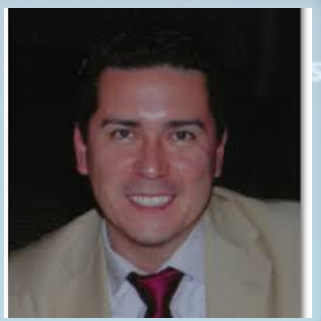
IoT Week 2017 – Day 2 Session: 16:15-17:15 Room 2
Panel Emerging IoT Researches and Technologies Big Data
IoT and Big Data | International Conference Centre of Geneva (CICG)

Dr. Martin Serrano

Principal Investigator and Data Scientist
Insight Centre for Data Analytics, Ireland
<martin.serrano@nuigalway.ie>



Dr. Martin Serrano

IoT & Stream Processing Unit Head

Chair IEEE ComSoC IoT Experientation

OASC Board Member, Ireland

IEEE ComSoc
Emerging Technologies Chapter
Sub-Committee Internet of Things IoT Experimentation

2016

siliconrepublic

25 key people influencing the internet of things

by John Kennedy

6 OCT 2015 936 SHARES

Irish and Ireland-based leaders, scientists and technologists are putting the country on the global map in terms of the internet of things (IoT) revolution.

NIST GCTC Smart Cities Project, Technical Coordinator, USA

R+D+I Advisor, Dew Mobility, Fremont, Ca USA

Santa Clara University Lecturer, Silicon Valley, USA

2015

Research Excellence
President's Award Nominee SFI-NUIG, Ireland

2014

Industry

Irish Software Association · Ibec
SHORTLISTED
ISA Software Industry Awards 2014

IoT Scientific Director, Galway, Ireland
NUIG-National University of Ireland

Irish Software Association
Software Industry Awards outstanding Academic Achievement Nominee, Ireland

Industry

NATIONAL Panasonic
Kumamoto, Japan
Design Engineer Supervisor, AKME-BC

California State University
Lecturer, San Luis Obispo (CalPoly), USA

MIT-IoT Hackaton
IoT Best Industry Solution
IoT Media Lab, Cambridge, Ma. U.S.A

2013

WIT-Waterford Institute of Technology
Cloud Computing & Semantics
Researcher, Ireland

Insight

DCU

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UCD DUBLIN

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Big Data and IoT

...Big Data

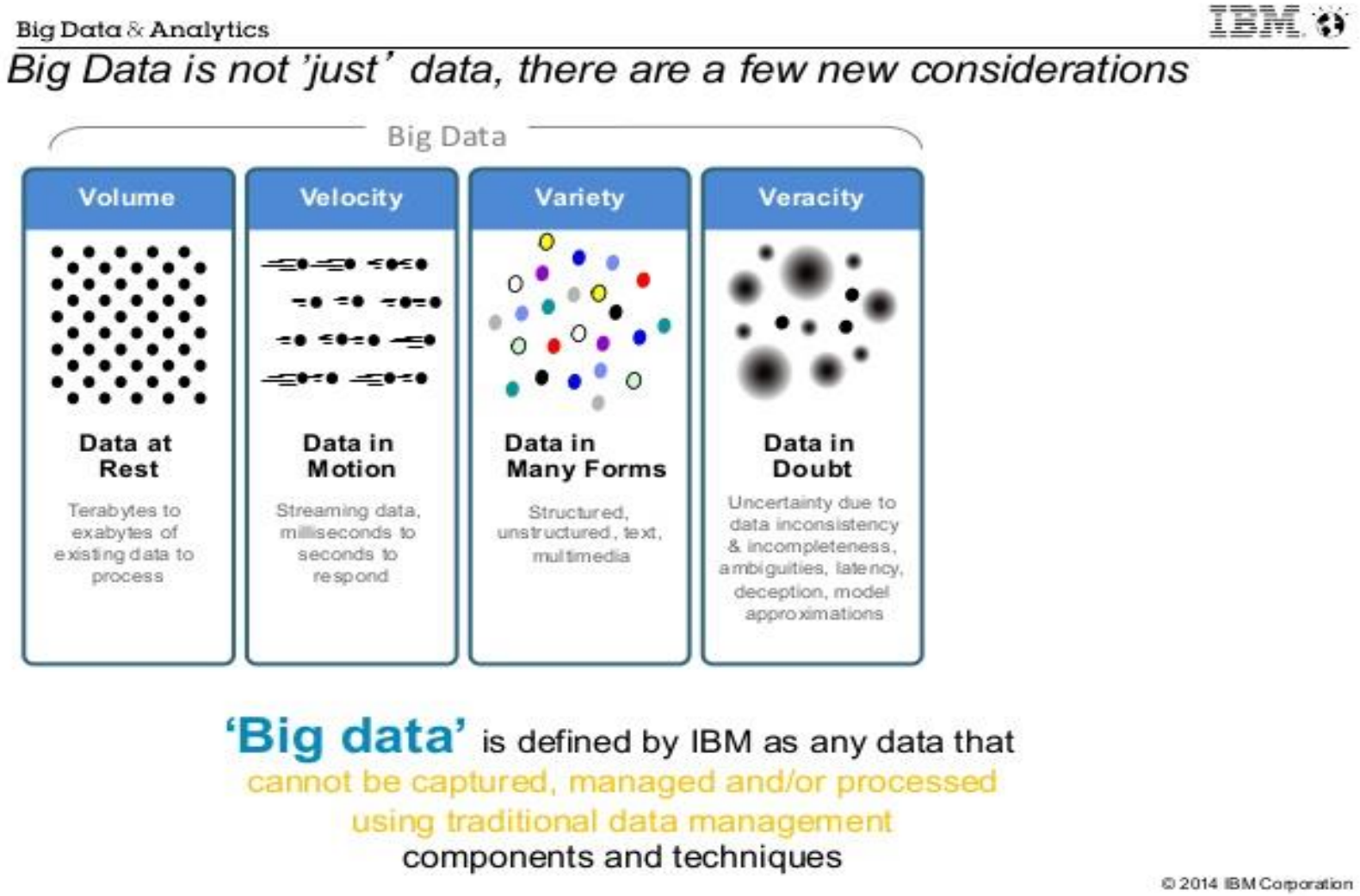
How big is Big Data?

Production of Big Data

IoT Big Data for Healthcare...

