Digital Transformation in the Automotive Industry

Digitale Transformation in der Automobilindustrie

Dr. Michael Nolting

Lecture 3

Tutorials

- Homework will be reading the book from Gene Kim „The Phoenix Project“

The homeworks are optional and not relevant for the exam

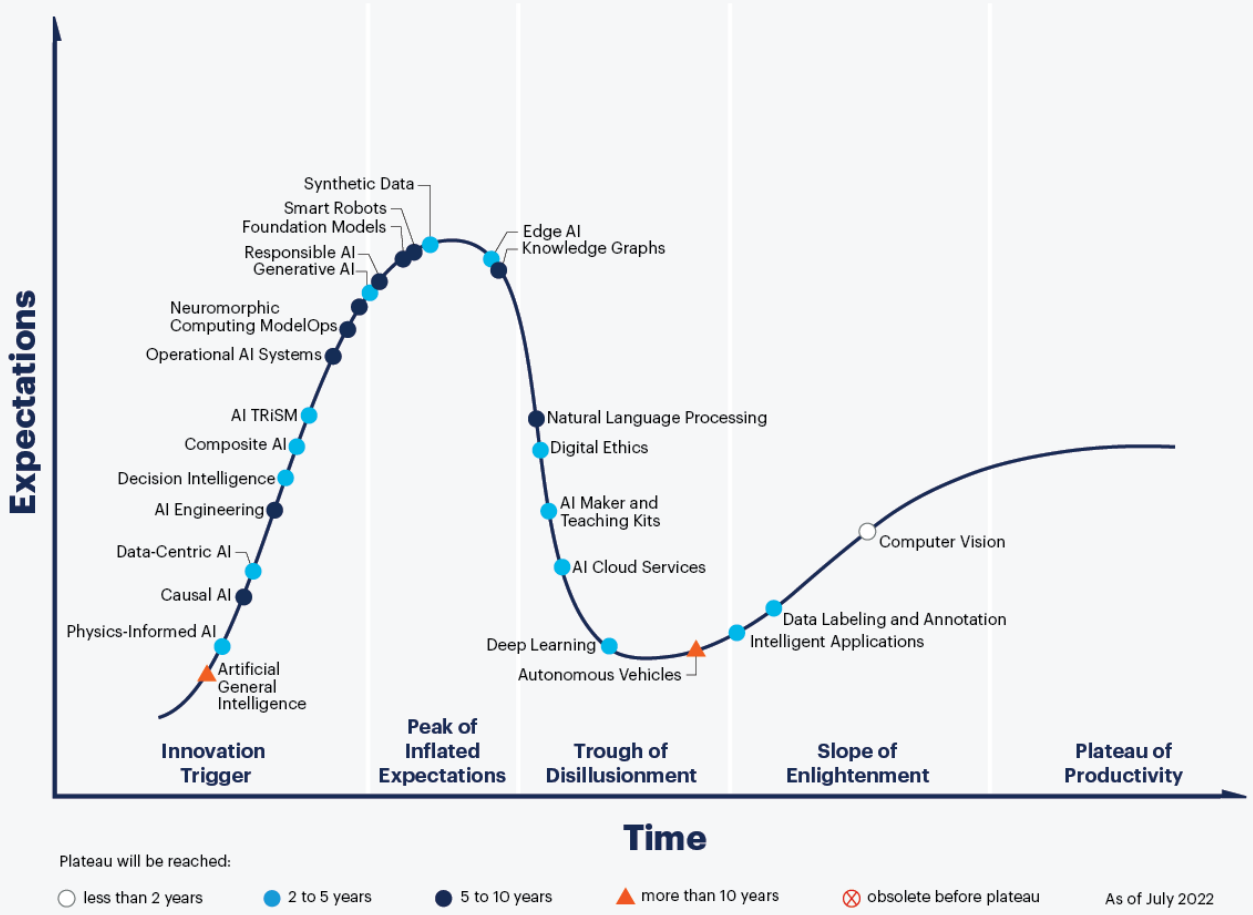
Lecture Overview

1. Introduction: Why Digital & Data Transformation	7. Culture & Organization
Homework 1: Reading 60 mins the Phoenix Project	Homework 7: Reading 60 mins the Phoenix Project
2. The World is Changing: ACES & VUCA	8. Examples of Digitalization Projects I
Homework 2: Reading 60 mins the Phoenix Project	Homework 8: Reading 60 mins the Phoenix Project
3. The Technological Disruption	9. Examples of Digitalization Projects II
Homework 3: Reading 60 mins the Phoenix Project	Homework 9: Reading 60 mins the Phoenix Project
4. Challenges for the Transformation - Innovation	10. TESLA as THE Digital Player
Homework 4: Reading 60 mins the Phoenix Project	Homework 10: Reading 60 mins the Phoenix Project
5. Challenges for the Transformation - Legacy	11. Q & A – Exam
Homework 5: Reading 60 mins the Phoenix Project	
6. How to Transform Into a Techgiant	
Homework 6: Reading 60 mins the Phoenix Project	

Technological Disruption

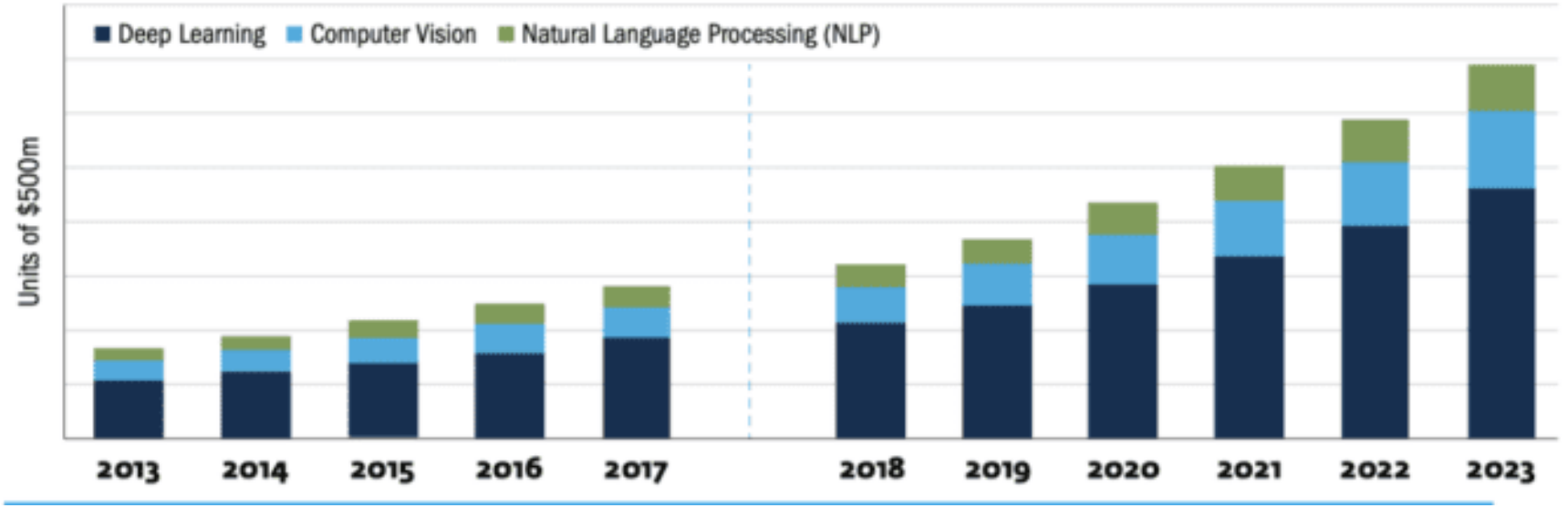
A technological disruption occurs when a new piece of technology, called disruptive technology, changes the way consumers, businesses, and industries operate. When they're first developed, disruptive technologies often create a new market. They establish their own value networks and are typically risky outliers when they're introduced.

