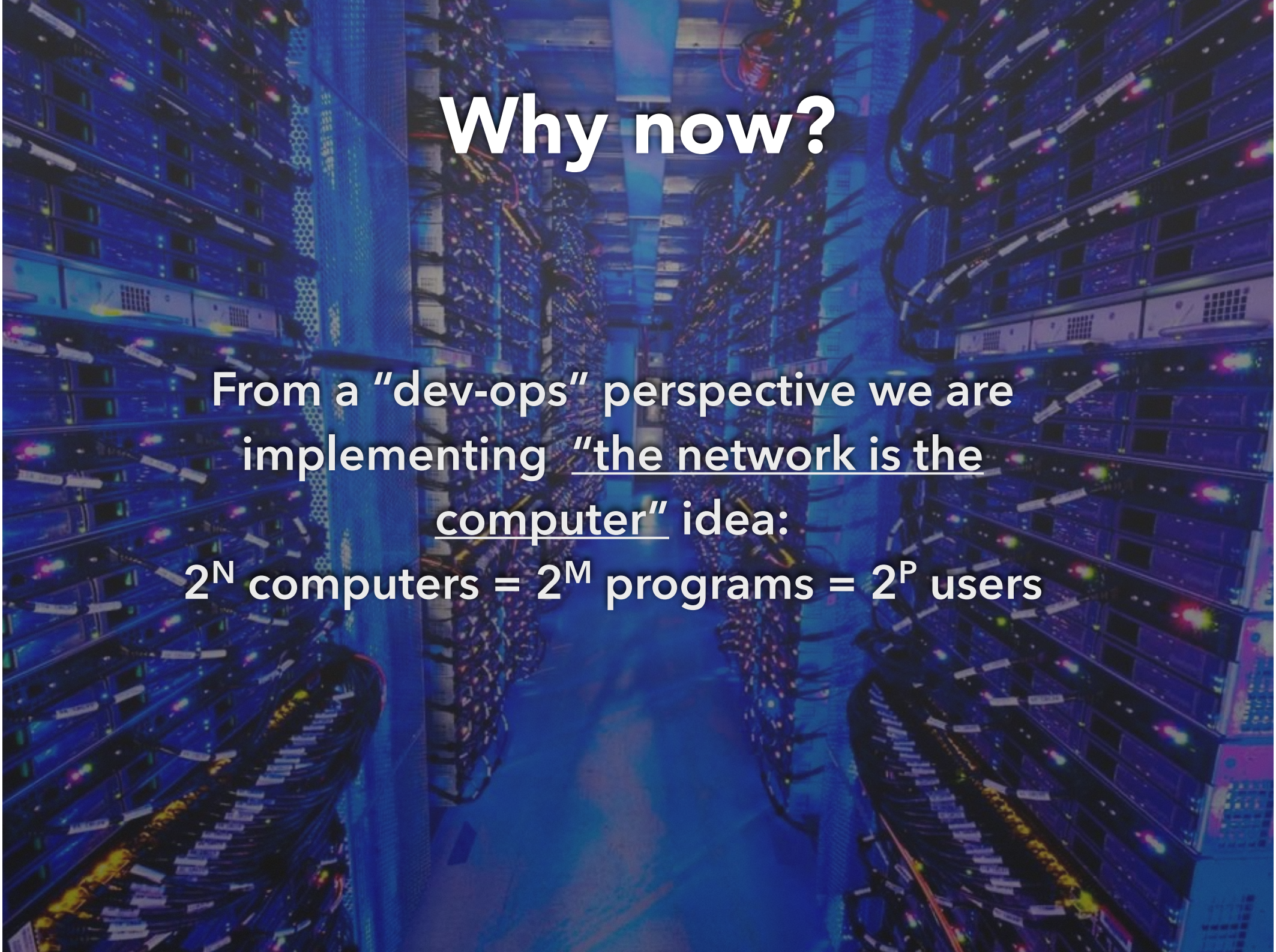
Why now?

Why now?



A few years ago we reach the present situation.
From a user perspective:

M computers = N programs = 1 user



Why now?