Conclusions

Big Data


Big Data & Analytics
IBM
Big Data is not 'just' data, there are a few new considerations
Big Data
Volume
Velocity
Variety
Veracity
Data at Rest
Terabytes to exabytes of existing data to process
Data in Motion
Streaming data, milliseconds to seconds to respond
Data in Many Forms
Structured, unstructured, text, multimedia
Data in Doubt
Uncertainty due to data inconsistency & incompleteness, ambiguities, latency, deception, model approximations
'Big data' is defined by IBM as any data that cannot be captured, managed and/or processed using traditional data management components and techniques
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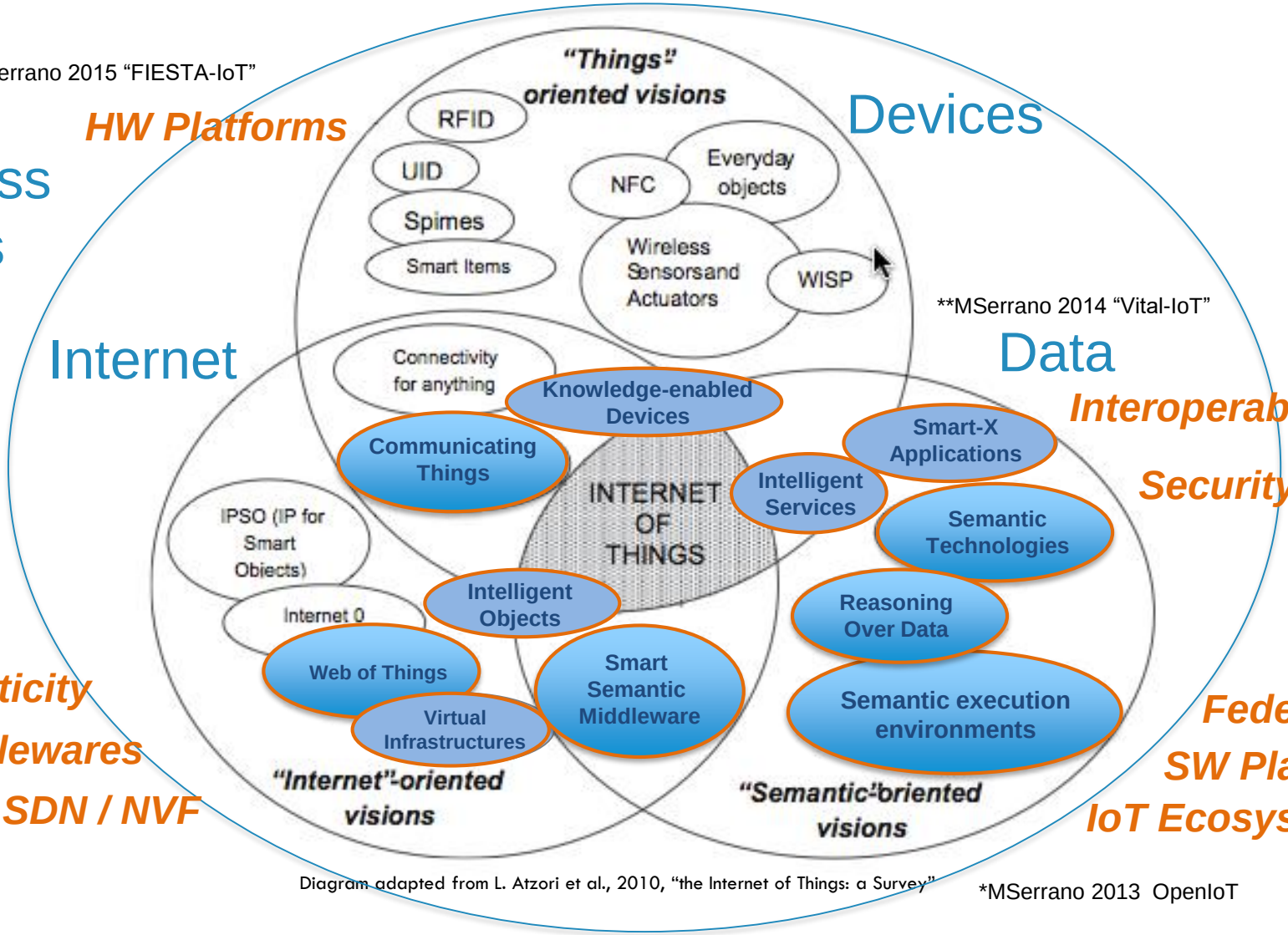
IoT: One Paradigm, Different Visions

***MServrano 2015 “FIESTA-IoT”

HW Platforms

Business Models

Devices



**MServrano 2014 “Vital-IoT”

Data

Interoperability

Security

Elasticity

Middlewares

SDN / NVF

Federation

SW Platforms

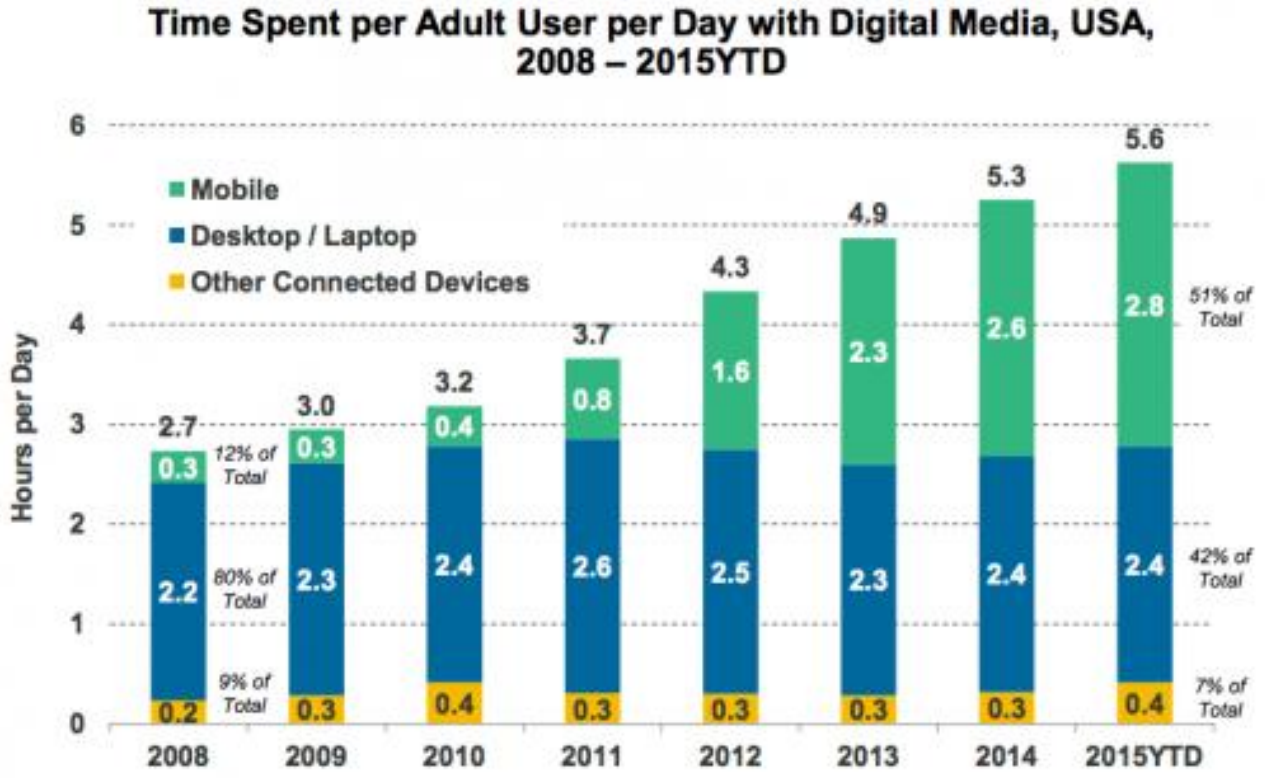
IoT Ecosystems

Diagram adapted from L. Atzori et al., 2010, “the Internet of Things: a Survey”

