Industrial Transformation and the Digital Revolution: A Focus on Artificial Intelligence, Data Science and Data Engineering

Adam Drobot

December 7th-11th

ITU Kaleidoscope 2020

Outline

- *Industrial Transformation and the Digital Revolution*
  - *The Digital Revolution*
    - *Digital Transformation*
  - *Thinkers and Futurists*
  - *Industrial Transformation*
  - *Technologies in Focus*
    - *The role of Analytics and Artificial Intelligence*
    - *The importance of Data Science and Data Engineering*

- The Digital Revolution

The Digital Revolution

In the last
two decades

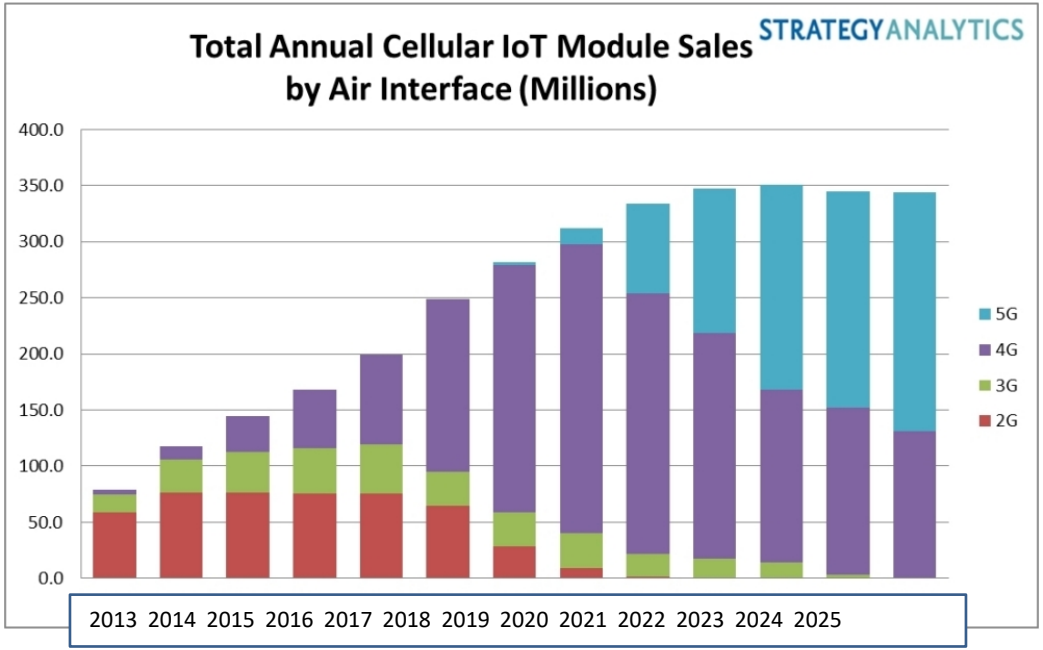
A Consumer
Driven Revolution

The Digital Revolution

Four New Worldwide Infrastructures

- The Internet
- Wireless Mobility
- Computing
- eRetail and eDelivery

The Digital Revolution



Growth of Wireless Mobile Infrastructure

The Digital Revolution

High Performance Computing

Hyperscale Data Centers

Cloud Computing

Fog/Edge Computing

Workstation Computing

Desktop Computing

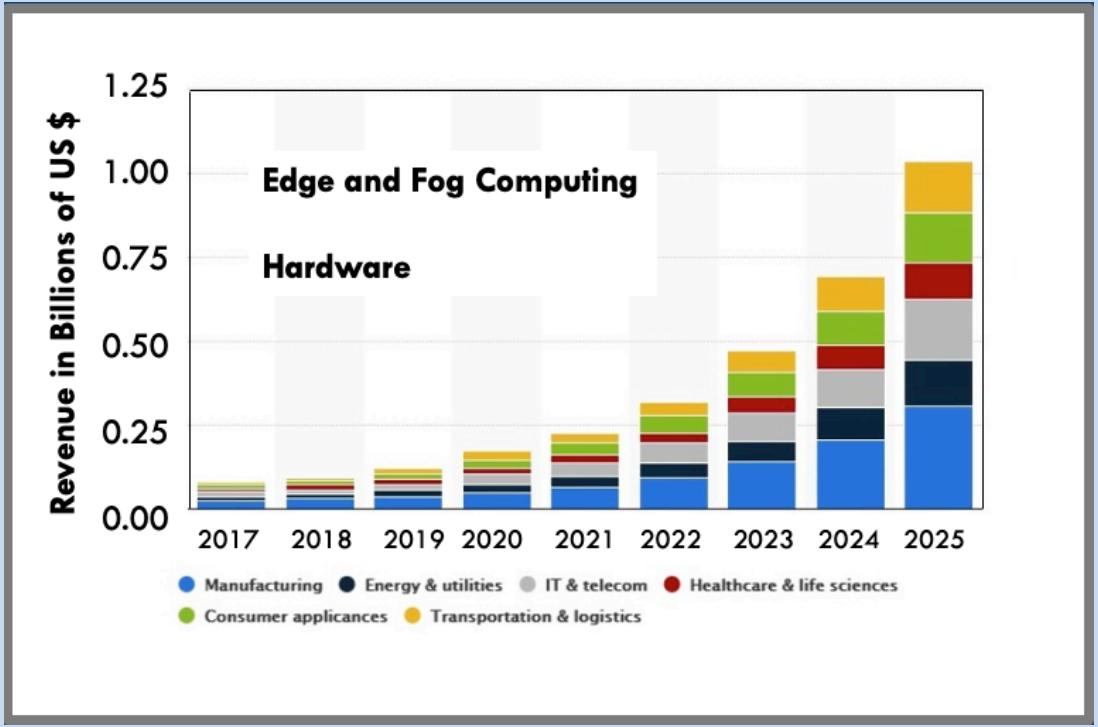
Embedded Computing

Nomadic/Mobile Computing

Thing Computing

Computing Hierarchy

The Digital Revolution

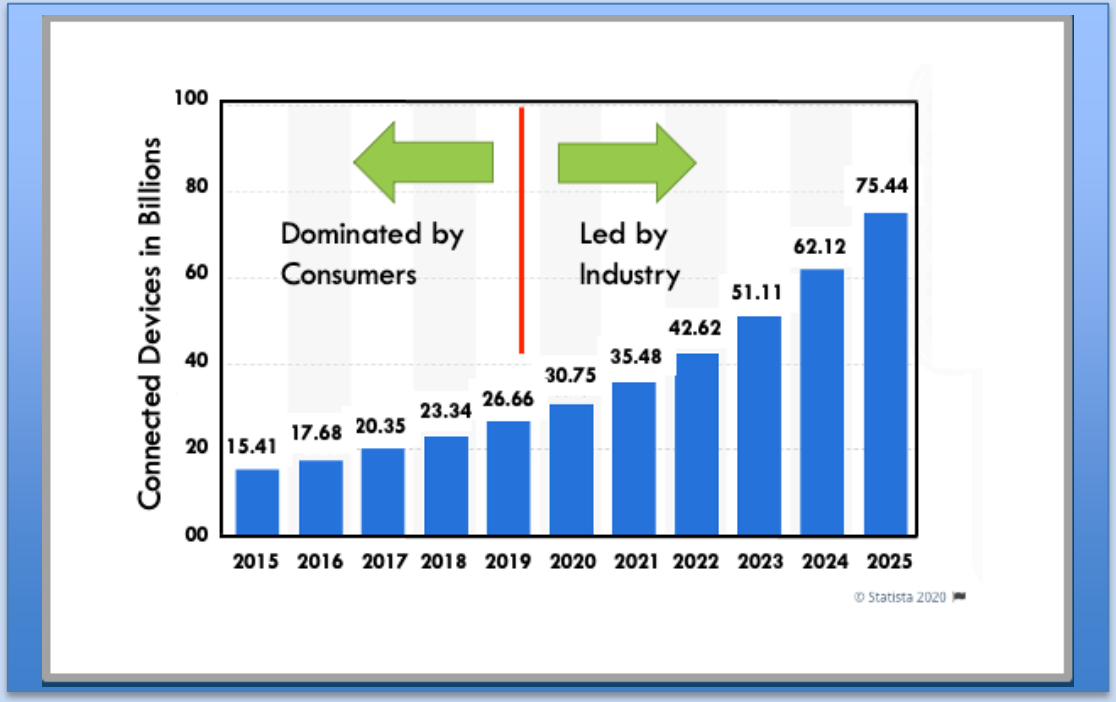


Growth of Computing Capabilities

The Digital Revolution

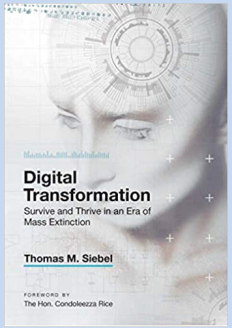
Growth of eRetailing and Delivery Capabilities