From a “dev-ops” perspective we are implementing “the network is the computer” idea:

2^N computers = 2^M programs = 2^P users

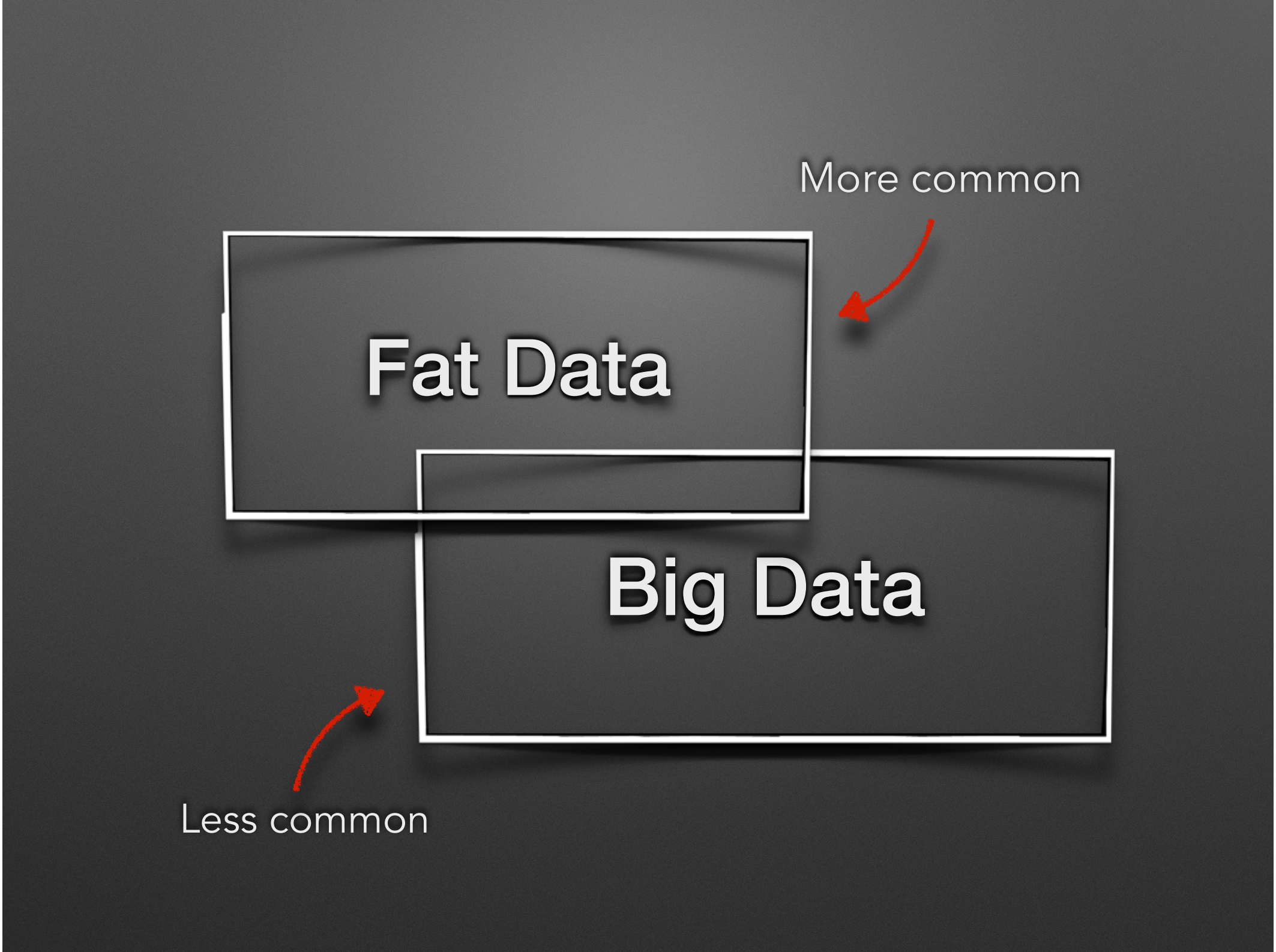
Why now?

The “cloud” is a necessary condition to process big data, but not the main cause of the Big Data fever.

Big Data

What is Big Data?

- For some people, they have big data when its size > 65536 x 256.
- In general we have big data when its size does not allow its storage and analysis in a big computer.


More common
Fat Data
Big Data
Less common

Big Data

Wal-Mart handles over one million customer transaction per hour, the information is stored on a database sized in excess of 2.5 Petabytes ($2{,}0 \times 10^{16}$ bits).

By 2016 it is likely that a typical hospital will create 665 terabytes (5.32×10^{15} bits) of data a year.