Hype Cycle for Artificial Intelligence, 2022



gartner.com

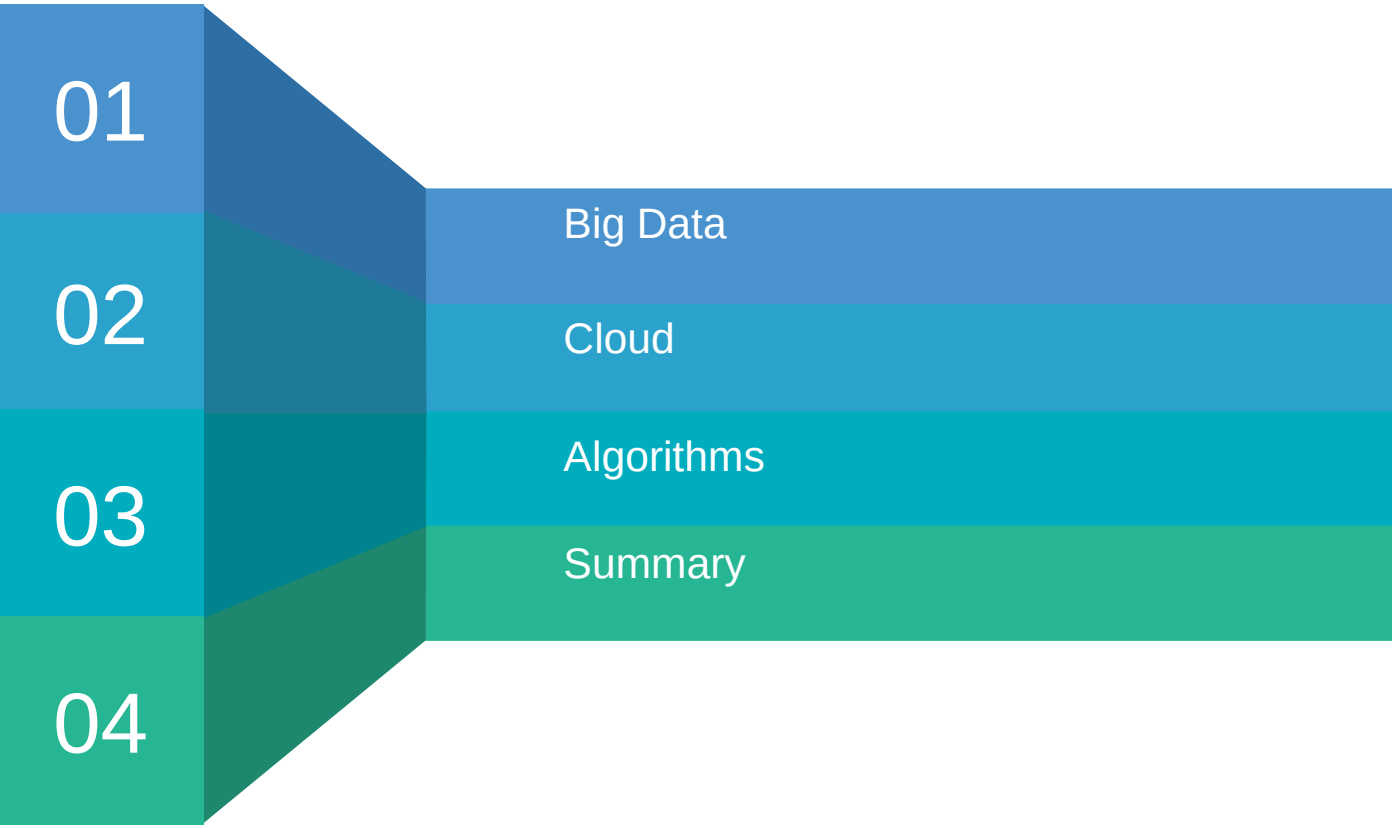
Gartner



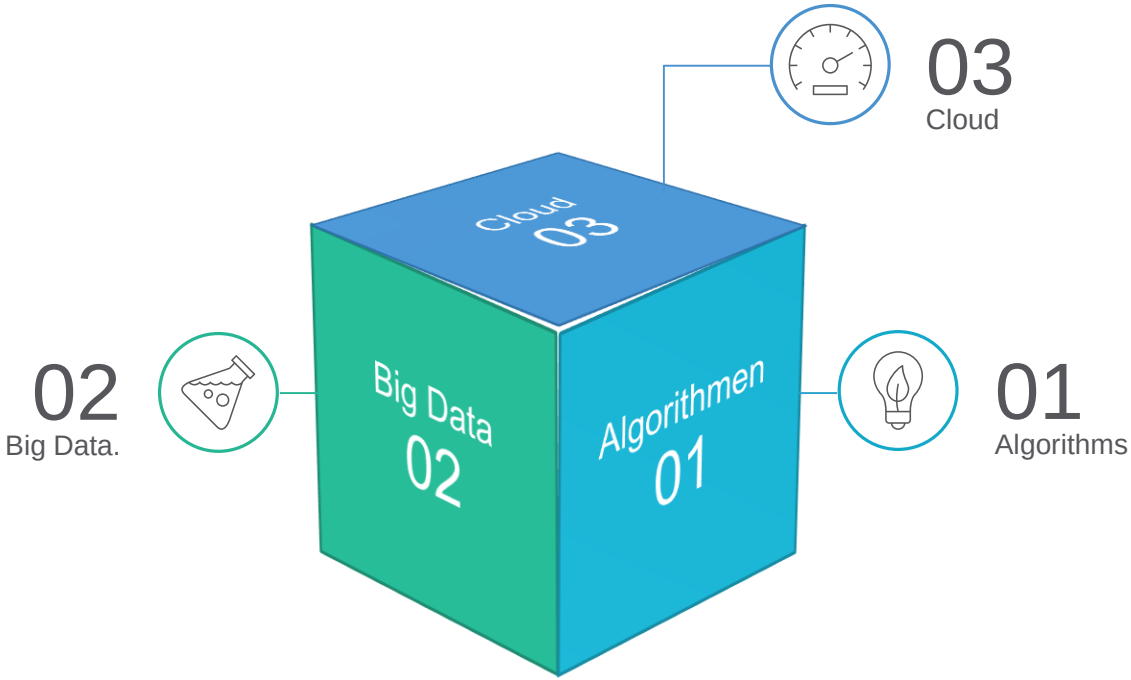
https://www.ifc.org/wps/wcm/connect/7c21eaf5-7d18-43b7-bce1-864e3e42de2b/EMCompass-Note-75-AI-making-transport-safer-in-Emerging-Markets.pdf

[AI, ML, and Data Engineering InfoQ Trends Report—August 2022]