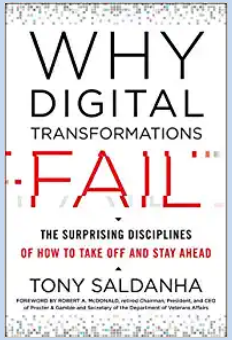
The Digital Revolution



A Change In the Action

The Digital Revolution – Digital Transformation

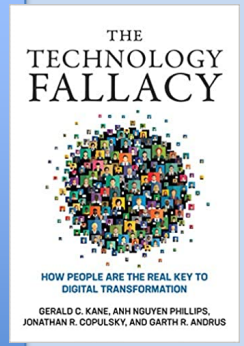




Tom Siebel

Why its an imperative

Jerry Kane

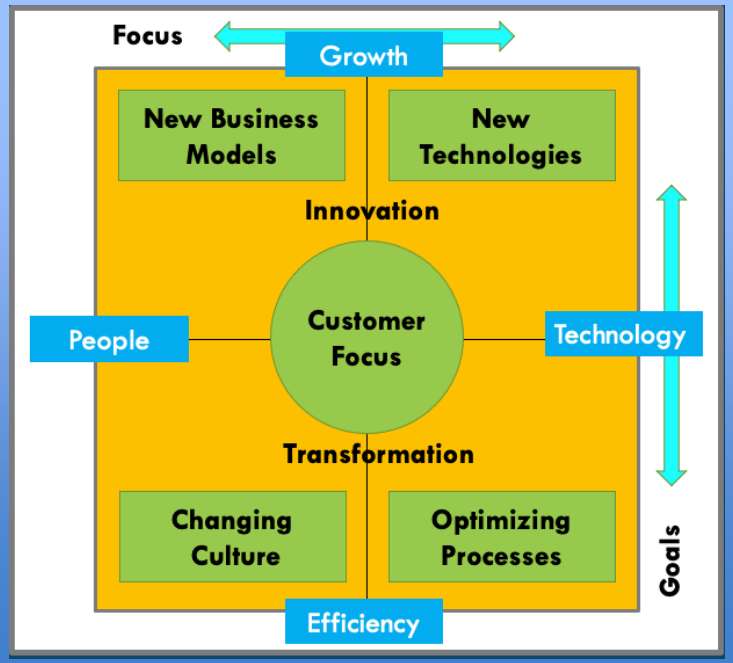


Why its hard

Tony Saldanha

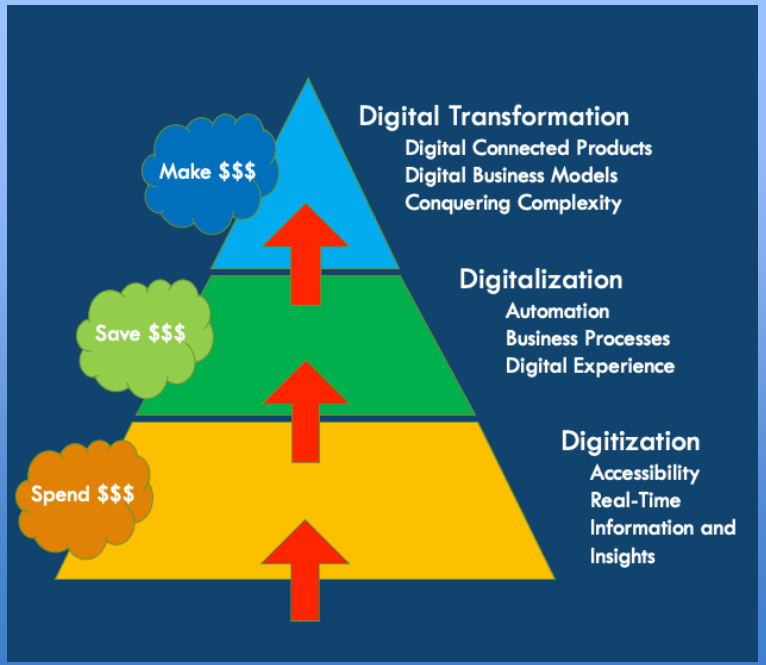
Why its not just about technology

The Digital Revolution – Digital Transformation



- Digital Transformation
- Industry 4.0
- Robotics
- The Internet of Things
- Digital Twins – for Manufacturing, Products, Services, and Processes
- Digital Sensor Networks
- Wide-spread use of diagnostics and prognostics for maintenance, repair, and overhaul
- Asset management
- Logistics
- _____

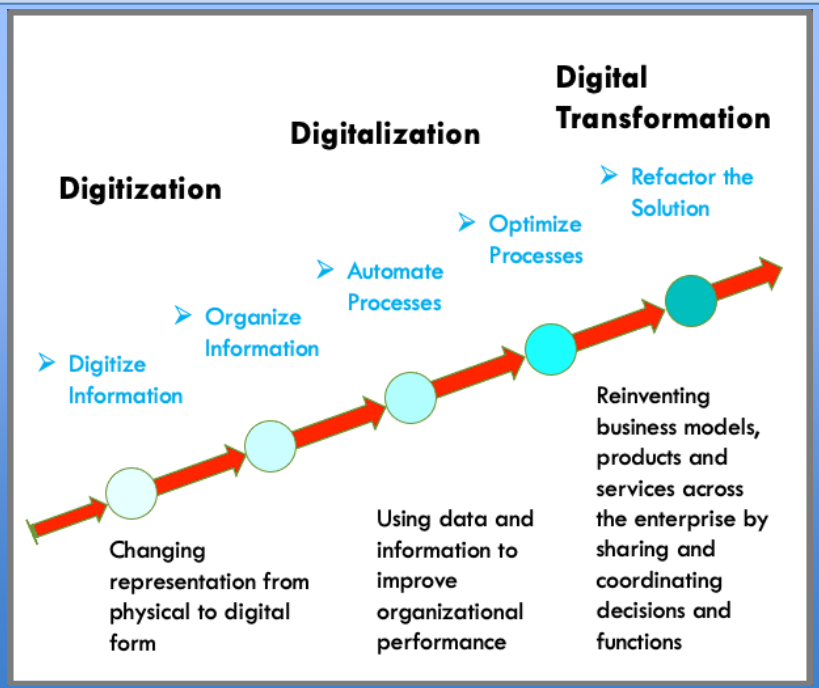
The Digital Revolution – Digital Transformation



The Three Components of the Digital Revolution

- Digital Transformation
- Digitalization
- Digitization

The Digital Revolution – Digital Transformation

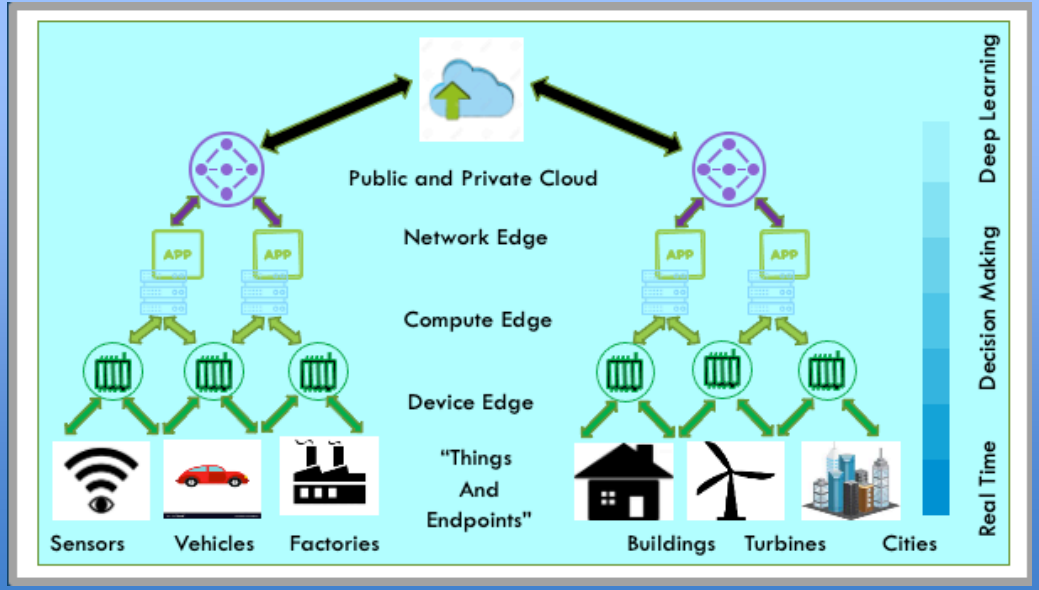


The Three Components of the Digital Revolution

- Digital Transformation
- Digitalization
- Digitization

The Digital Revolution

The intertwining of Communications, Computing, and Storage Technologies

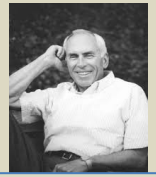


- Futurists and Thinkers

Futurists and Thinkers

Alvin Toffler

Thomas Kuhn



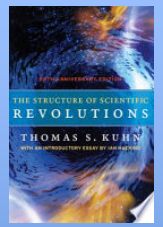
Roy Amara

Derek John de Solla Price

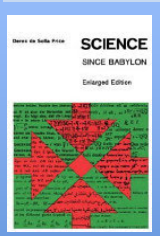
Ray Kurzweil

Futurists and Thinkers

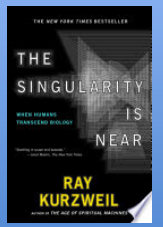
Thomas Kuhn: ”The Structure of Scientific Revolutions”



Derek John de Solla Price: “Science Since Babylon”



Ray Kurzweil: “The Singularity is Near”



Roy Amara: Amara’s Law

"We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run."