Big Data

With a personal computer:

- You can find an element in a 1 MB file in less than a second.
- You can find an element in a 1 GB file in less than a minute.
- You can find an element in a 1 TB file in less than sixteen hours.
- You can find an element in a 1 PB file in less than two years.
- You can find an element in a 1 EB file in less than two thousand years.

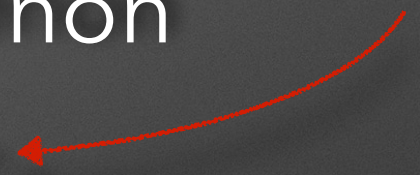
Big Data

Big data is more than size.
It is commonly characterized with four V:

Big Data

The cloud is key to deal with the three V, but the main phenomenon behind Big Data is **datification**.

Key enabler



The three V are a consequence of it.

Big Data

We are rendering into data many aspects of the world that have never been quantified before:

business networks
books I'm reading
location
physical activity
consumed food
purchases
physiological signals
straight thoughts
friendship
gaze
driving behavior

Big Data

Information comes from:

- Corporate Data Bases (structured information).
- Unstructured information in documents, Wikipedia, textbooks, journals, blogs, tweets, etc.
- Images in the web, public cameras, phones, TV, YouTube, etc.
- Public APIs: smart cities, government, search engines, etc.
- Sensor Data: GPS, accelerometer, physico-chemical sensors, sociometric sensors, super-colliders, telescopes, etc.

Big Data

There are several Big Data flavors:

- Big multidimensional arrays (homogeneous data).
- Big tables (structured data).
- Big text.
- Big image.
- Big sound.
- Big sequential data (sensors, tweets, etc.)

Big Data

There are several problems:

- ETL (Extract, Transform, Load)
- BI/Analytics (Think you can do in SQL)
- **Advanced Analytics.**
- **Machine Learning.**
- Visualization.