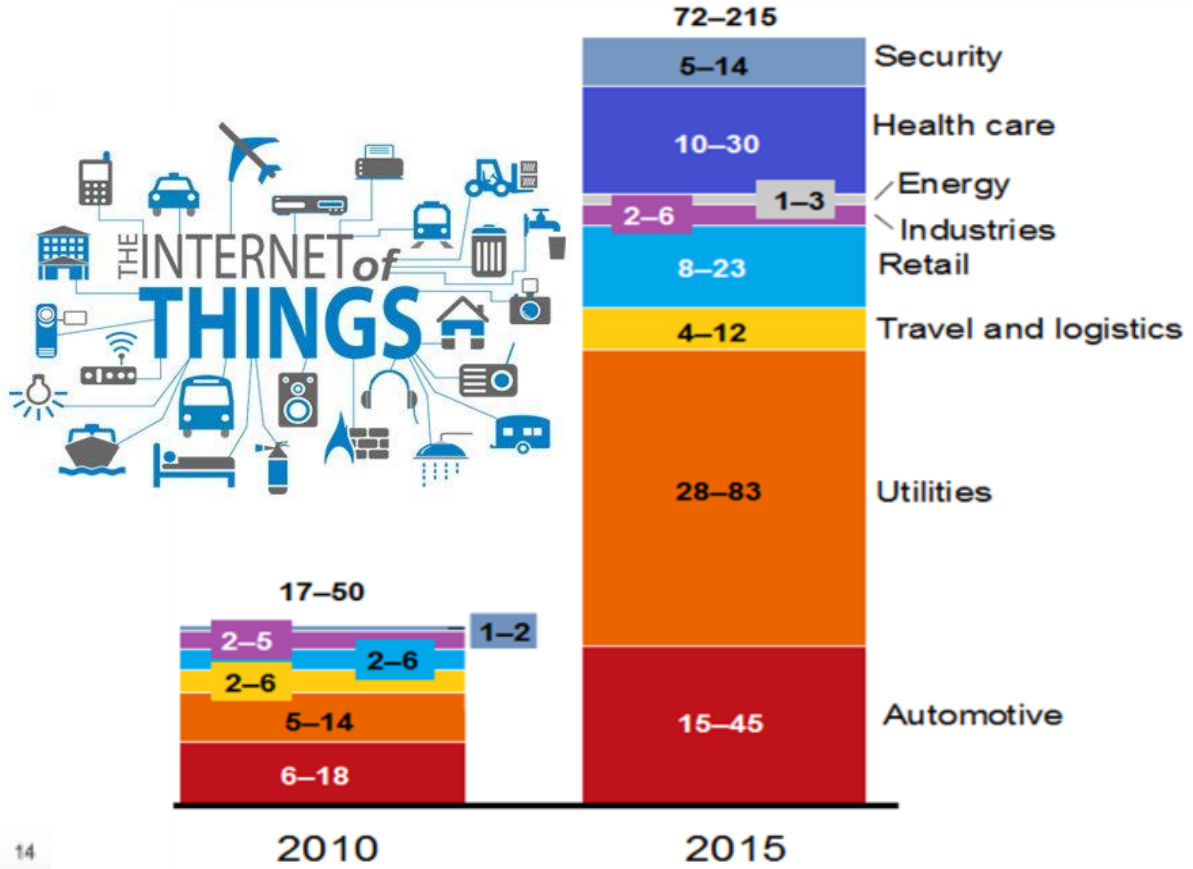
*MServrano 2013 OpenIoT

Internet usage growth vs Data Production

Internet *Usage* (Engagement) Growth Solid
+11% Y/Y = Mobile @ 3 Hours / Day per User vs. <1 Five Years Ago, USA



Device Data production in the world (Number of Sensor/Devices in Millions)



http://www.nojitter.com/post/240152248/big-data-internet-of-things-the-network-impact

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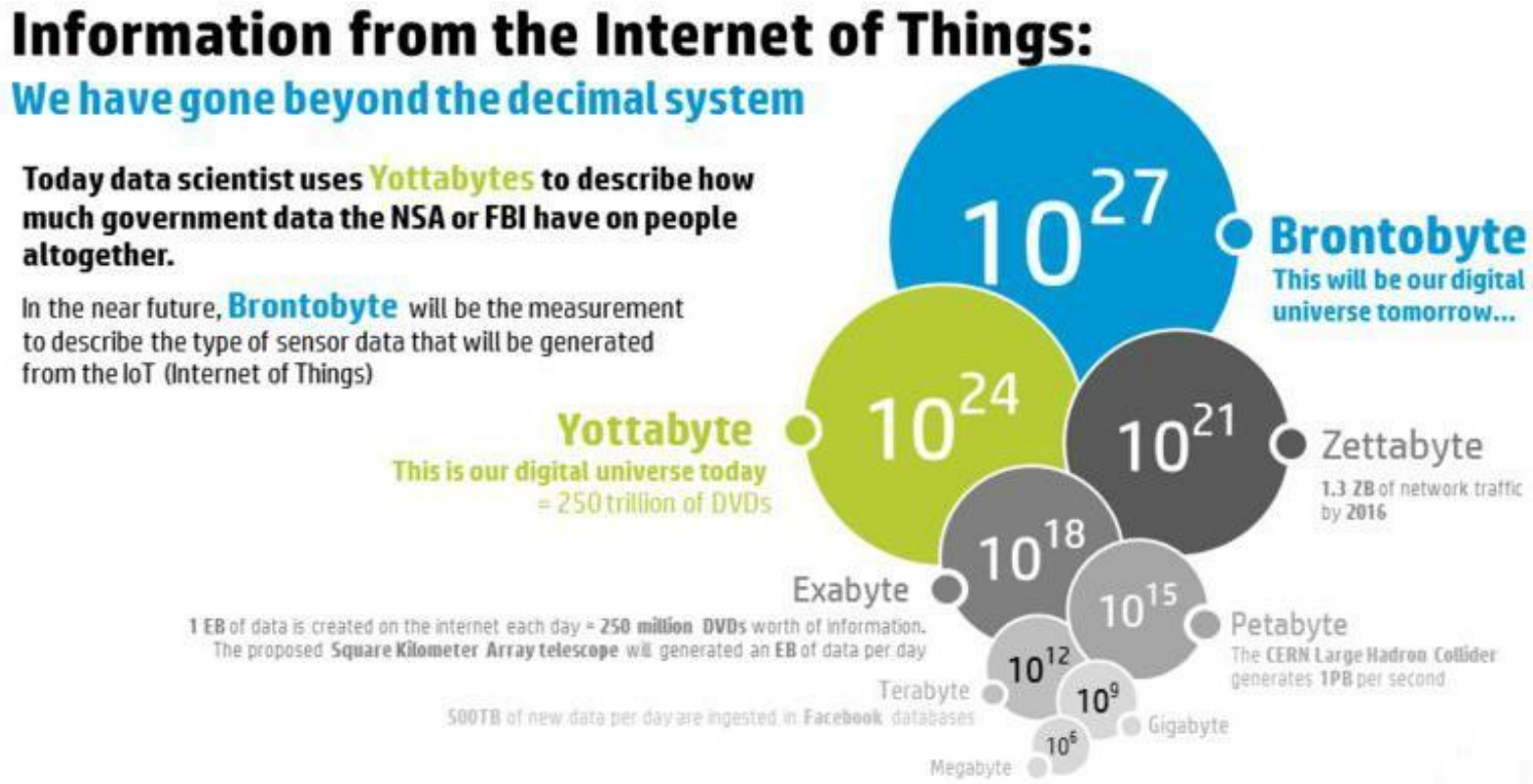
How Big is Big Data?

The units for measuring Big Data

“The amount of data stored in the U.S. in 2010...
about 3,500 Petabytes is equal to the big data storage for all the rest of the world combined.” (A petabyte is 1 million gigabytes)

Sensing as a Service and Big Data,” Arkady Zaslavsky, Charith Perera, and Dimitrios Georgakopoulos, Research School of Computer Science at The Australian National University.



1 Petabyte = 1 000 000 000 000 000 bytes
1 Terabyte = 1 000 000 000 000 bytes
1 Gigabyte = 1 000 000 000 bytes
1 Megabyte = 1 000 000 bytes

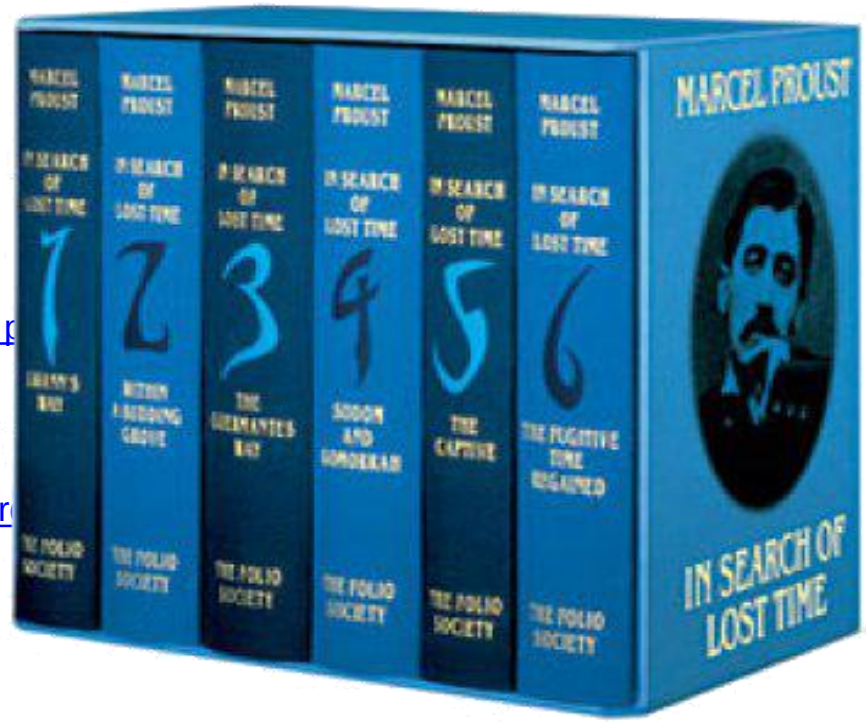
Big Data Readers

1 TERA byte = 1,000 gigabytes

Word Document Pages
85,899,345 pages of Word documents would fill one terabyte

Book title	Author	Edition/publisher
À la recherche du temps perdu volumes	Marcel Proust	Gallimard (Collection Folio edition, 1988–1990) 3,031 p

Page size	Word count	Language	Notes
7.0 inches (17.8 cm) x 5.0 inches (12.7 cm)	1,267,069	French	Guinness World Recor Longest Novel.