Futurists and Thinkers

Alvin Toffler: ”Future Shock”

Quotes

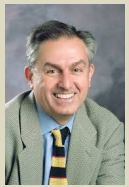
”You’ve got to think about big things while you’re doing small things, so all the small things go in the right direction."

“The future always comes too fast and in the wrong order.”

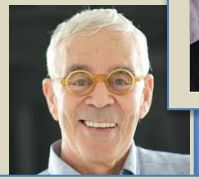
“Technology feeds on itself. Technology makes more Technology possible.”

Futurists and Thinkers

Mary Meeker



Michael Hammer
James Champey



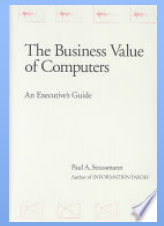
Gideon Gartner

Geoffrey Moore

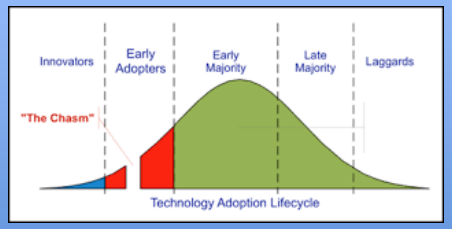
Paul Strassmann

Futurists and Thinkers

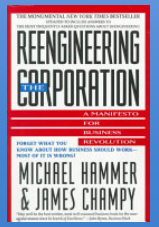
Paul Strassmann: "The Business Value of Computers"



Geoffrey Moore: "Crossing the Chasm"

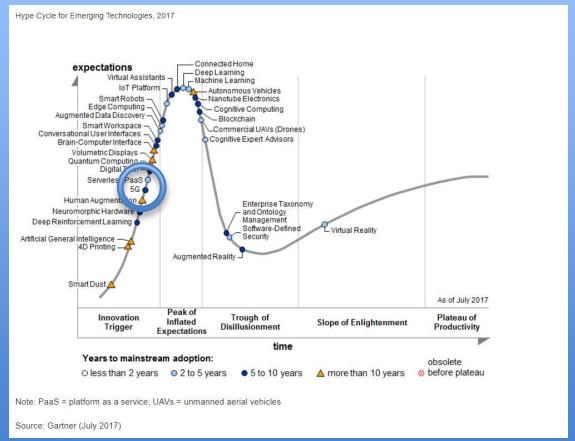


Michael Hammer and James Champey: "Re-engineering the Corporation"



Futurists and Thinkers

Gideon Gartner: The Magic Quadrant and the Hype Curve



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Industrial Transformation and the Digital Revolution

Open Tech Works

Futurists and Thinkers

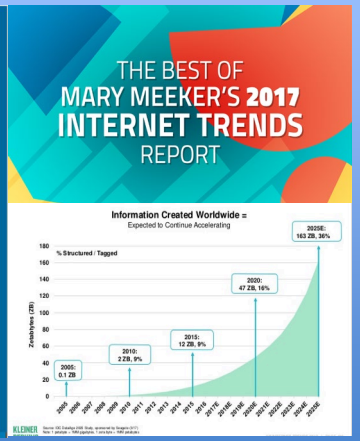
Mary Meeker: "Internet Trends Report"

Internet Trends 2017

1)	**Global Internet Trends** = Solid…Slowing Smartphone Growth	4-9
2)	**Online Advertising (+ Commerce)** = Increasingly Measurable + Actionable	10-80
3)	**Interactive Games** = Motherlode of Tech Product Innovation + Modern Learning	80-150
4)	**Media** = Distribution Disruption @ Torrid Pace	151-177
5)	**The Cloud** = Accelerating Change Across Enterprises	178-192
6)	**China Internet** = Golden Age of Entertainment + Transportation (Provided by Hillhouse Capital)	193-231
7)	**India Internet** = Competition Continues to Intensify…Consumers Winning	232-287
8)	**Healthcare** @ Digital Inflection Point	288-319
9)	**Global Public / Private Internet Companies…**	320-333
10)	**Some Macro Thoughts…**	334-351
11)	**Closing Thoughts…**	352-353

KLEINER PERKINS

KP INTERNET TRENDS 2017 | PAGE 354

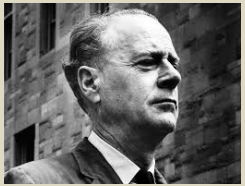


URL: http://www.kpcb.com/internet-trends

A View from Futurists and Thinkers

Grace Hopper

Clayton Christensen



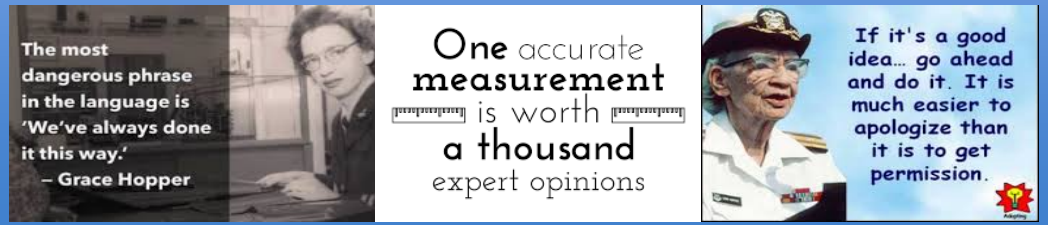
Marshall McLuhan

Winston Churchill

Futurists and Thinkers

Winston Churchill: On Architecture, Process, and Endurance

Grace Hopper: Nature of Change, Leadership, and Facts



Futurists and Thinkers

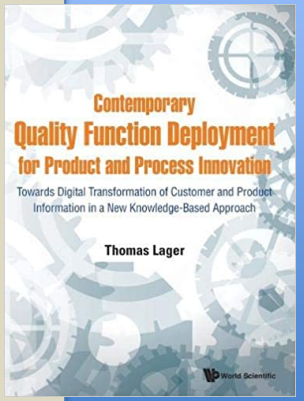
Marshall McLuhan: The importance and impact of Media

Clayton Christensen

- Industrial Transformation

Industrial Transformation

Thomas Lager



New Life and meaning for an old and well-established concept!

Industry 4.0 and beyond

Industrial Transformation

Convergence of Information Technology and Operational Technology

Industrial Transformation

Value and adoption

Manufacturing
Products
Services
Processes

Industrial Transformation

Value and adoption

Many Settings
Many
Different
Requirements

Industrial Transformation

Life Cycle Support – Design, Build, Operate, Upgrade

- Flexibility in Manufacturing Reconfiguration
- Agility in, effectiveness, asset uptime, supply chain optimization, recovery from disruptions, and asset yield.
- Avoiding Risks
- Quality and Compliance
- Automation
- Asset Management, Efficiency and Cost Savings

Functional Benefits as seen from Analyst Surveys

Industrial Transformation

- Improving customer experience
- Better customer engagement, outcomes, and value
- Transitioning to new business models
- Differentiating product and service offerings
- Unique products and services with new highly desirable features
- Safety, regulatory compliance, quality, avoiding product malfunction

Business Benefits as seen from Analyst Surveys

Industrial Transformation

Industry 4.0
Manufacturing
Oriented

Lifecycle View

From Lust to Dust

Industrial Transformation

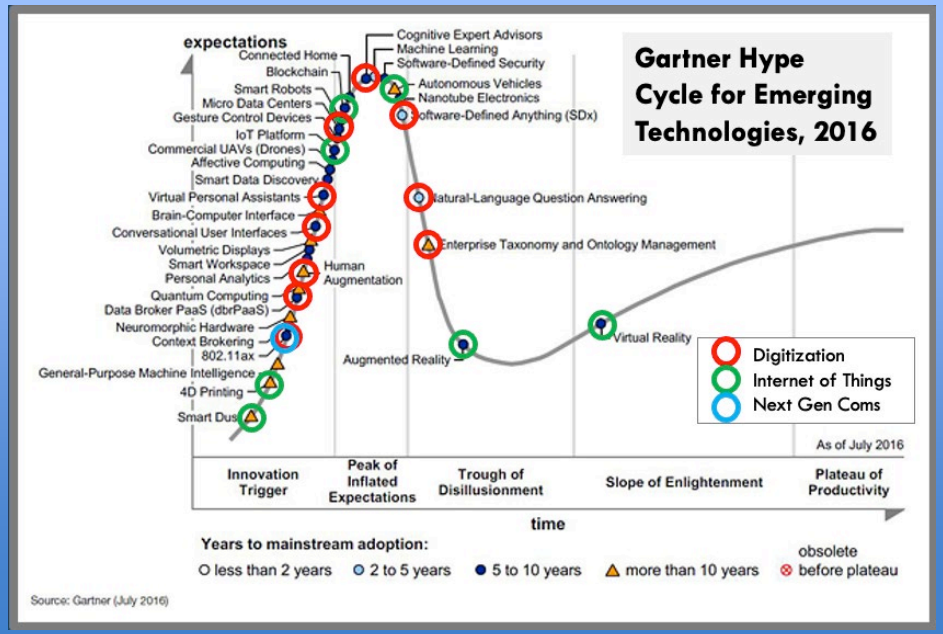
Level	Levels of Maturity and Performance
1.	Providing awareness and pointing to important aspects of situational status, supporting actual analysis and decisions to be made by people. (Situational)
2.	Identifying the cause of the situation or issue reliably, reducing the time to resolution, but leaving the nature of the response to people. (Diagnostic)
3.	Anticipation and identifying situations before they occur, providing the organizations with time to exercise remedial options. (Prognostic)