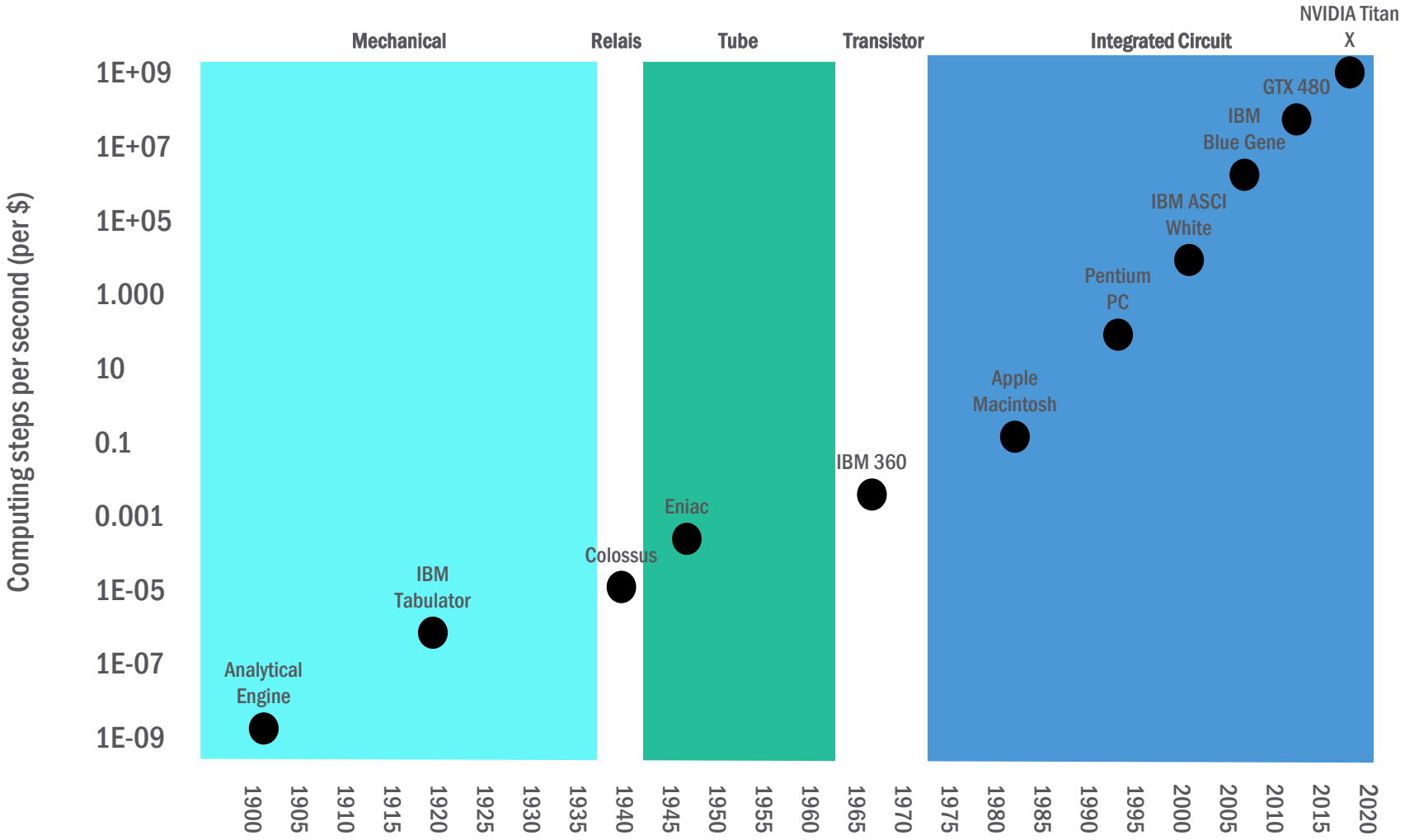
Agenda



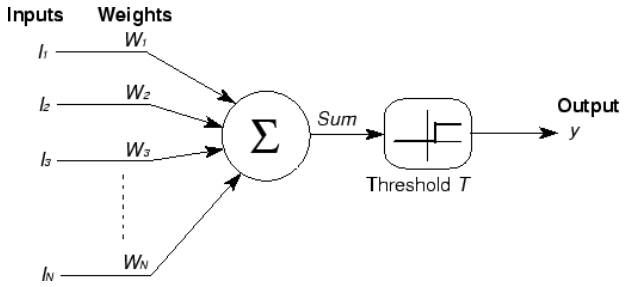
The ABC of AI:
Algorithms, Big Data and Cloud



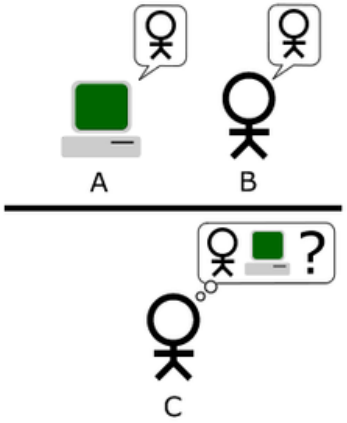
Why? Moore's Law



History of AI



1943: McCulloch & Pitts – Foundations for artificial neuronal network

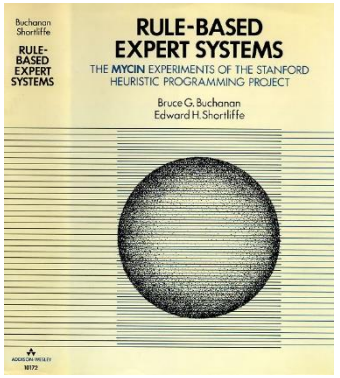


1951: Turing – Machine Intelligence

1956: McCarthy – Artificial Intelligence

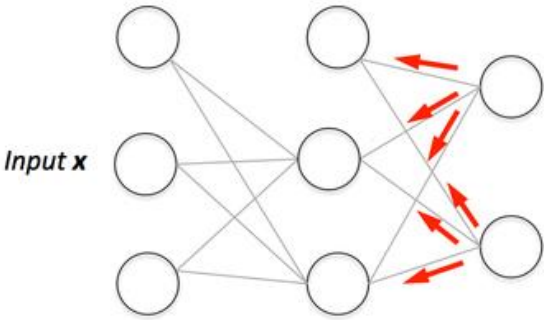
```
> Hello, I am Eliza.
* I am afraid.
> How long have you been afraid?
* Since midterms.
> Tell me more...
* I am afraid that I will fail
my course.
> Do you enjoy being afraid that
you will fail your course?
```