85,899,345 pages / 3031 pages = 28340.26 Guinness novels can be stored

A long book of 1214 pages which means it could archive about 70,757 similar size books.
It can read in Two months, So the entire library may take 141,514 months or 11,792 years.

“If a human read one book per week during 100 years would end reading only 5200 books”

Big Data Listeners and Watchers

1 TERA byte = 1,000 gigabytes

Music Files
Assuming that an average song takes up five megabytes,
one terabyte could fit approximately 200,000 songs or 17,000 hours of music.

60min / 3 min average song = 20 Songs / hour then
24 hours = 480 songs a day,
480 songs x 365 Days = 175,200 Songs
“Assuming a human non-stop listening songs today 1T = 1+ year Continuously”

Movies
You could fit approximately 500 hours worth of movies on one terabyte.
Assuming each movie is roughly 100 minutes long, that would be about 300 movies.

“If a human watch a movie/day a terabyte can store almost the video library of a year”

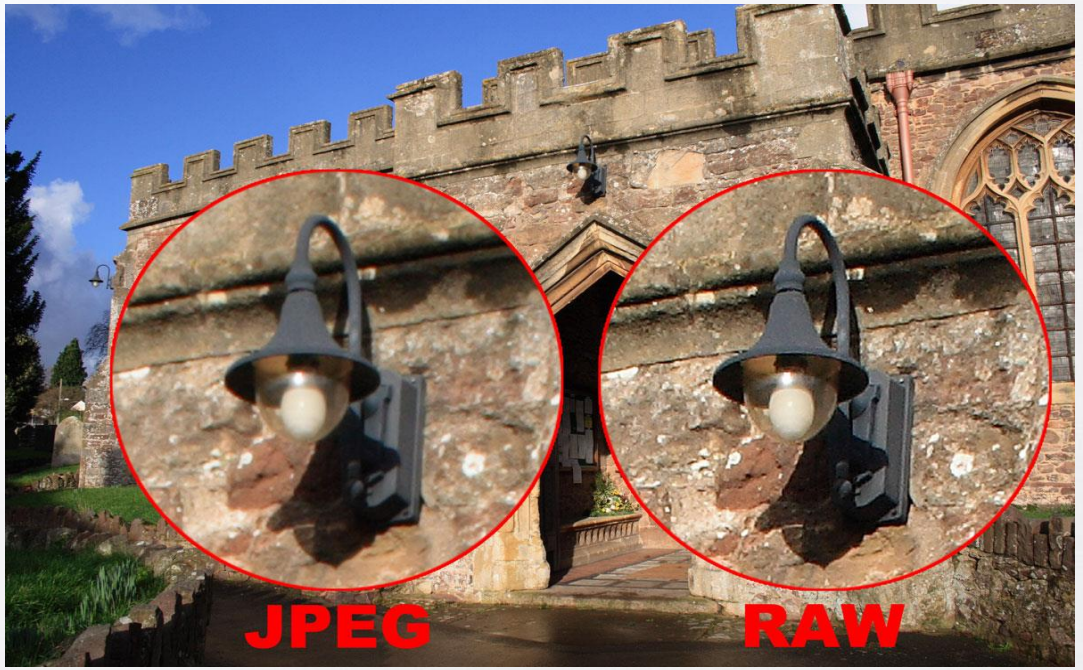
Big Data Image Addicts (Selfies)

1 TERA byte = 1,000 gigabytes

Pictures
Depends on the compression format in one terabyte:

Compressed JPEG
(is the most common file format for consumer cameras.)

5MP	1.5	megabytes	500 000 Photos (Approximately)
22MP	6.6	megabytes	150 000 Photos (Approximately)



"If a human takes a selfie at every awake hour (16 Selfies / day) at 5MP a terabyte can store 85 years of selfies"