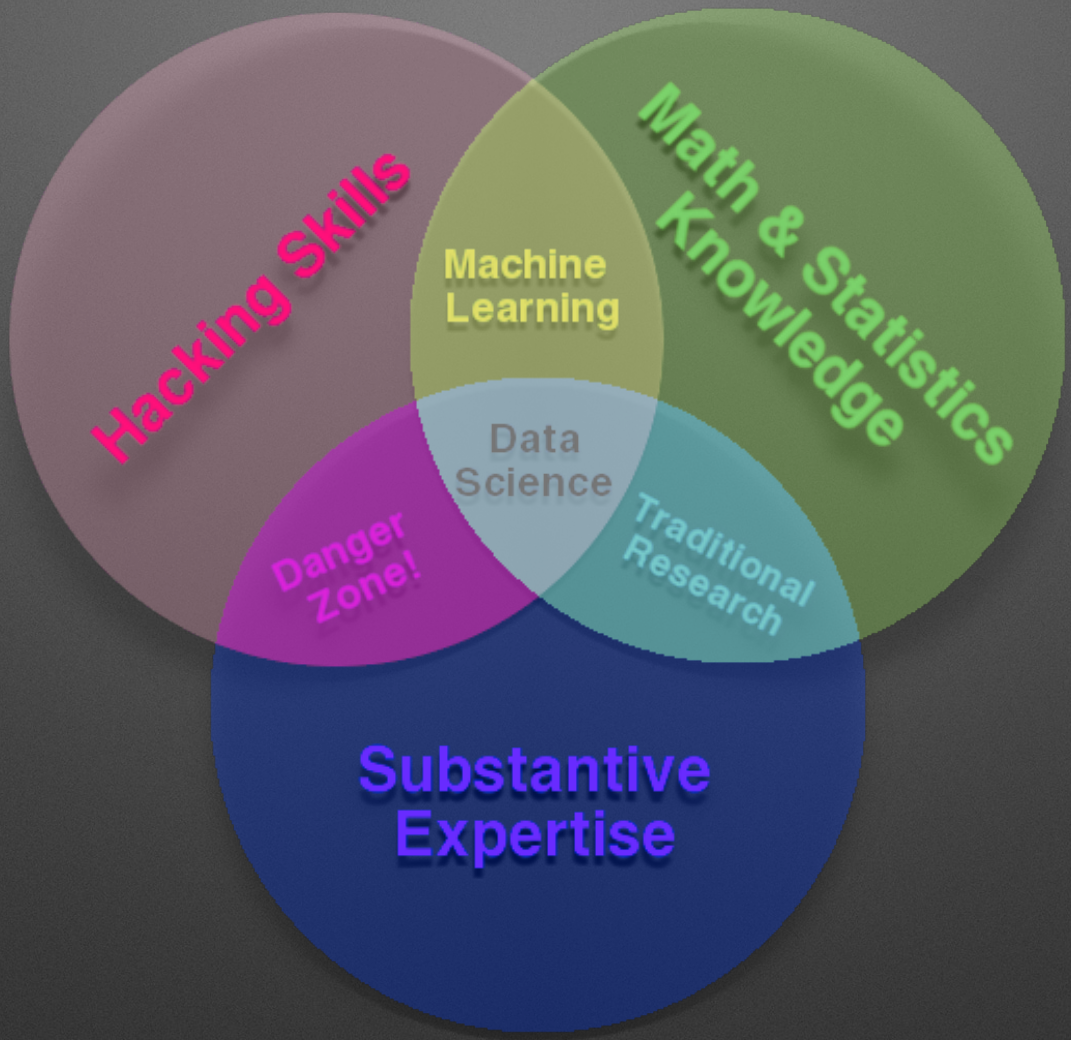
Data Science

Technology is the collection of tools, including machinery, modifications, arrangements and procedures used by humans.

Big Data is a key **technology** to process massive amounts of data (f.e. to count items).

Methodology is the systematic, theoretical analysis of the methods applied to a field of study.

Data Science is a **methodology** to define what we want to do with data, how do we evaluate our actions, what decisions can be grounded on data, how do we combine evidences from several sources, etc.



Drew Conway's Data Science Venn Diagram

Data Science

Data Science is **not** a **science** but a methodology based on multidisciplinar knowledge.

> *Currently, most company decisions are based on intuition and best practices. The alternative is to integrate data-based knowledge in the decision process.*

Data Science is a new data processing model focused on turning data into actions.