1966: Weizenbaum – NLP Eliza



1976: Buchanan – MYCIN

History of AI



1986: Hinton – ANN Backpropagation

2005: AI Big Bang – GPUs and Data

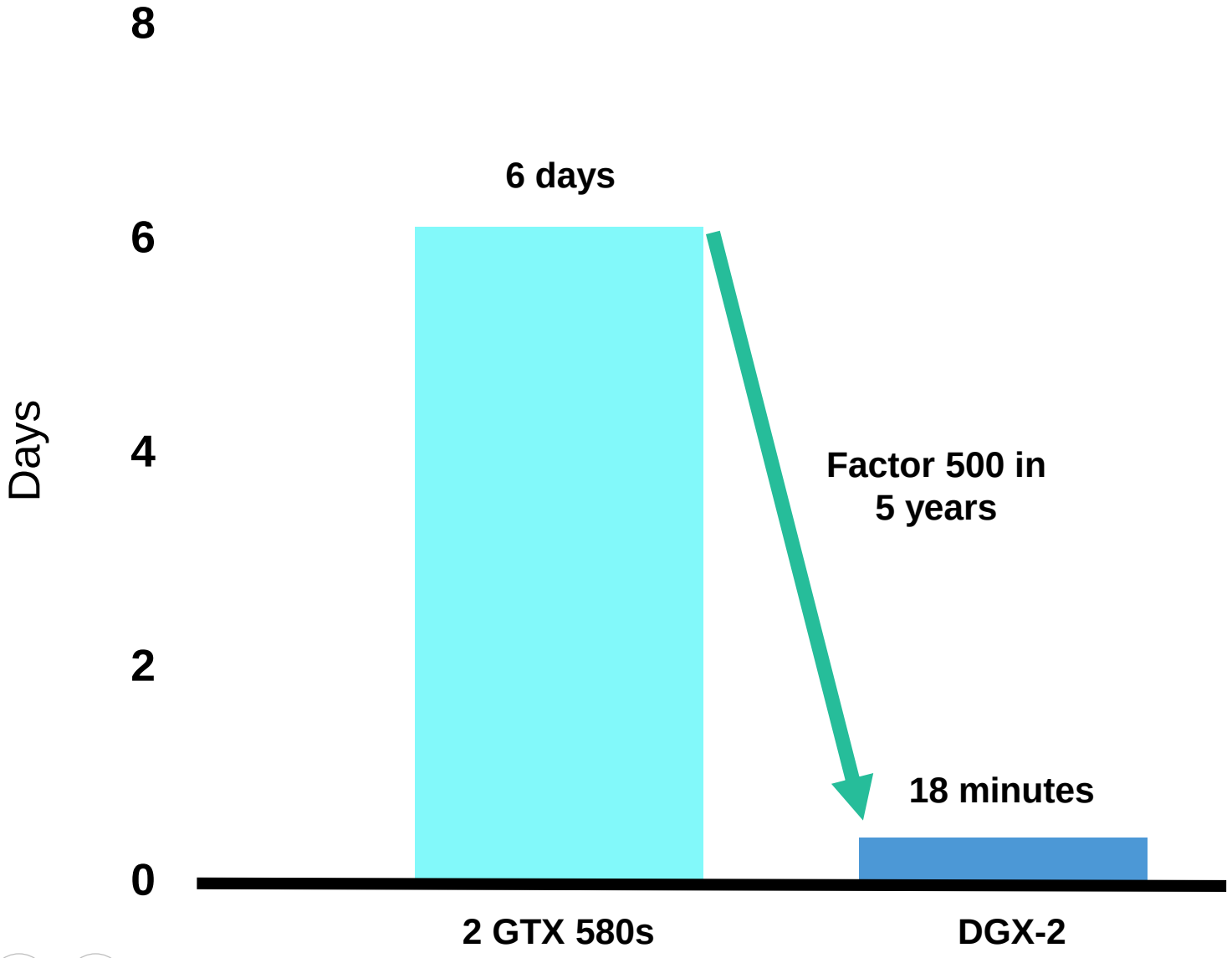
2009: Google – Self Driving Car

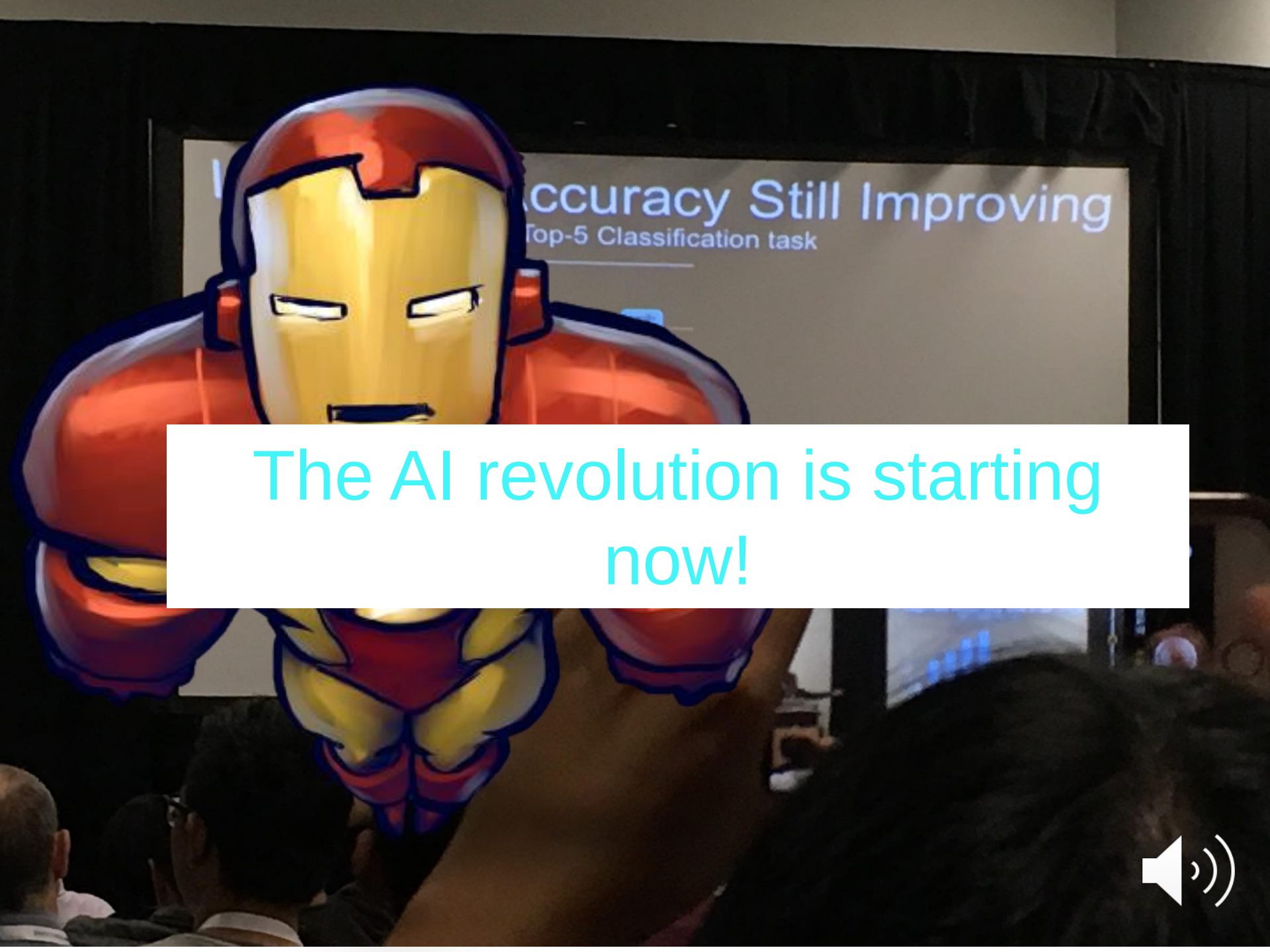
2011: IBM Watson – Defeat Human in Jeopardy Game

2016: Google AlphaGo – Defeat Human in Go

2018: Google Duplex – Personal Assistant

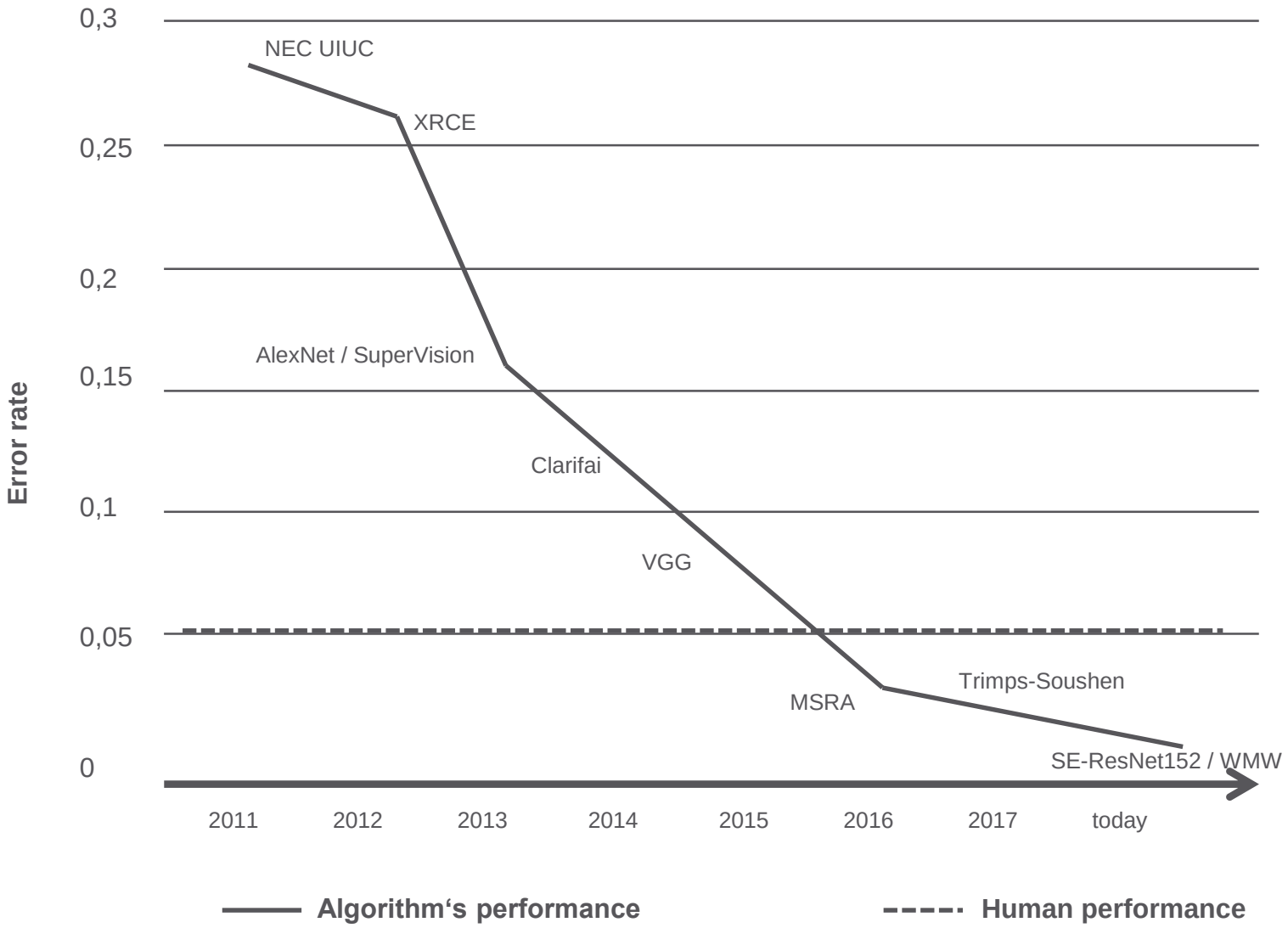
… and it is accelerating!





The AI revolution is starting now!