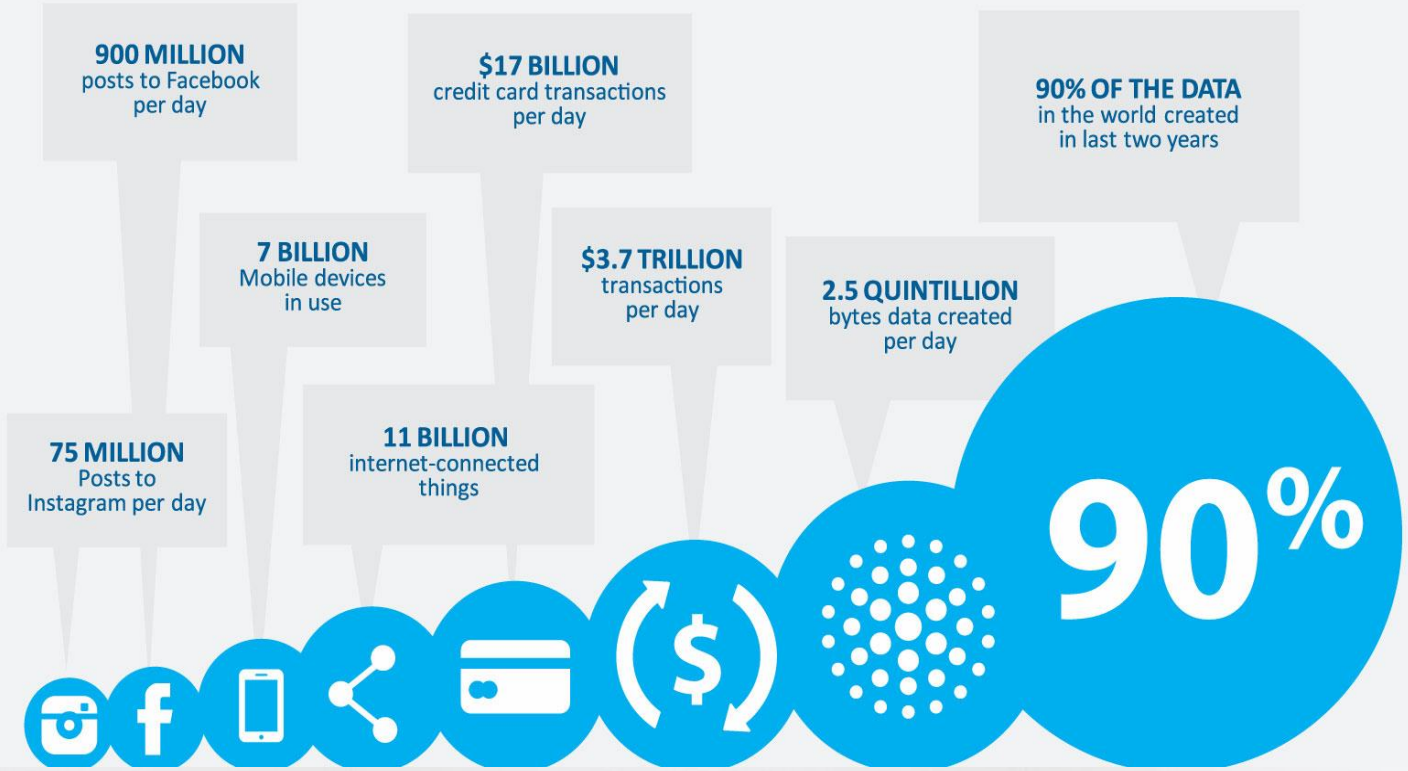
Uncompressed RAW

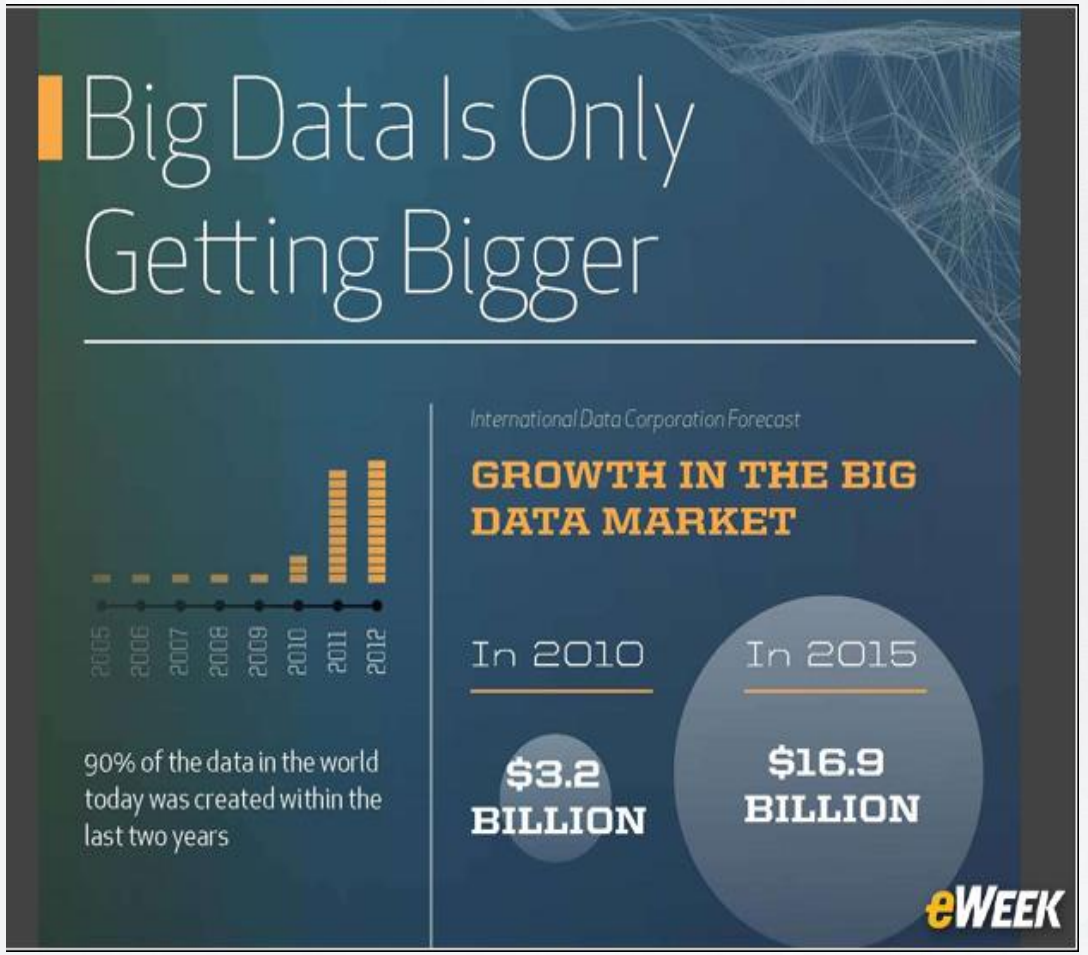
5MP	15.0 megabytes	60 000 Photos (Approximately)
22MP	66.0 megabytes	15 000 photos (Approximately)

"If a human takes a selfie everyday at 5MP a terabyte can store 164 years of selfies"