Industrial Transformation

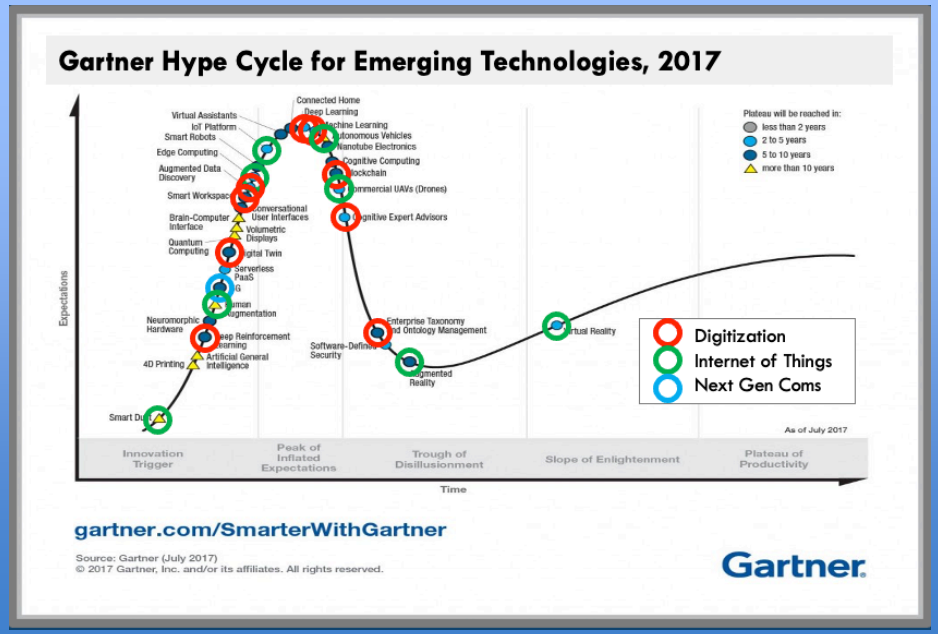
Level	Levels of Maturity and Performance
4.	Discovering problems and at the same time identifying solutions or courses of action and remedies, with people in the loop to authorize. (Prescriptive)
5.	Improving and optimizing on a continuous basis, and discovering through learning alternate, and sometimes unexpected paths to better outcomes (Autonomic)

- Technologies in Focus

Technologies in Focus



Technologies in Focus



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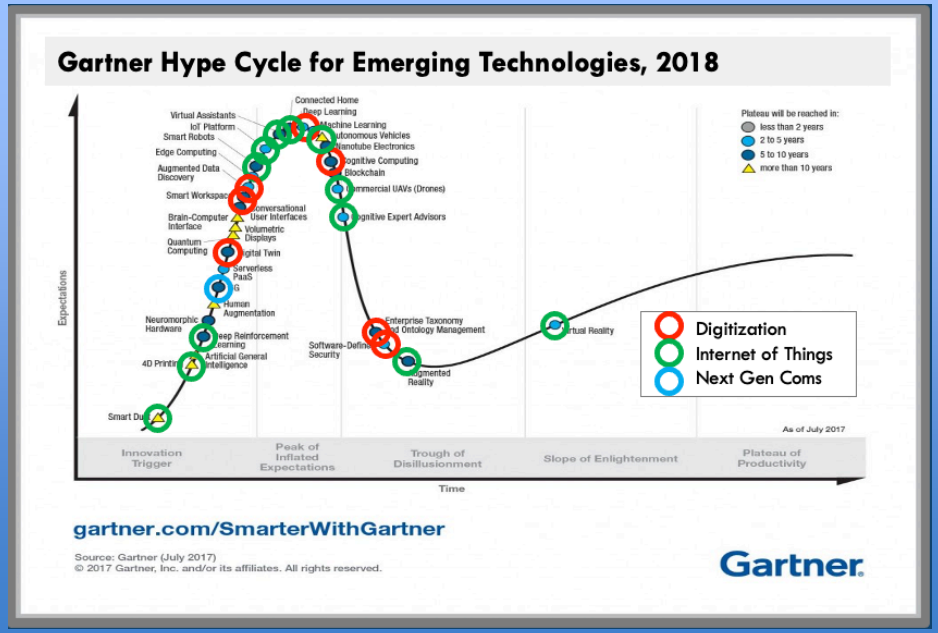
Industrial Transformation and the Digital Revolution