Superhuman Accuracy



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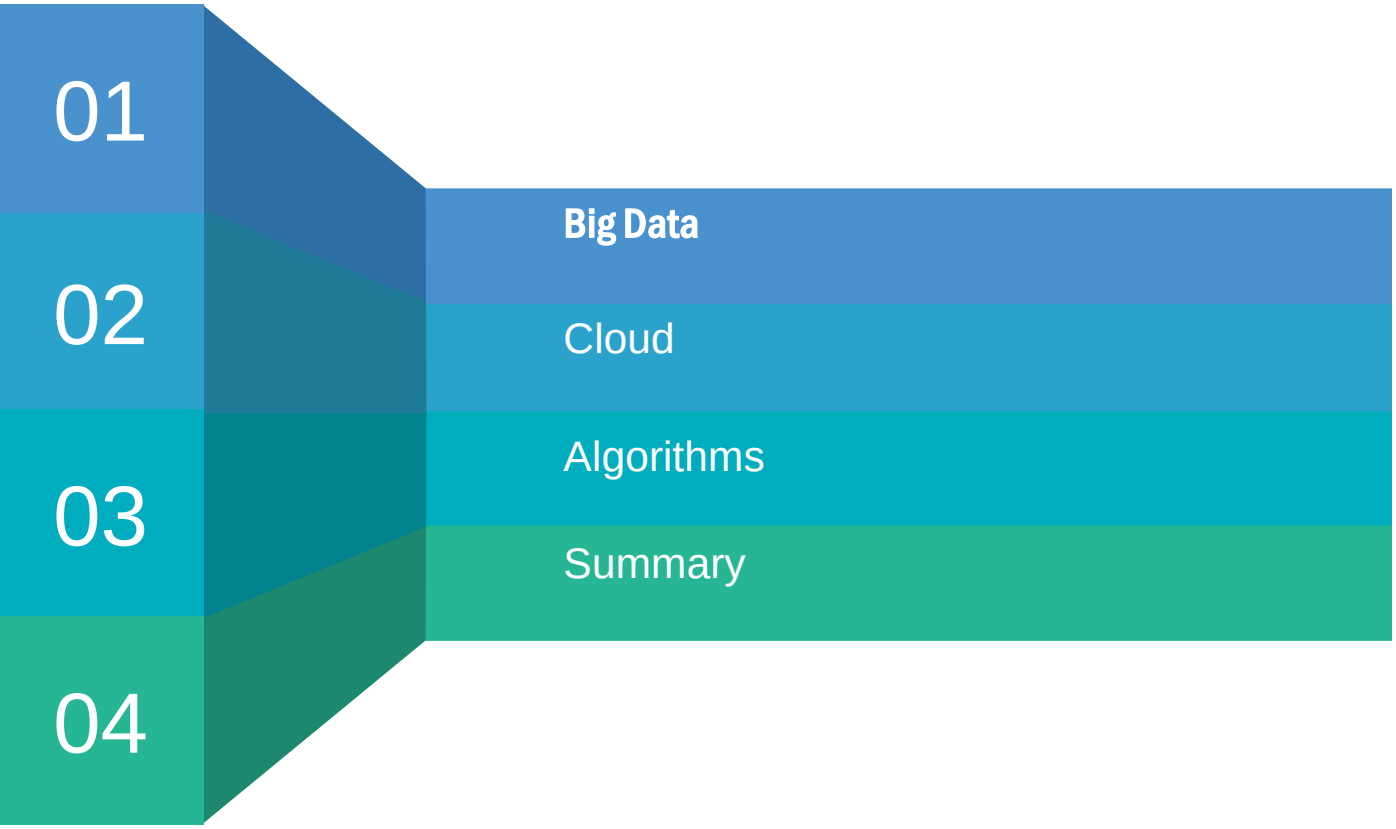


Big Data is everywhere

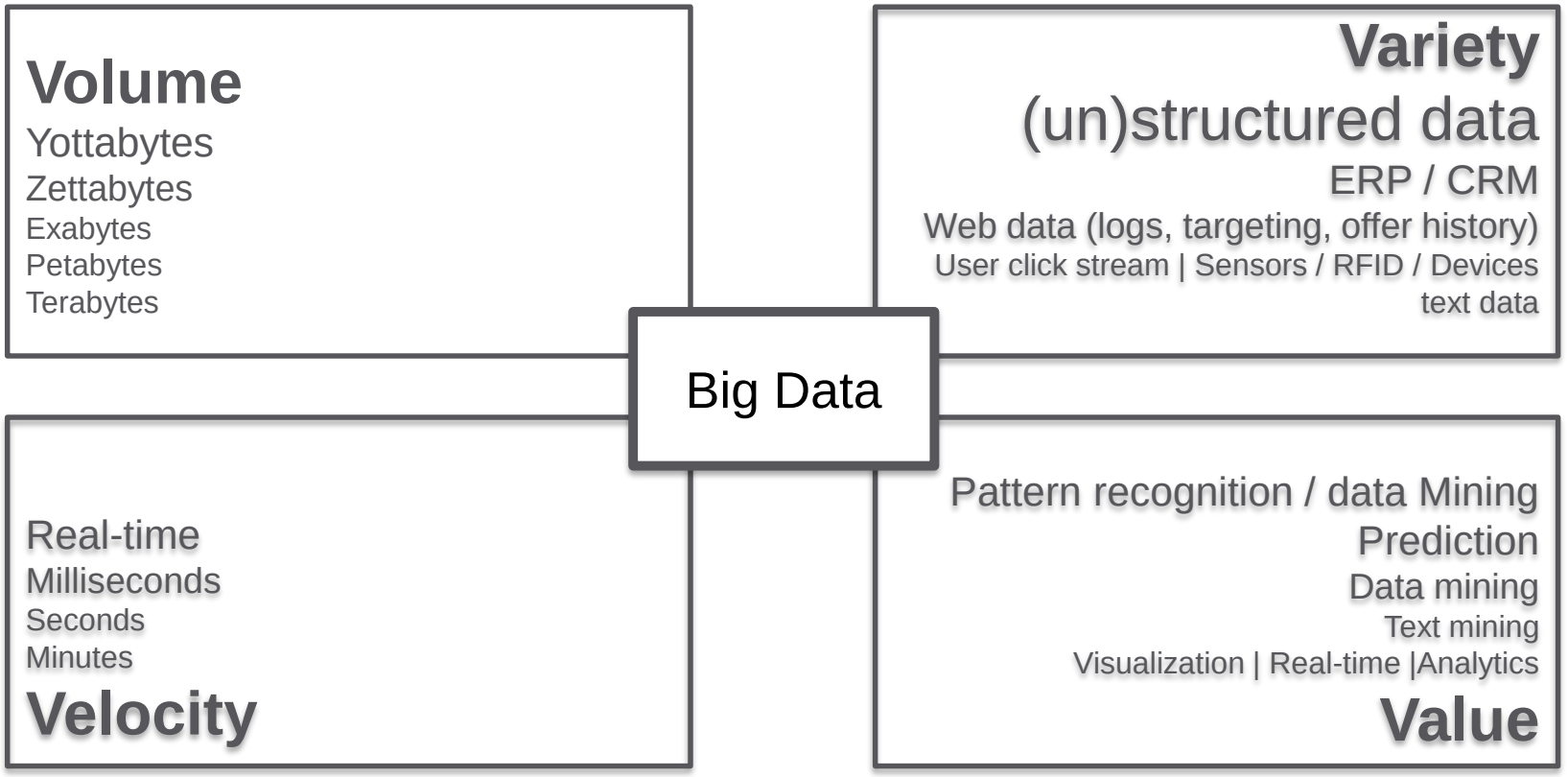
550 millions of tweets

2,7 billions facebook users

1,9 billions of youtube users

And many more sources: Car data, Internet of things, ...

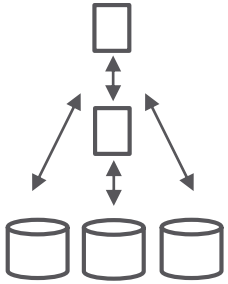
Big Data



Source: http://www.bitkom.org/de/publikationen/38337_73446.aspx

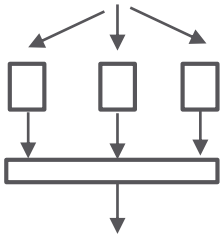
Tools
(Big Data history)

Google File System
(2003)

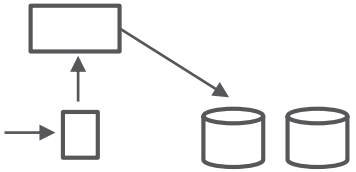


Apache Hadoop

Map Reduce
(2004)



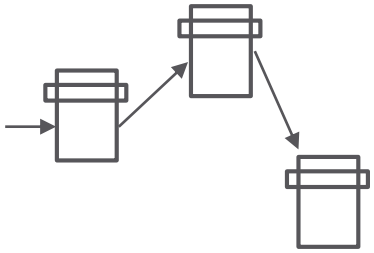
Big Table
(2006)



Apache HBase

Cassandra

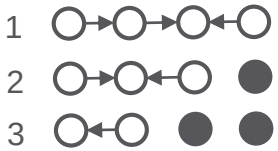
Percolator
(2010)



Twitter Storm

Yahoo S4

Pregel
(2010)

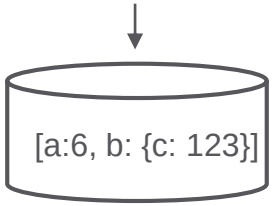


Apache Giraph

Microsoft Trinity

Titan

Dremel
(2010)



Apache Drill

Cloudera Impala

Tez/Stinger

Why Big Data?

Legacy approach (Oracle, IBM, ... data warehouse):

- Scale vertically
  - Single extra large server
  - Very limited number of CPUs and RAM
  - Attached storage array

- Limited analytics possibilities
  - Server bandwidth constraints
  - CPUs have to fit into one server

- Cost approx. $ 15,000 / TB data

Why Big Data?