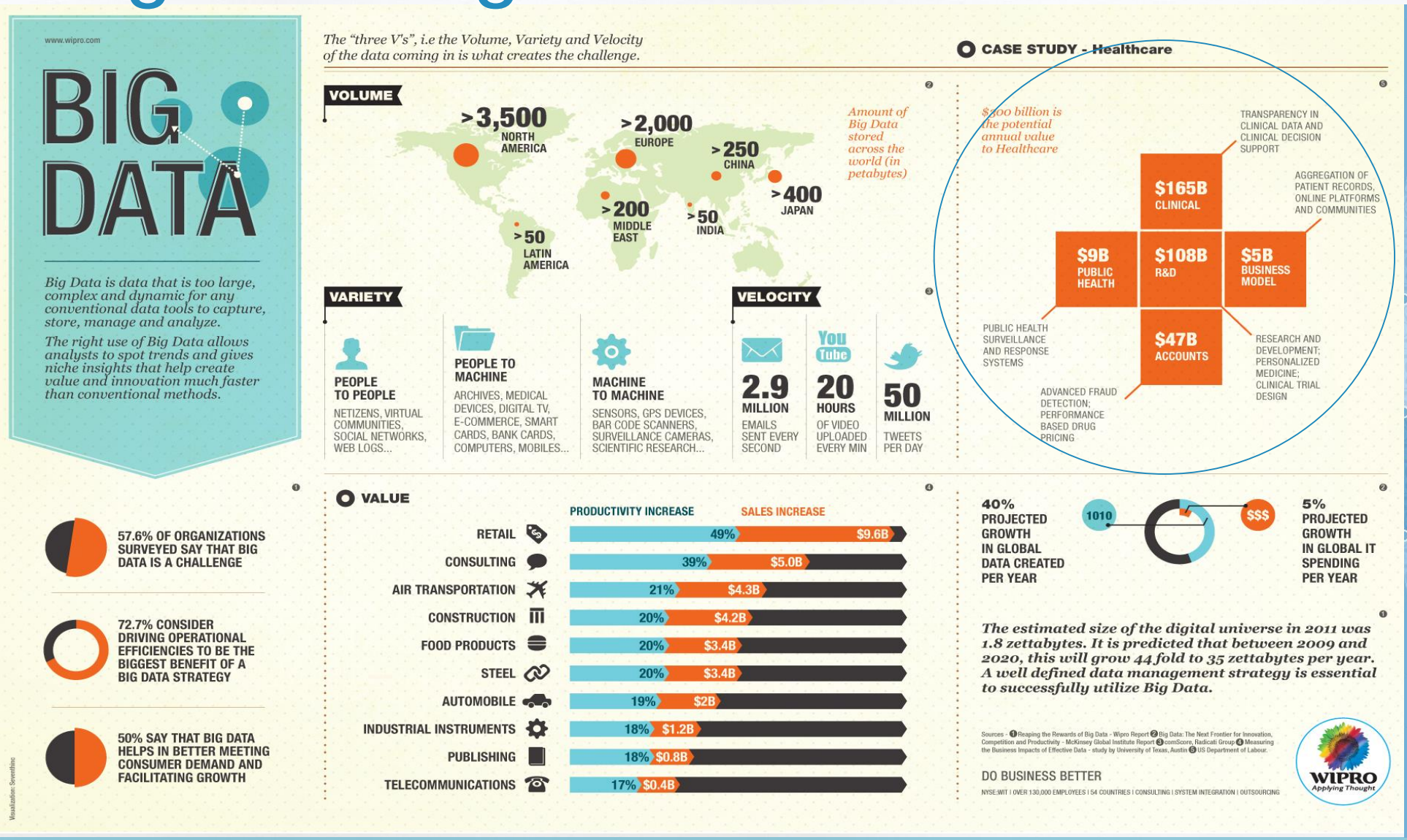
Data Production in the Internet

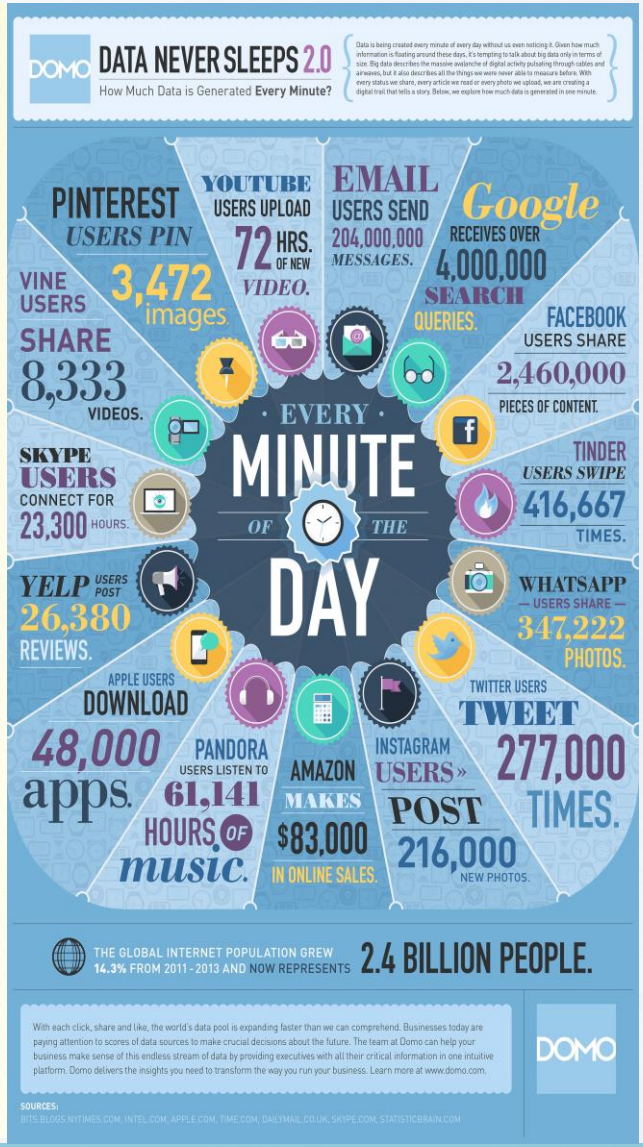
Who is producing the Big Data?





Big Data Figures





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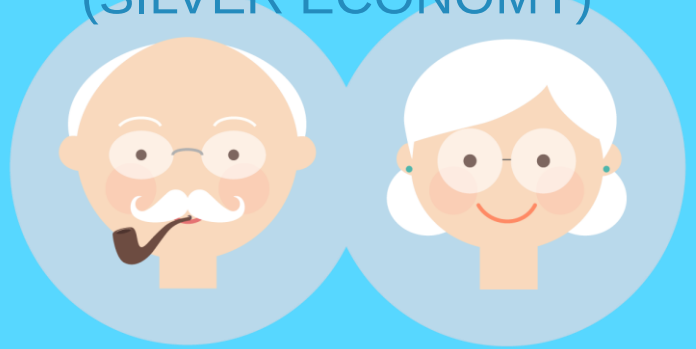
ACTIVAGE CONTEXT

ACTivating InnoVative IoT smart living Environments for AGEing well

"Activity is Medicine"

SILVER SOCIETY

(SILVER ECONOMY)



ACTIVE and HEALTHY AGEING (AHA)