Technologies in Focus



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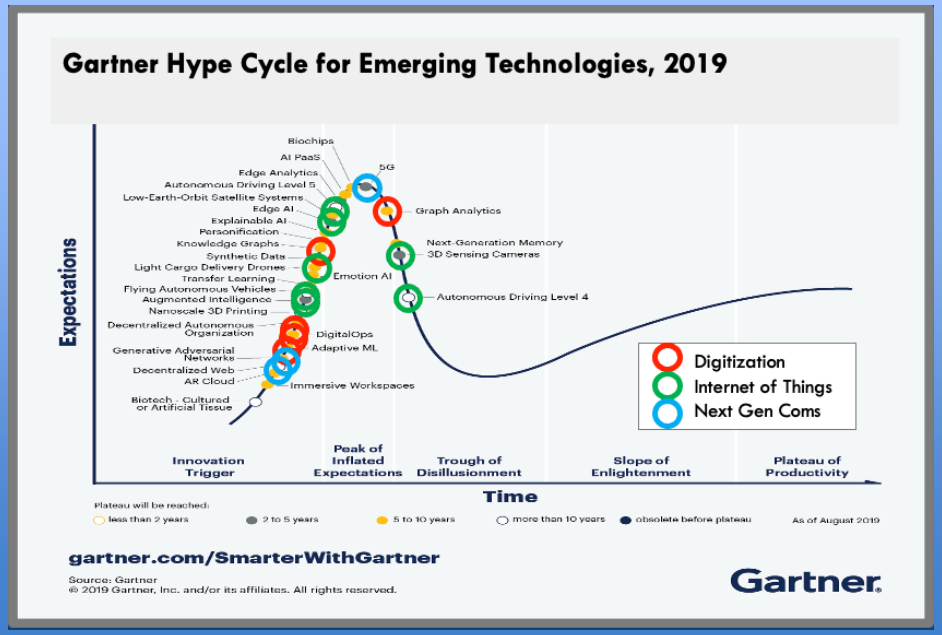
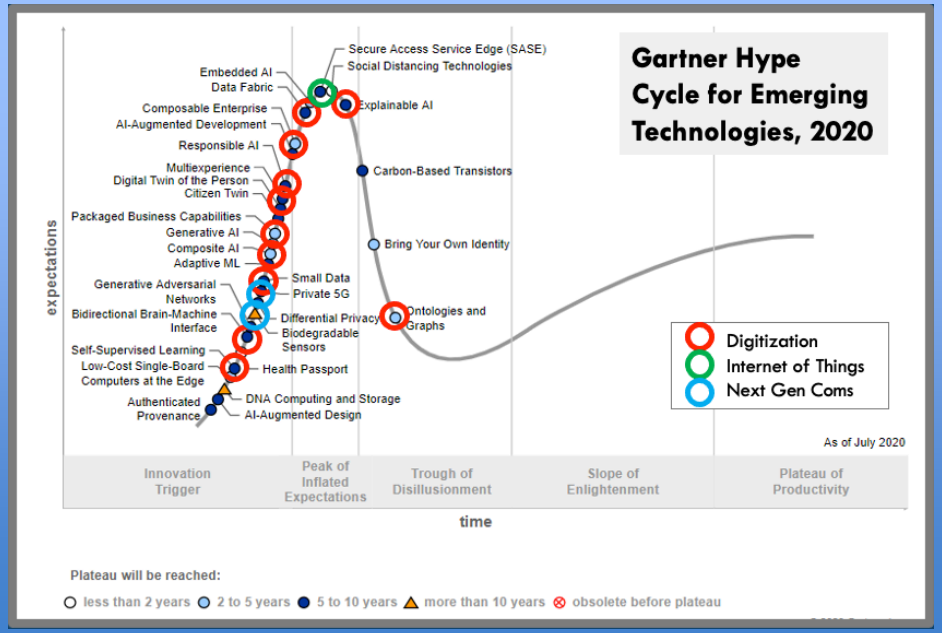
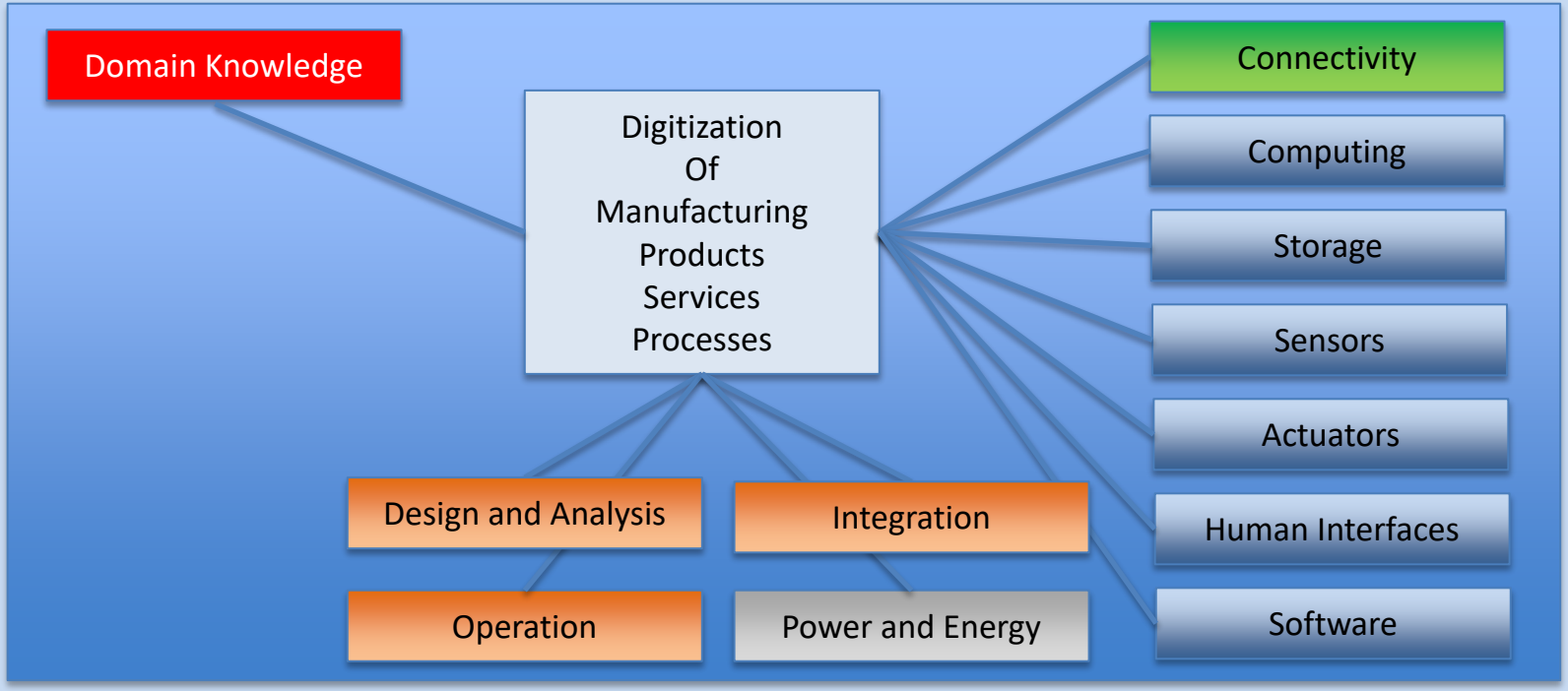


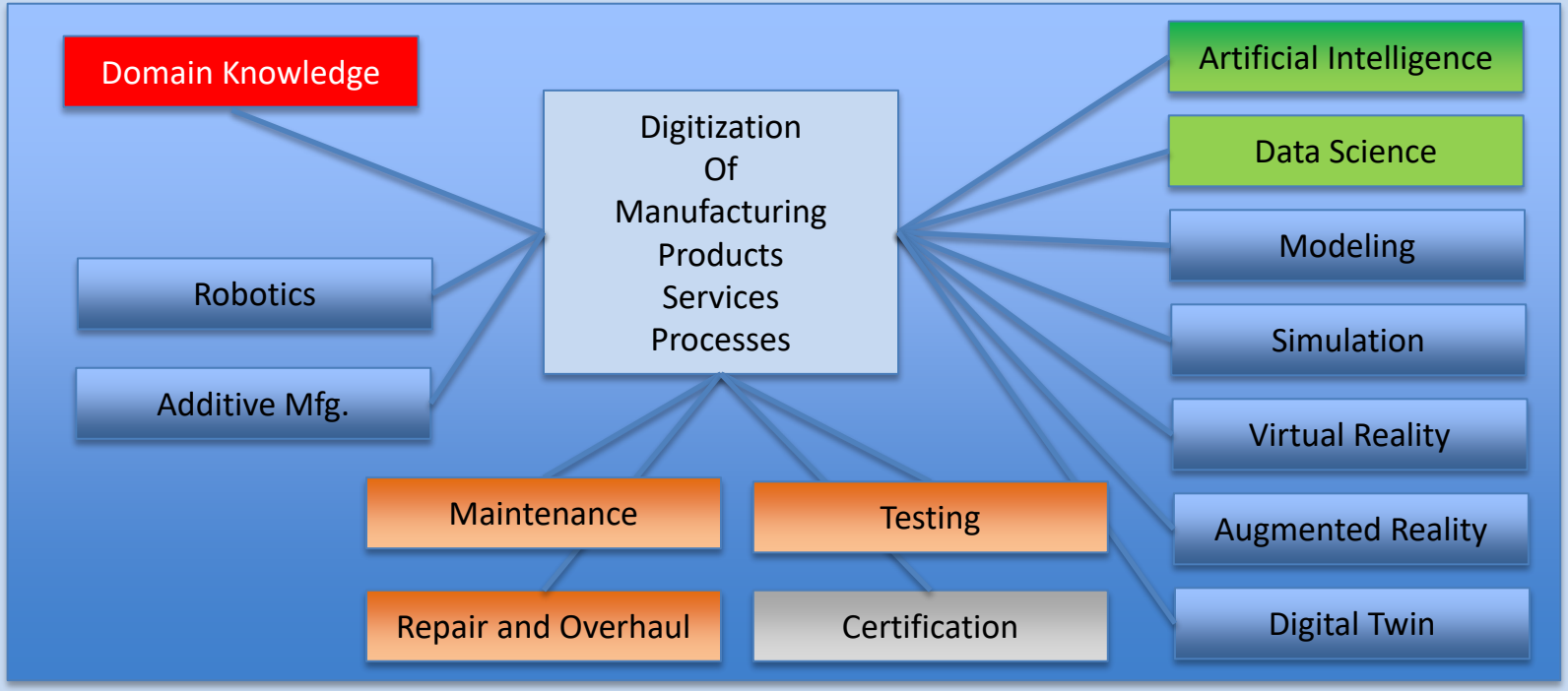
Technologies in Focus



Technologies in Focus



Technologies in Focus – Enablers



Technologies in Focus

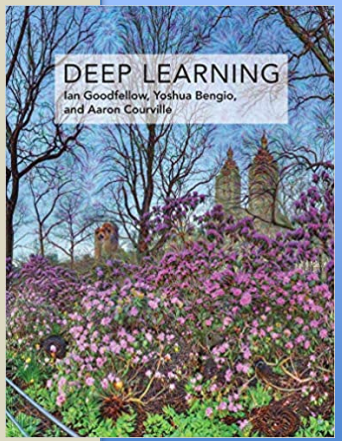
Data is the new Oil

Data May Be The New Oil But Artificial Intelligence Is The Engine That It Fuels

Technologies in Focus

Ian Goodfellow
Yoshua Bengio
Aaron Courville

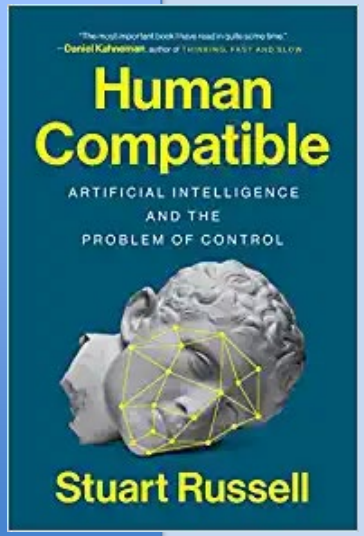
Technical Foundations of ML



Technologies in Focus

Stuart Russell

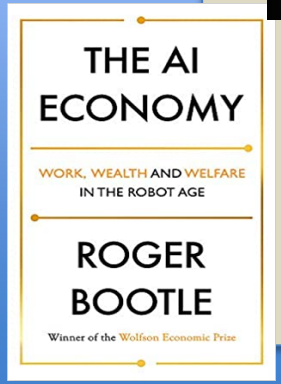
The weaknesses in AI/ML, the consequences, and how to fix them.