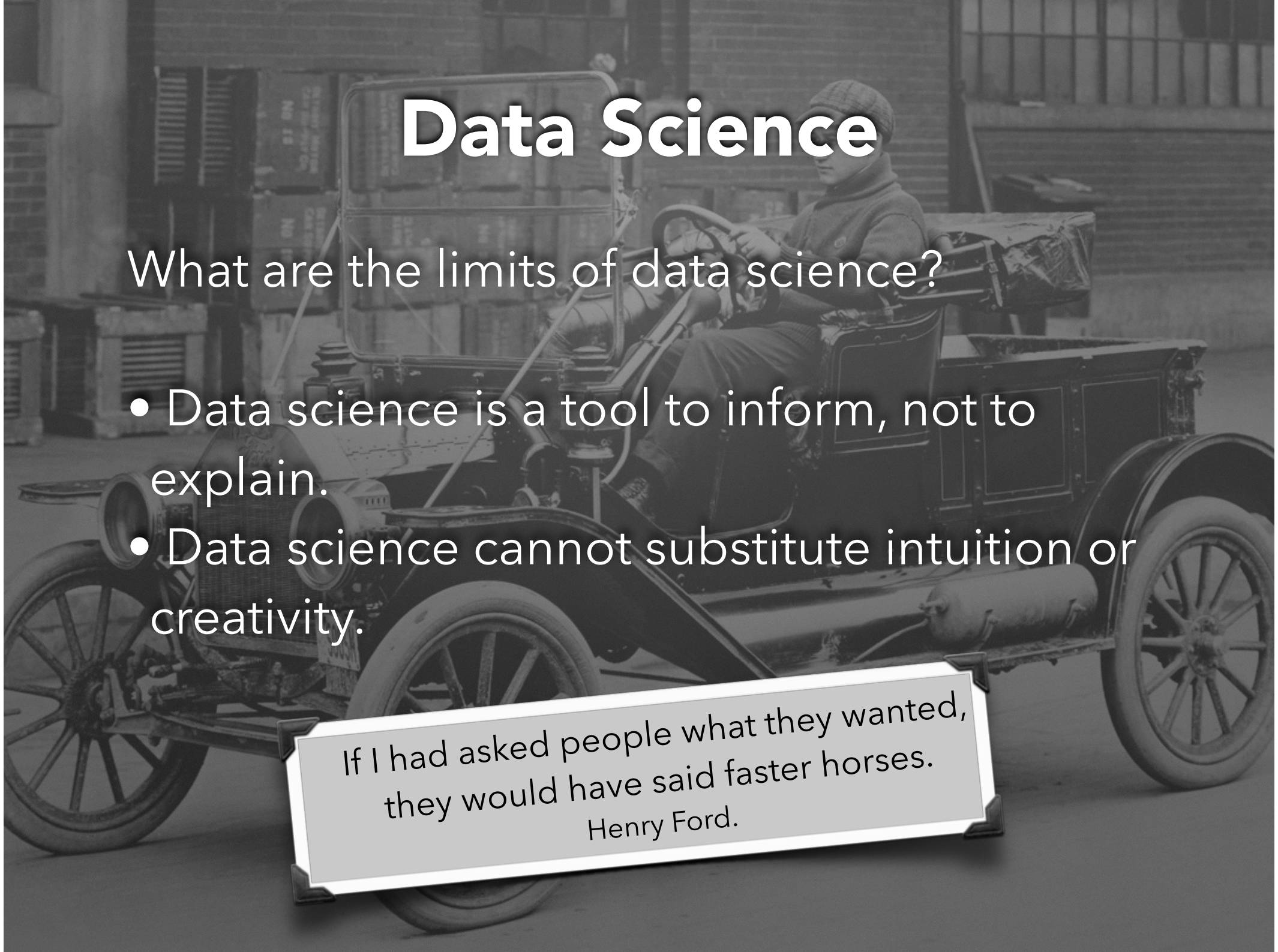
Data Science

Steps:

- Ask a question.
- Get the data. They can be heterogeneous and non structured.
- Data Processing (cleaning, munging, etc.).
- Data Analysis (computer science, linguistics, economy, sociology, etc.).
- Take a decision and act.

Data Science

Data Science is a new job!



Data Science

What are the limits of data science?

- Data science is a tool to inform, not to explain.
- Data science cannot substitute intuition or creativity.

> If I had asked people what they wanted, they would have said faster horses.
>
> Henry Ford.

Data Science

COMPANY
Mastercard

INDUSTRY
Finance

EMPLOYEES
67,000

TYPE
Behavioral Analytics

PURPOSE:

With 1.8 billion customers, MasterCard is in the unique position of being able to analyze the behavior of customers in not only their own stores, but also thousands of other retailers. The company teamed up with Mu Sigma to collect and analyze data on shoppers' behavior, and provide the insights it finds to other retailers in benchmarking reports.

Data Science

COMPANY
Starbucks Coffee

INDUSTRY
Food & Beverage

EMPLOYEES
160,000

TYPE
Behavioral Analytics

PURPOSE:

Starbucks collects data on its customers' purchasing habits in order to send personalized ads and coupon offers to the consumers' mobile phones. The company also identifies trends indicating whether customers are losing interest in their product and directs offers specifically to those customers in order to regenerate interest.

Data Science

COMPANY
Spotify

INDUSTRY
Entertainment

EMPLOYEES
5,000

TYPE
Customer Segmentation & Behavioral Analytics

PURPOSE:

Spotify uses data from user profiles and users' playlists, and historical data on music played to provide recommendations for each user. By combining data from millions of users, Spotify is able to make recommendations even if a particular user doesn't have an extensive history with the site.

Data Science

COMPANY
Union Pacific Railroad

INDUSTRY
Transportation

EMPLOYEES
44,000

TYPE
Predictive Support

PURPOSE:

With predictive analytics and tools such as visual sensors and thermometers, Union Pacific can detect imminent problems with railway tracks in order to predict potential derailments days before they would likely occur. So far the sensors have reduced derailments by 75 percent.

Data Science

COMPANY
Coca-Cola Co.

INDUSTRY
Food

EMPLOYEES
146,200

TYPE
Market Basket Analysis

PURPOSE:

Coca-Cola uses an algorithm to ensure that its orange juice has a consistent taste throughout the year. The algorithm incorporates satellite imagery, crop yields, consumer preferences and details about the flavours that make up a particular fruit in order to determine how the juice should be blended.

Conclusions

- Big Data will be soon a commodity that will be used mainly for data munging and counting at scale.
- The most difficult part of **Big Data** is **Data.**
- Data Science is a new job with a bright future.