Big Data approach (Hadoop, Spark, ...):

- Scale horizontally
  - Many small servers
  - Lots of CPUs and RAM

- New opportunities for Deep Analysis:
  - Massive IO enables
    - Unstructured data analytics
    - Complex machine learning algorithms

- Cost approx. $ 1,000/TB data

Agenda

01 Big Data

02 **Cloud**

03 Algorithms

04 Summary

Cloud Computing: Definition

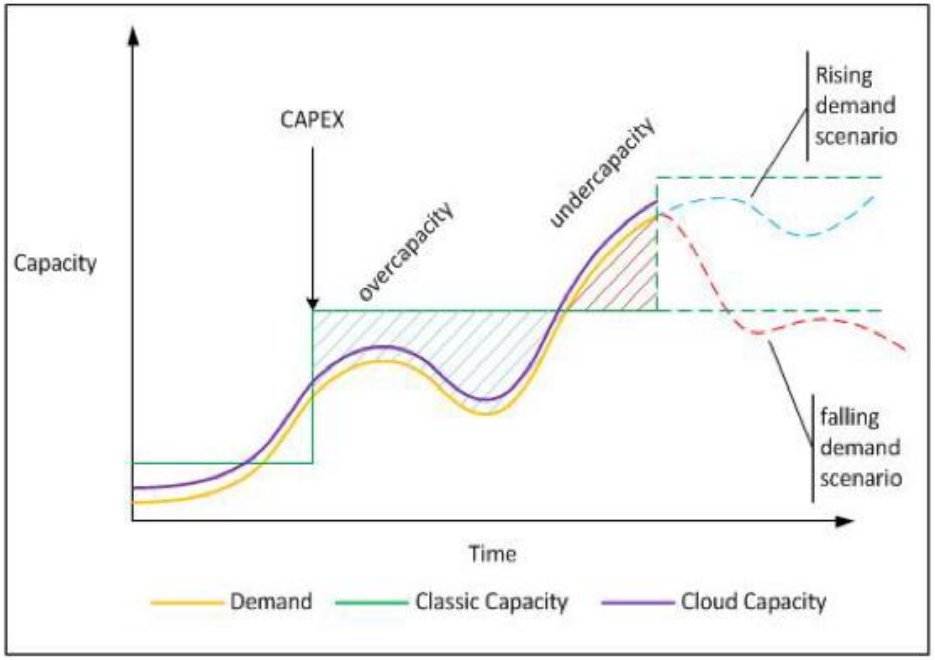
Cloud computing is the **delivery of computing as a service rather than a product**, whereby shared resources, software, and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet).

Clouds can be classified as public, private or hybrid.

Source: https://www.zdnet.de/88289874/cloud-monitor-65-prozent-der-unternehmen-nutzen-bereits-cloud-computing/

Mass Distribution by AWS

- Yield-Management of Amazon Web Services (90% of its capacity was not used all the time)



Capacity vs Utilization curves [8]

Frankly speaking...