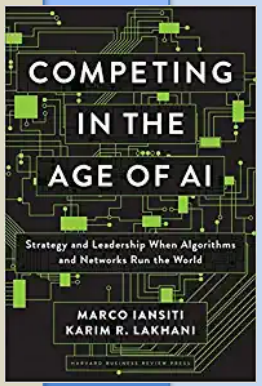
Technologies in Focus

Economic and Business Views

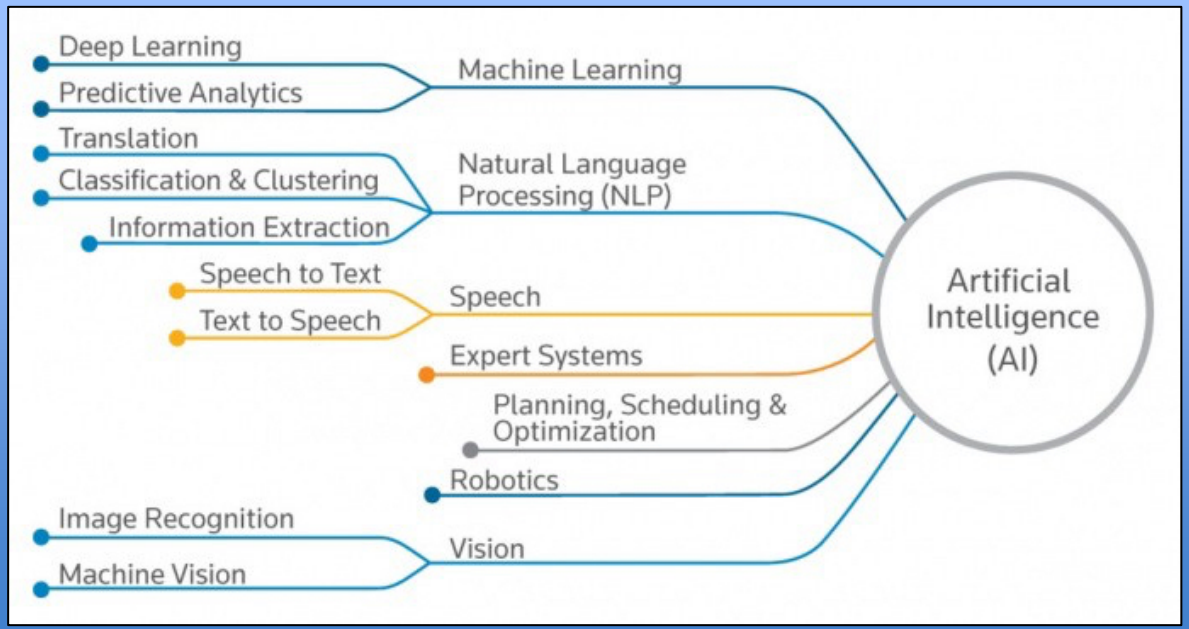
Roger Bootle



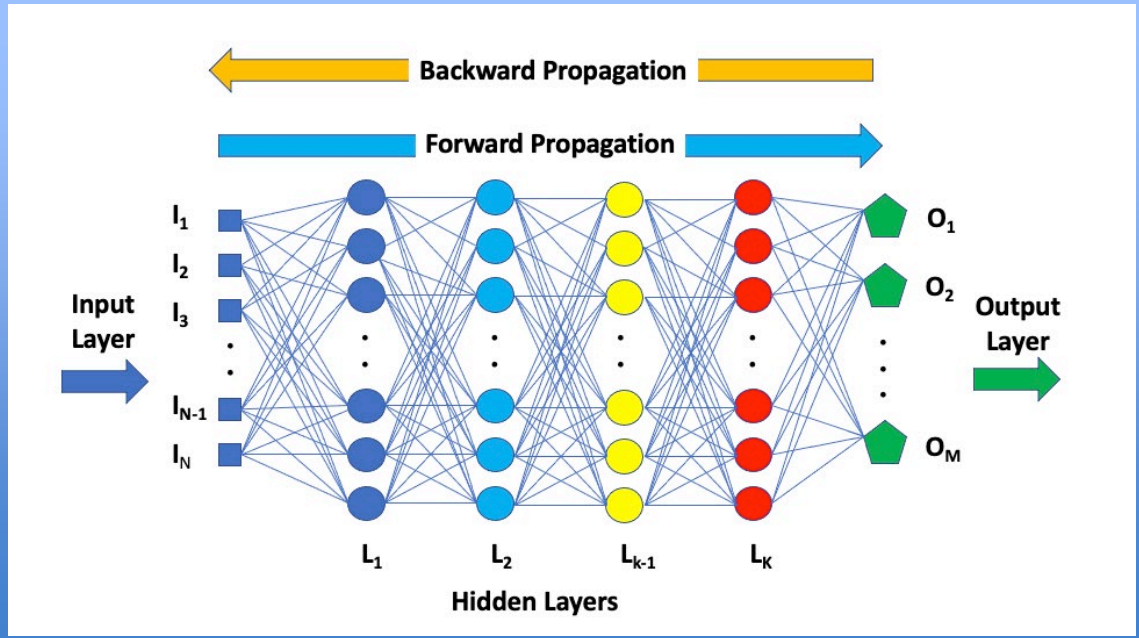
Marco Iansiti



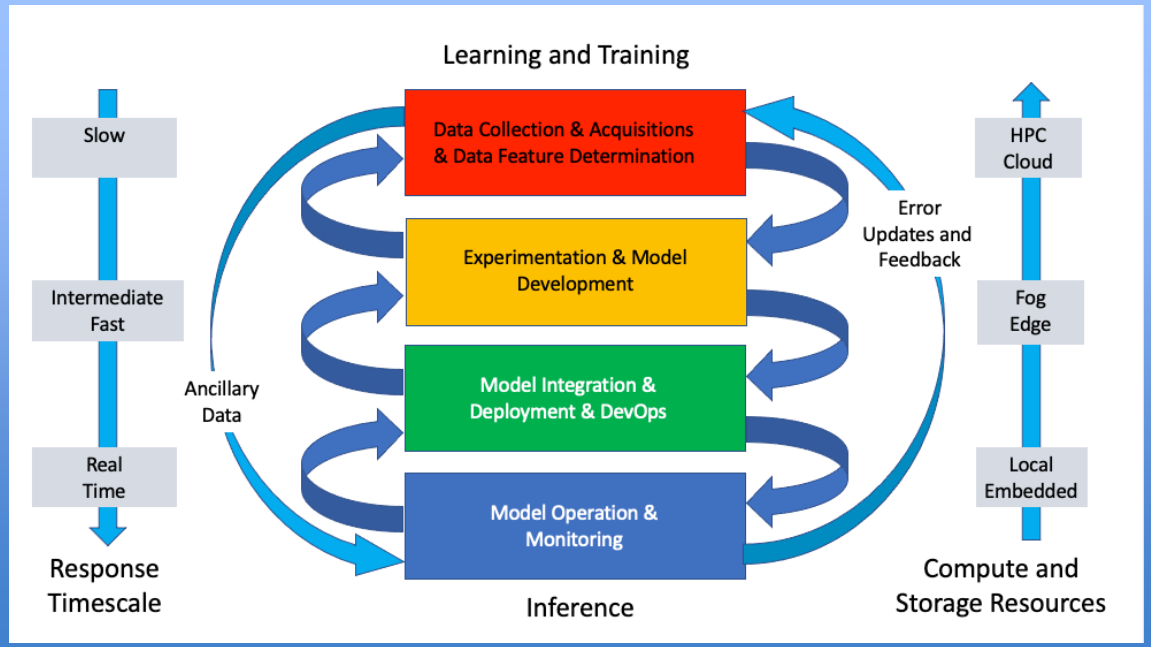
Technologies in Focus – Artificial Intelligence