ACTIVAGE Project in FIGURES

9 Deployment Sites

46 Partners

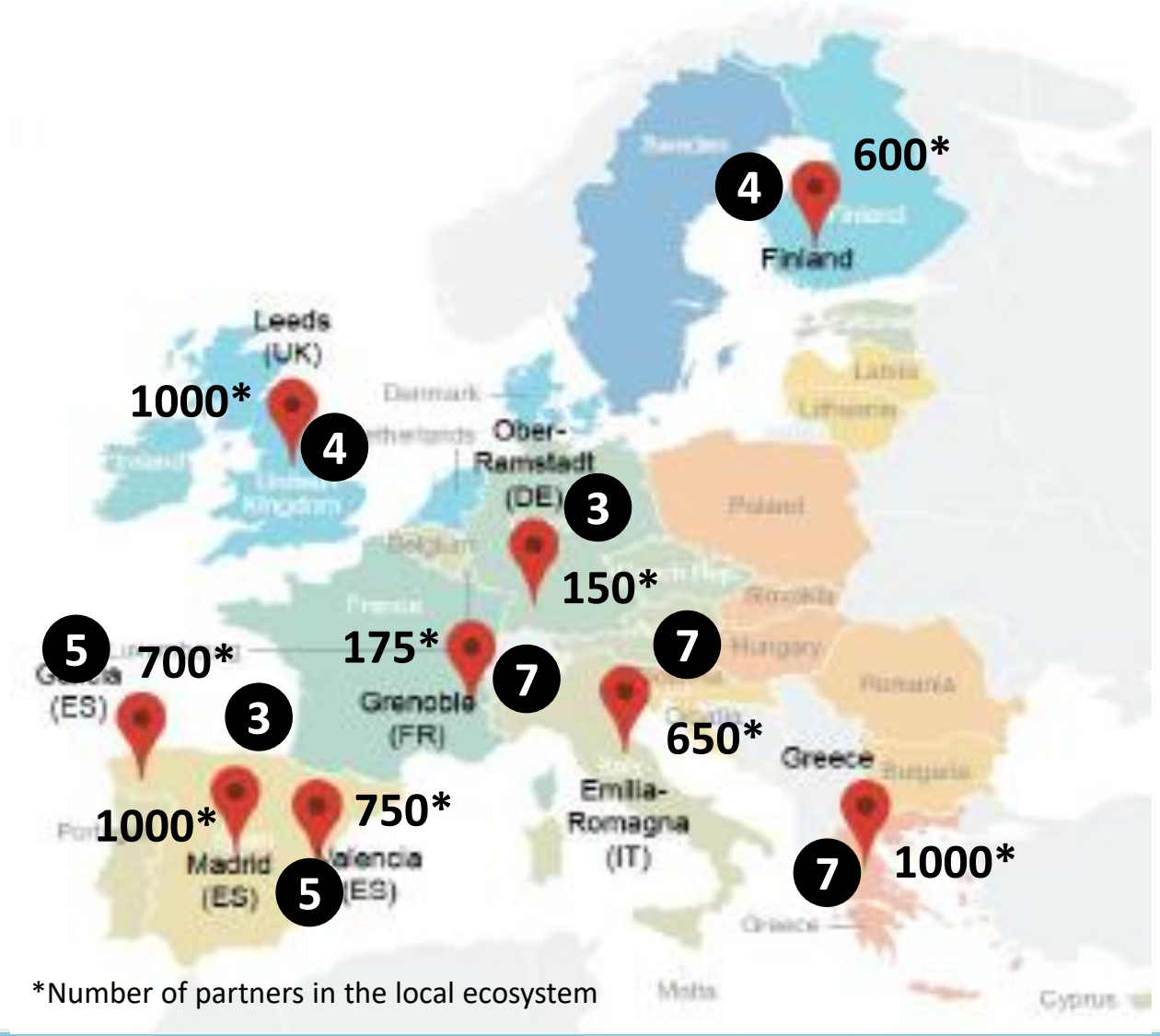
Targeting

1,642 Efforts PMs

7,200 users

6,000 Elderly Users

1,200 Carers



*Number of partners in the local ecosystem

ACTIVAGE USE CASES

4. Emergency Trigger

9. Support for Transportation & Mobility

8. Safety, Comfort & Safety at Home

3. Monitoring Assisted Persons outside home

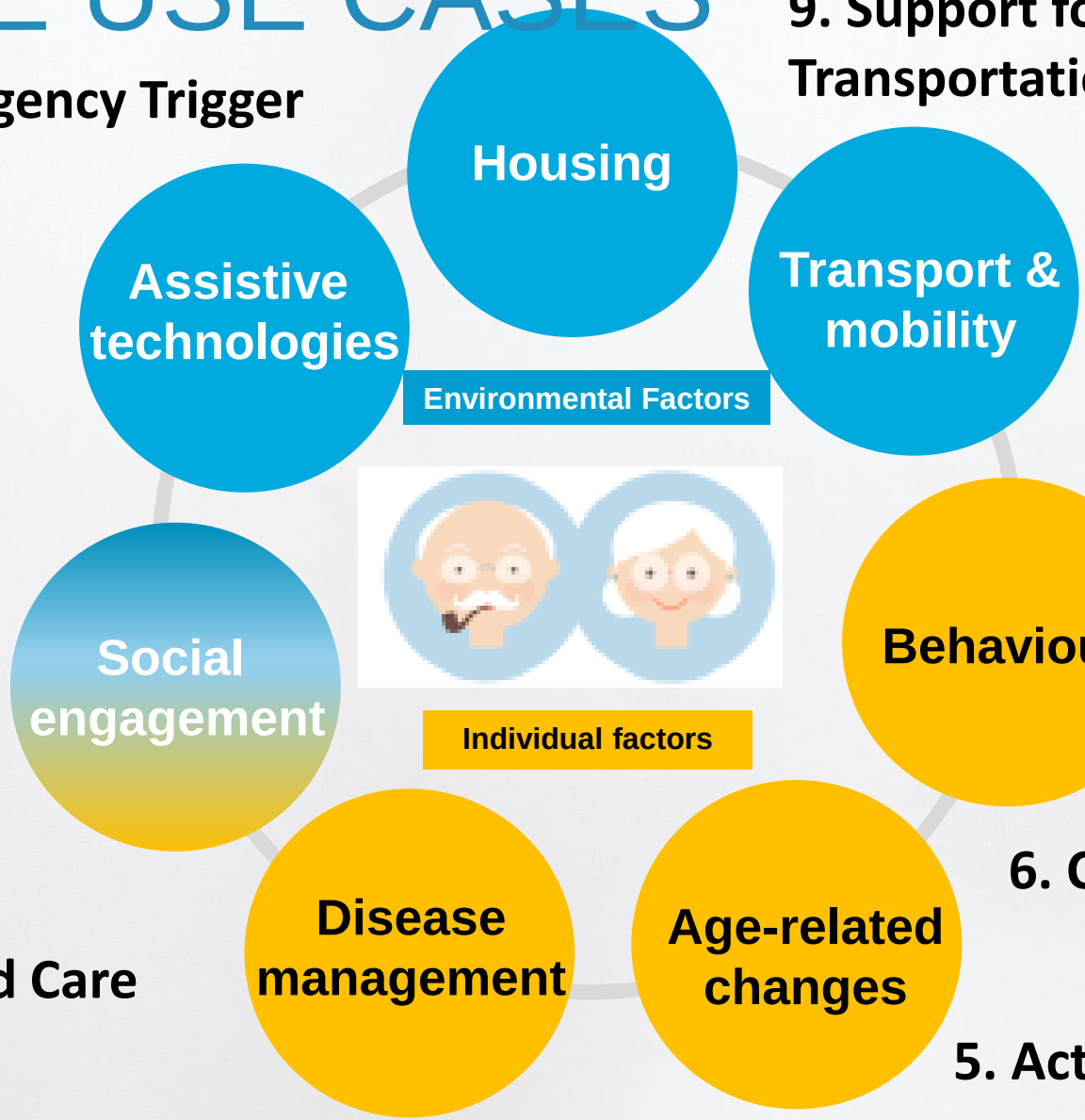
7. Prevention of Social Isolation

1. Daily Activity Monitoring

2. Integrated Care

6. Cognitive stimulation

5. Activity Promotion



ACTIVAGE Living Lab Solution

IoT-enabled Vital Signs Monitoring Services (Example 1)

Data Project Initiation 1 → Data Governance Process 2 → Data Quality Process 3 → Self-Audit Process 4 → Data Project Completion 5 → Data Project Access 6

Wristband Activity Track Sleep Quality

Wristband Blood Pressure

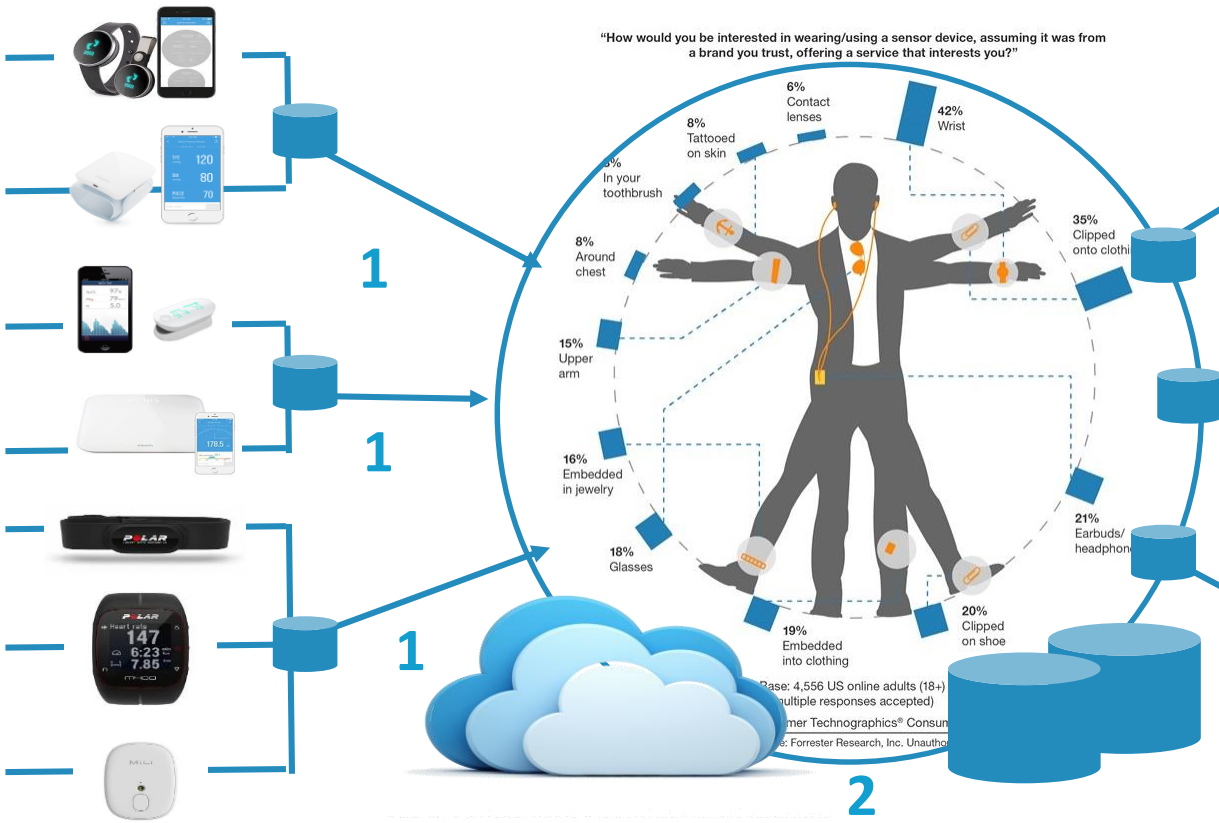
Wristband Oxigen Sensor

Weight Control Balance

Chestband BPM

Wristband GPS Tracker

UV Ray Indicator



Delivered by 6

Supported by 5

Powered by 4

3

VITAL www.vital-iot.eu VOS

Remote Monitoring Insight Living Lab

ACTIVAGE AIOTES

VITAL www.vital-iot.eu

OPENIoT www.openiot.eu

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ACTIVAGE KIOSK Solution

Devices, Application and Technology (Example 2)