Cloud Computing is like **Car Sharing for IT infrastructure:**

- **Pay as you go**

  → „I only pay the CPU I used. “

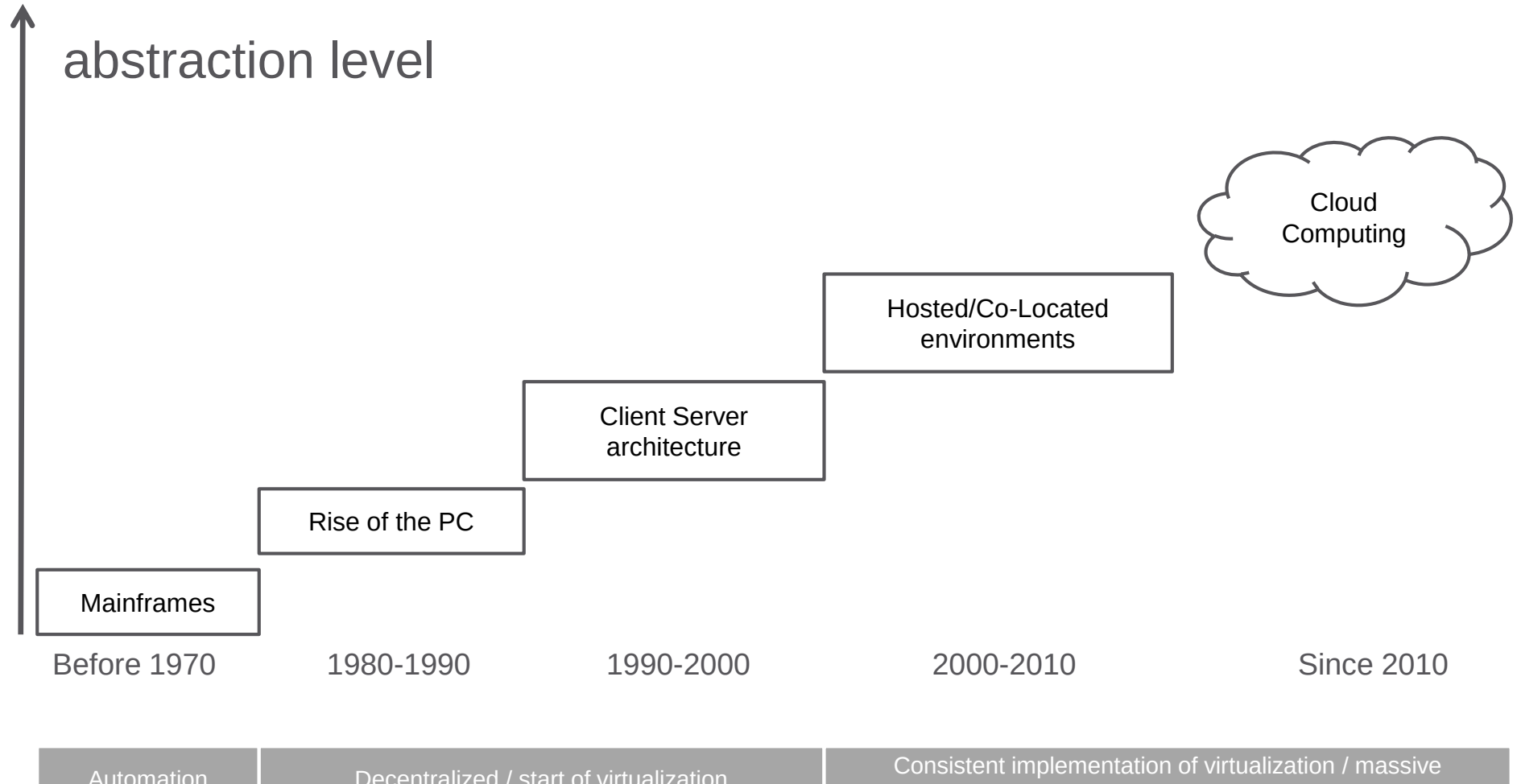
- **Scaling up, when needed**

  → „1,000 of servers with one click. “

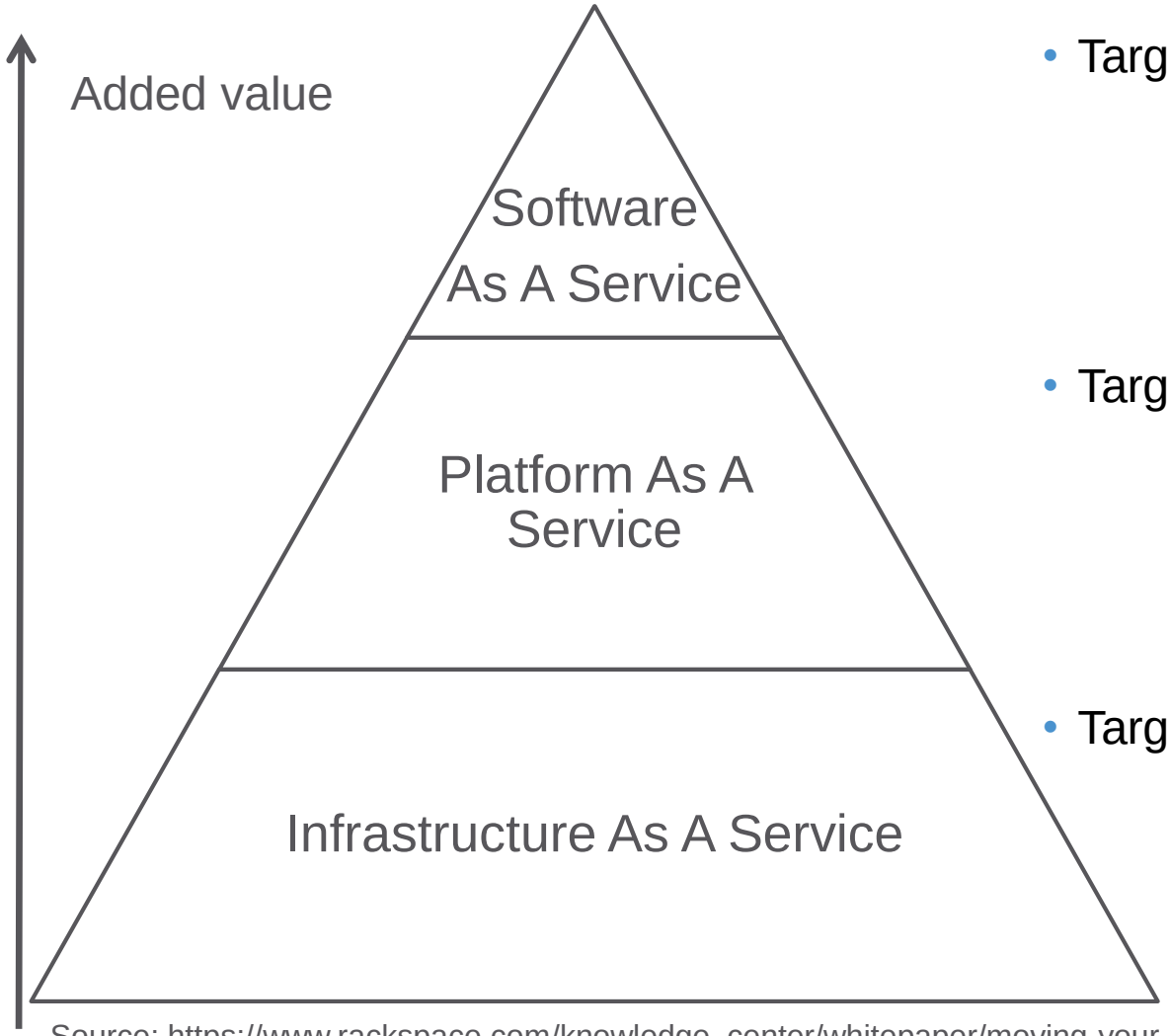
- **No up-front investment needed**

  → „Why set up an infrastructure with thousands of servers, when I do not need them all the time?“

History of Cloud Computing



Cloud Computing Service Pyramid



- Target group:
  Customers
- Target group:
  Developers
- Target group:
  IT / Admins

Source: https://www.rackspace.com/knowledge_center/whitepaper/moving-your-infrastructure-to-the-cloud-how-to-maximize-benefits-and-avoid-pitfalls

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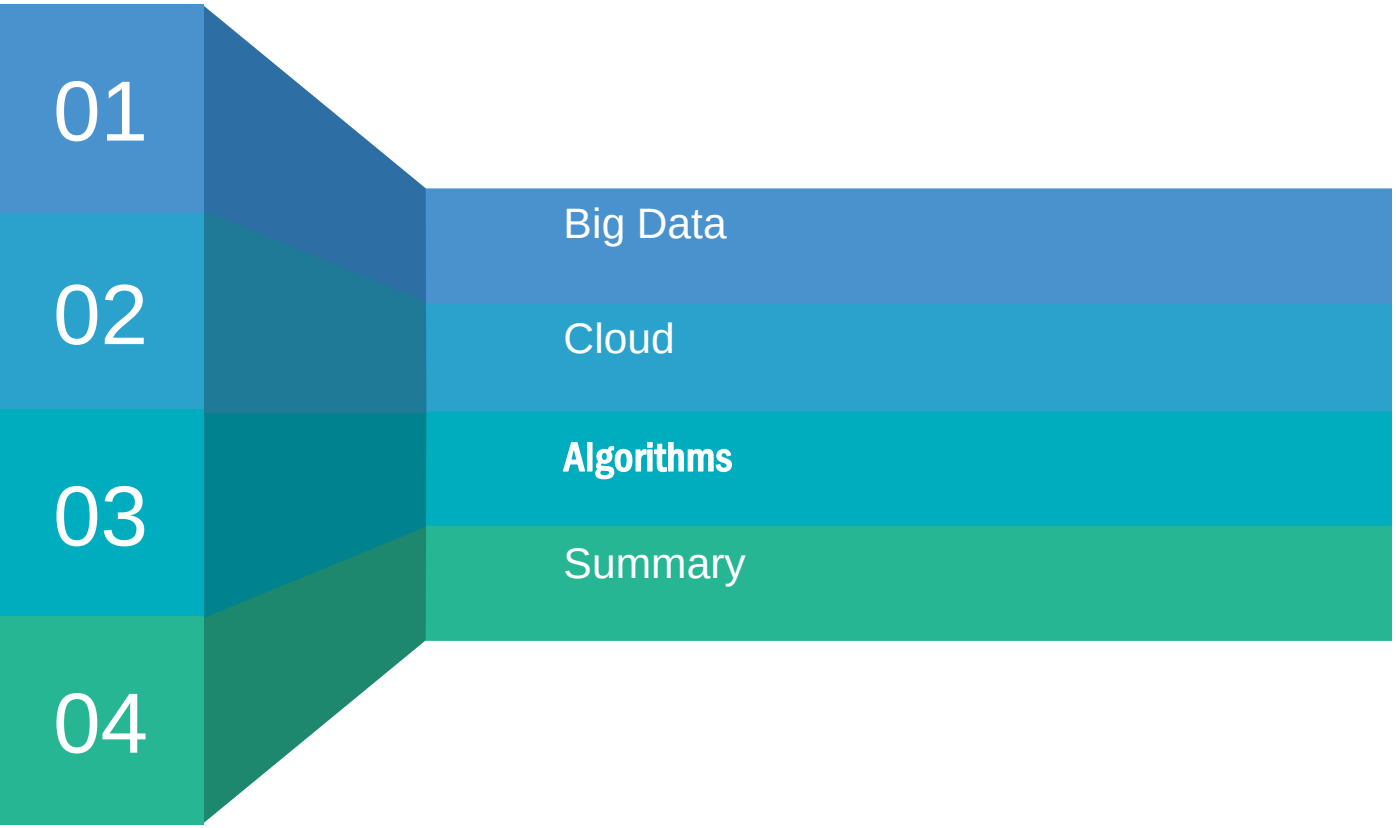
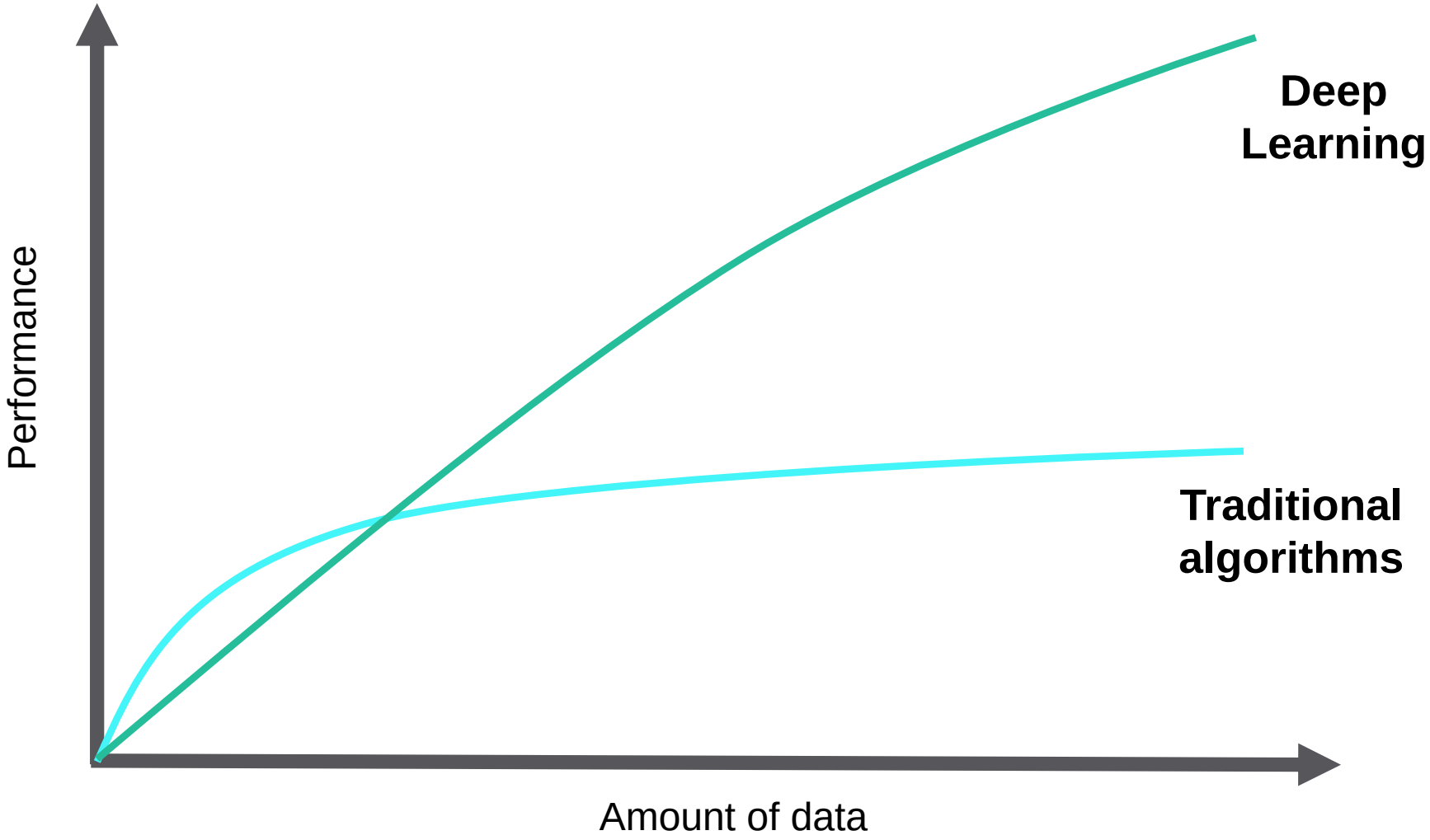
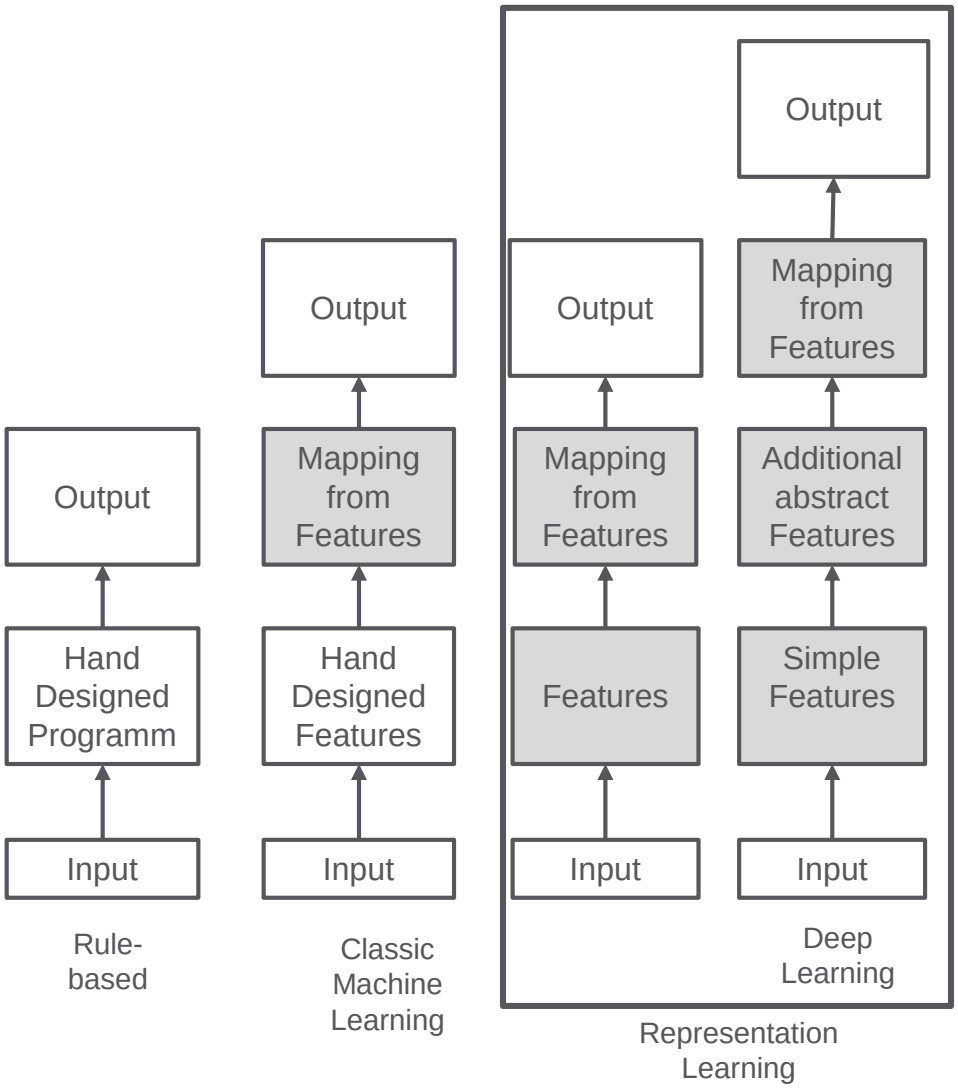