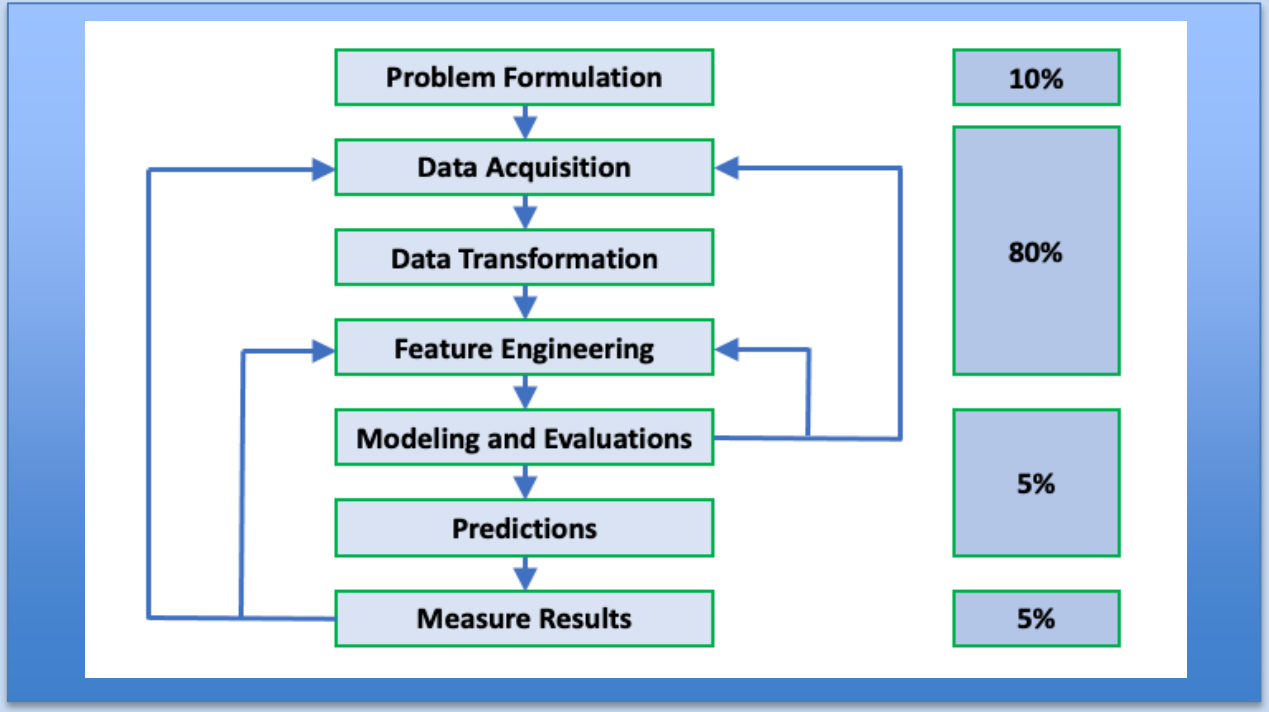
Technologies in Focus – Artificial Intelligence



Technologies in Focus – Artificial Intelligence



Technologies in Focus – Artificial Intelligence



Technologies in Focus – Artificial Intelligence

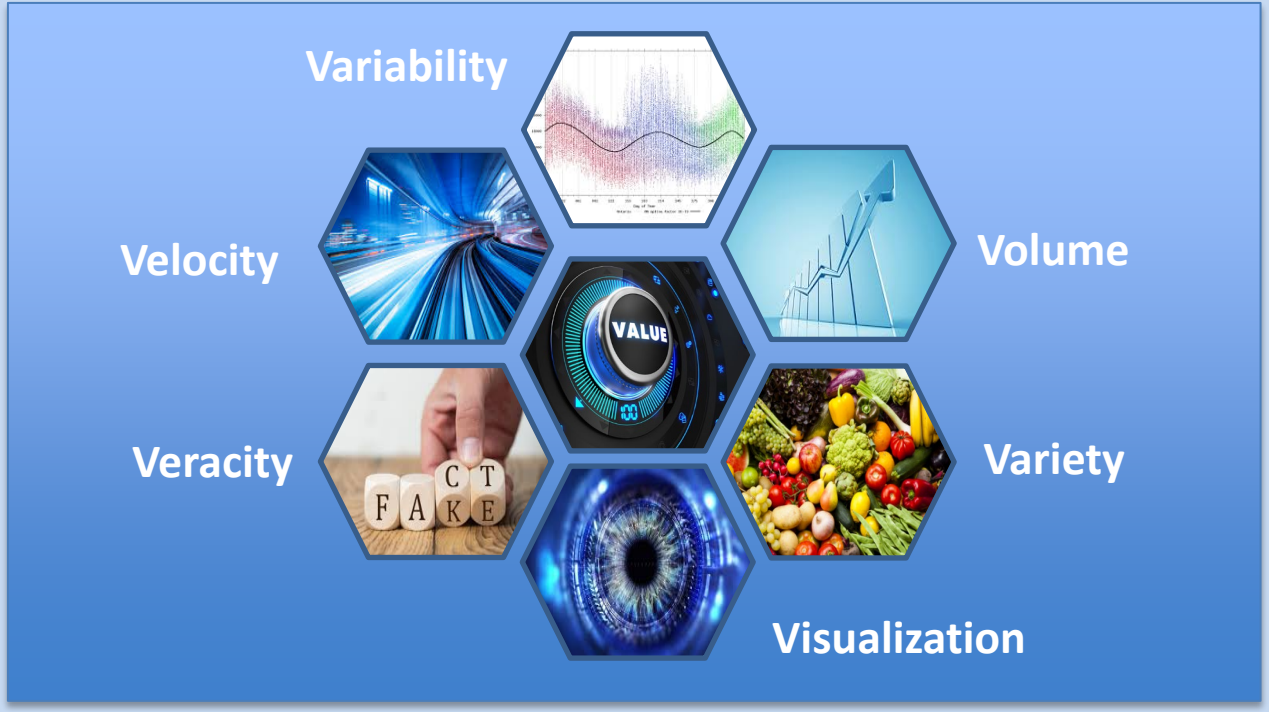
Focusing just on ML aspects of AI

- Great at pattern recognition but does not lead to cause and effect understanding
- Useful done in conjunction with modelling and emulation methods and domain expertise for intuition – they provide constraints and commonsense
- ML results sometimes fail – how can we understand why and how can we fix it?

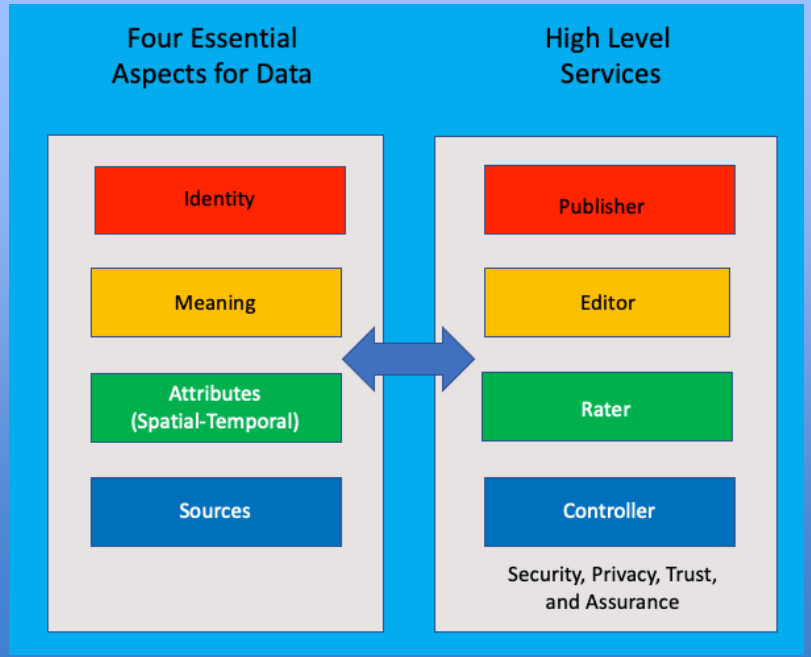
Technologies in Focus – Data Science and Engineering

- Over 90% of Data Stored Digitally was created in the last two years
- Between 2% and 4% of that Data was used
- Less than 0.1% of that data was analyzed
- Between 25million and 50 million people around the world were involved in collecting and curating data.

Technologies in Focus – Data Science and Engineering



Technologies in Focus – Data Science and Engineering

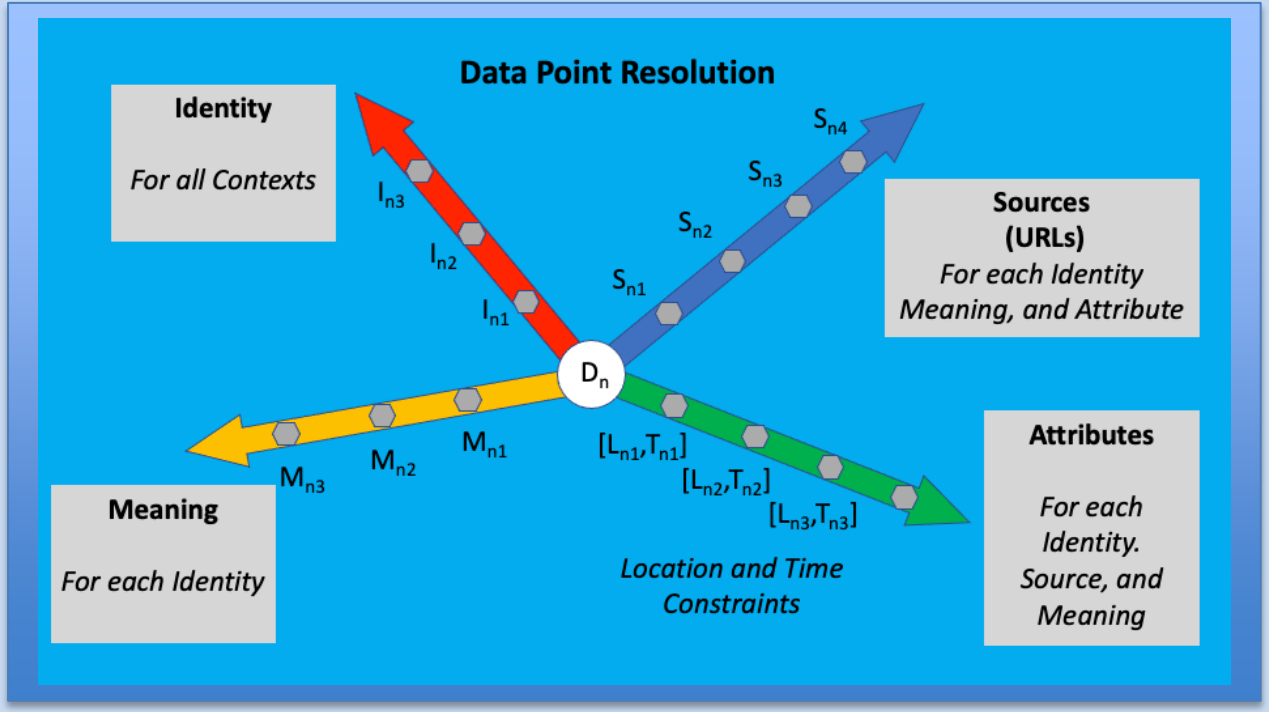


Essential Services To Make the Data Useful

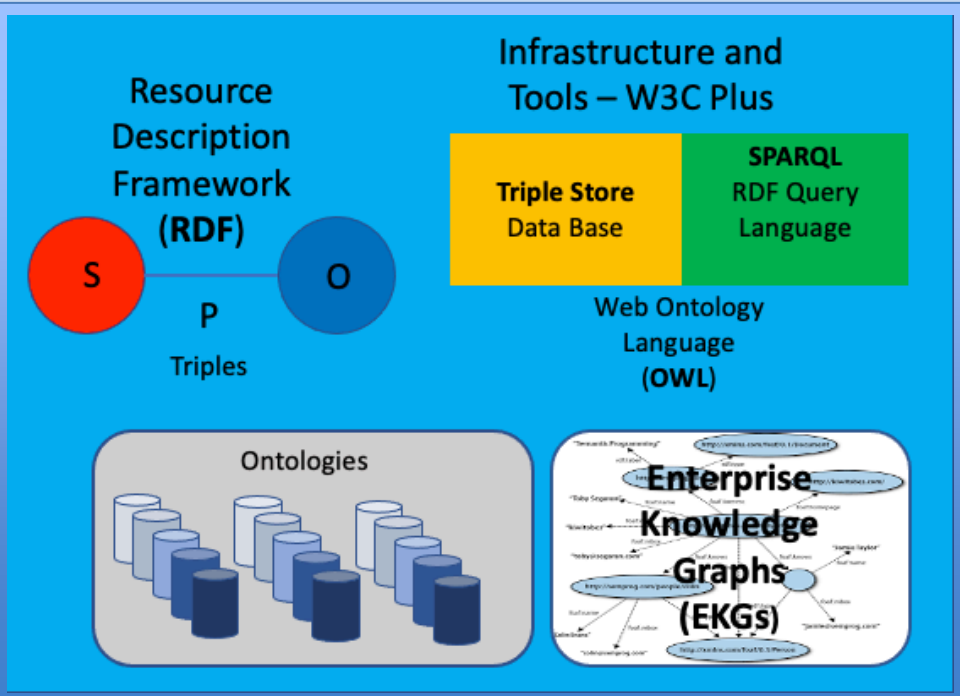
Technologies in Focus – Data Science and Engineering

The Atomic Building Blocks Are In The Data

And Its Resolution



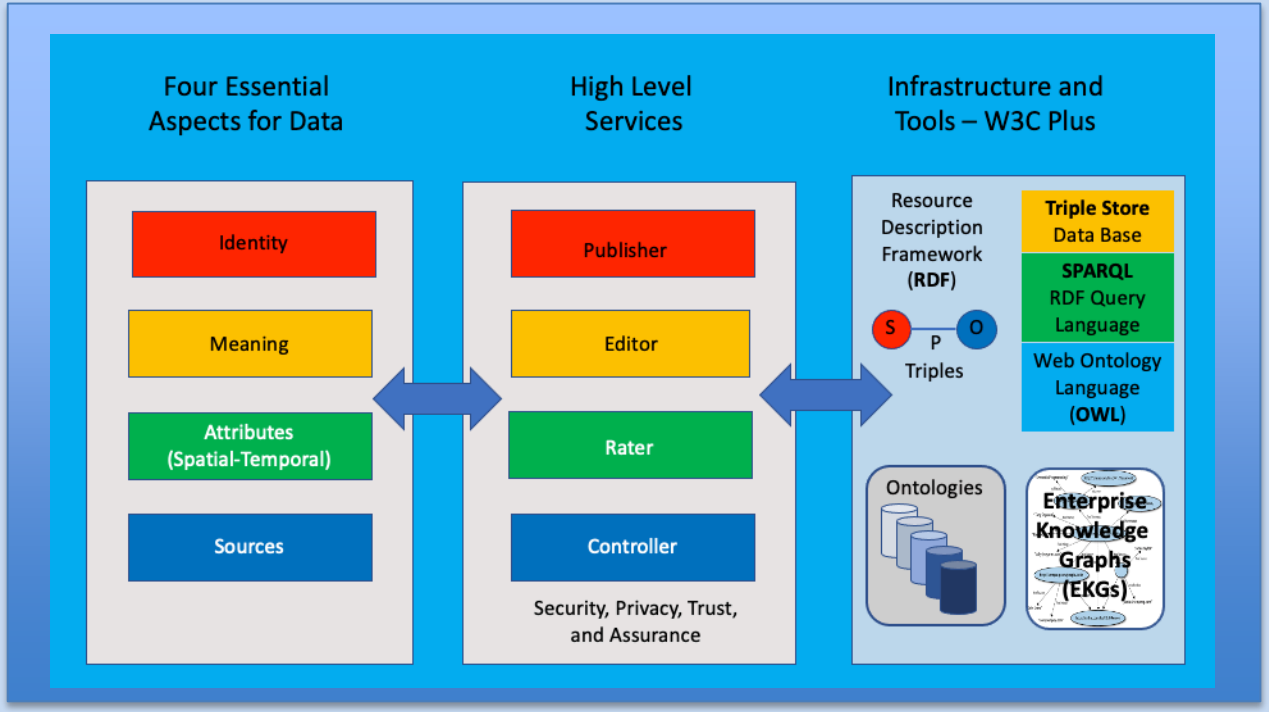
Technologies in Focus – Data Science and Engineering



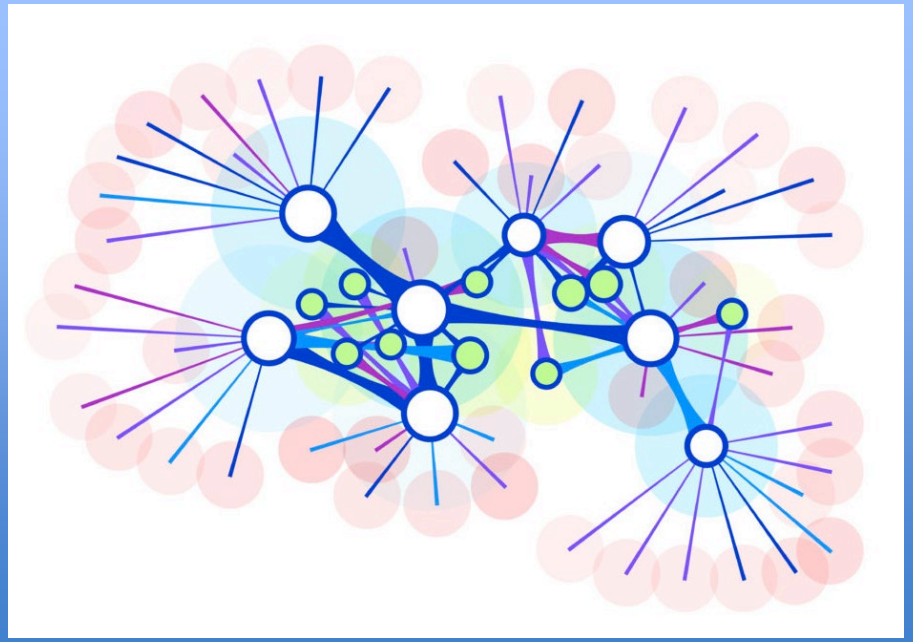
Established Foundations

Technologies in Focus – Data Science and Engineering

A System View



Technologies in Focus – Data Science and Engineering



The Value of Enterprise Graph Technology

- Uncovering of Relationships and Patterns
- Feature extraction
- Elimination of silos
- Reuse of Data
- Fact and data-based decision making

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Industrial Transformation and the Digital Revolution

Open Tech Works