Algorithms


Performance
Amount of data
Deep Learning
Traditional algorithms

Great Advantage of Deep Learning



Agenda

01 Big Data

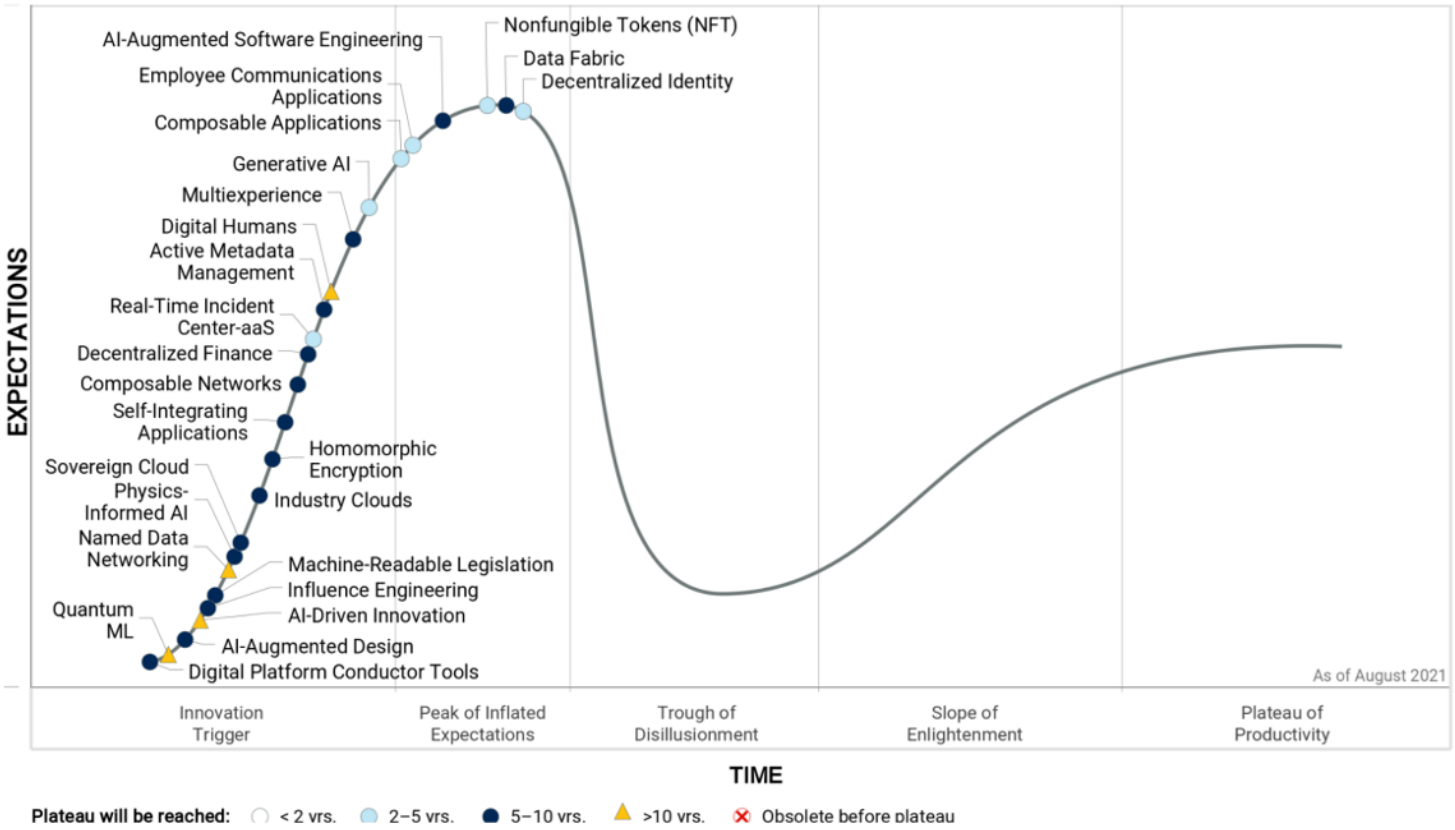
02 Cloud

03 Algorithms

04 **Summary**

Gartner Hype Cycle for Emerging Technologies (2021)

Trust, Growth, Change



Source: Gartner (August 2021)

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[Gartner Identifies Key Emerging Technologies Spurring Innovation Through Trust, Growth and Change]

Summary

1. Digital transformation will be driven by AI, which needs data, cloud and scalable algorithms
2. Data will be harnessed from people (social networks) and machines
3. Algorithms like deep learning scale with the amount of data fed into
4. Clouds will provide the needed processing power but must be trustworthy