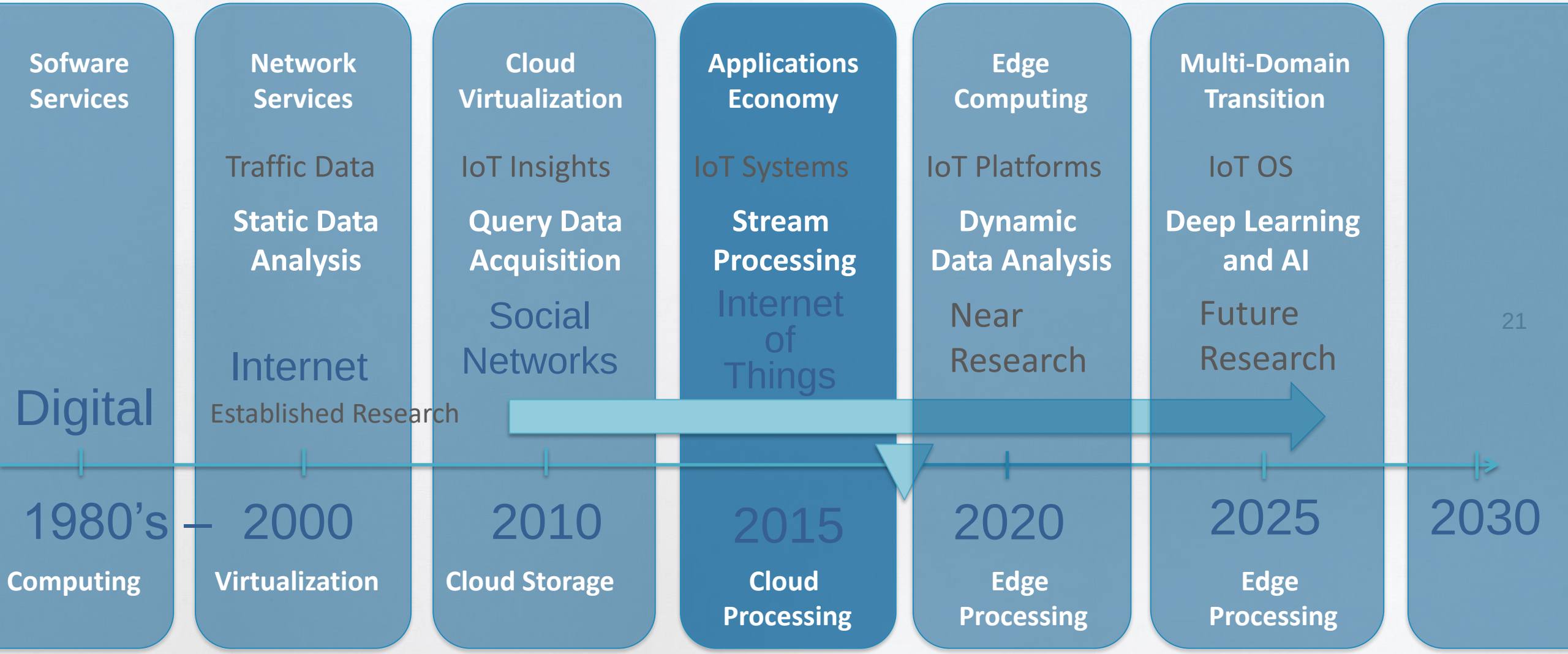
ACTIVAGE IoT Data Technology Challenges

- To have a "**Dynamic Knowledge Network**", based on:
  - **Data Exchange** between Deployment Sites.
  - **IoT Data-enabled** communication between Stakeholders.
  - Real Time Big Data Analytics **"Stream Processing"**

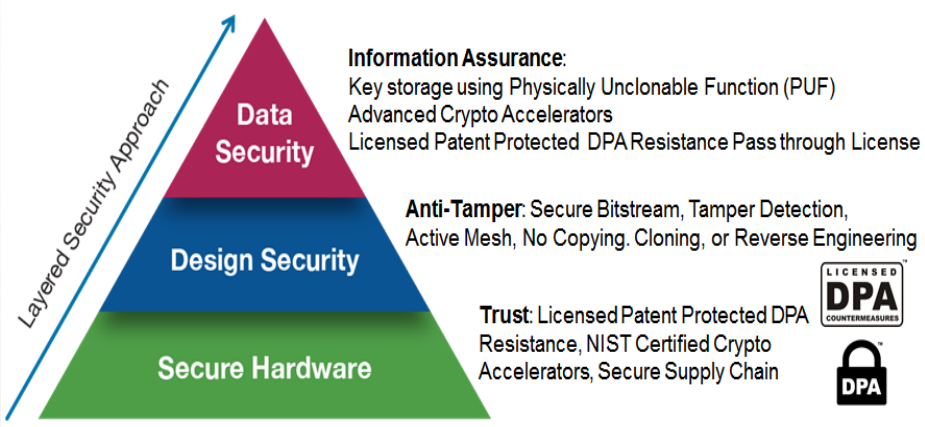
- To provide **IoT Data insights** to the main stakeholders of Silver Society and AHA communities with **appropriate data.**

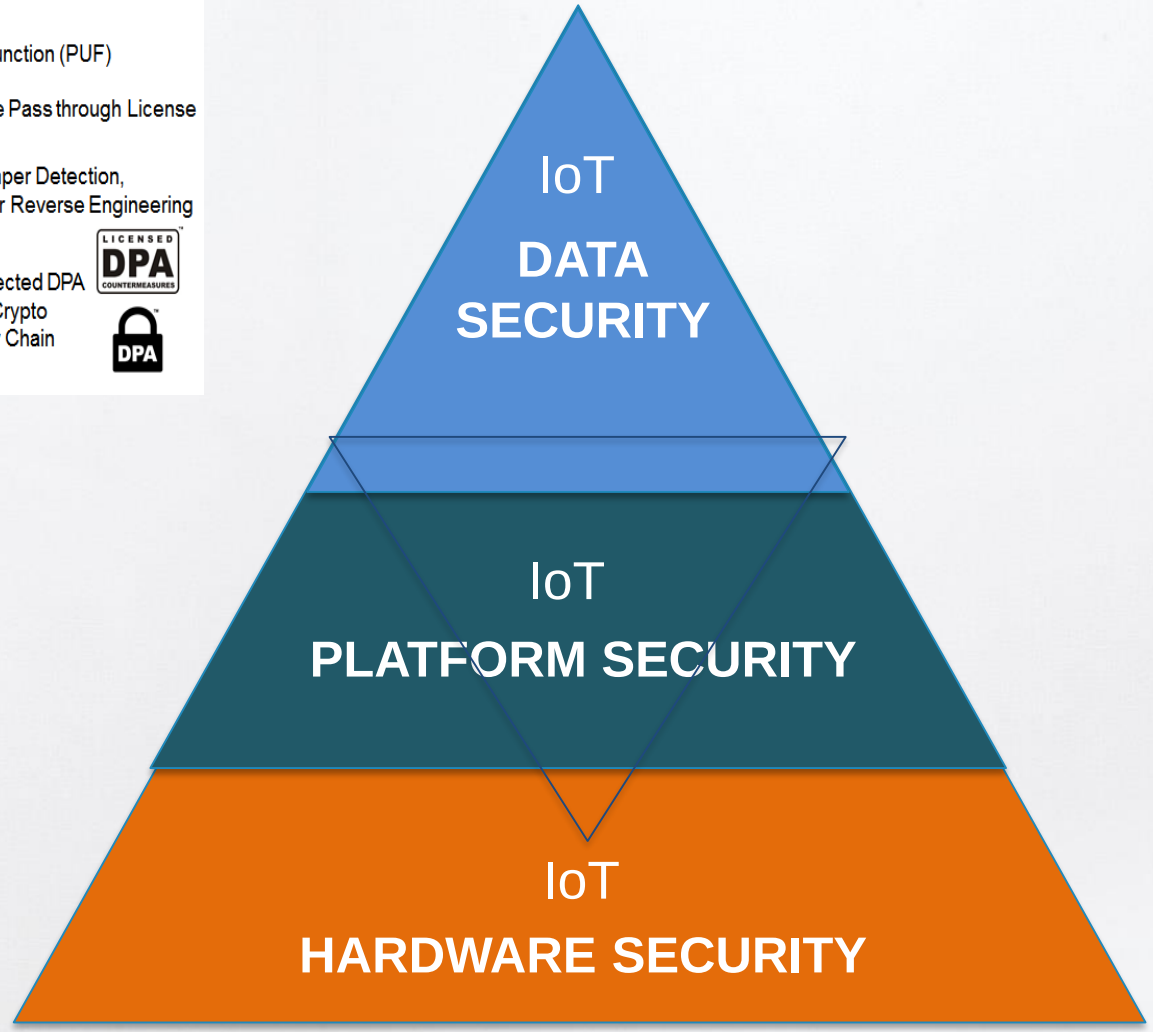
- To define **new business models** based on **IoT Data usability** and with real impact on Innovating European AHA and **IoT data available services.**

Data / Cloud / Stream / IoT Data Research Timeline

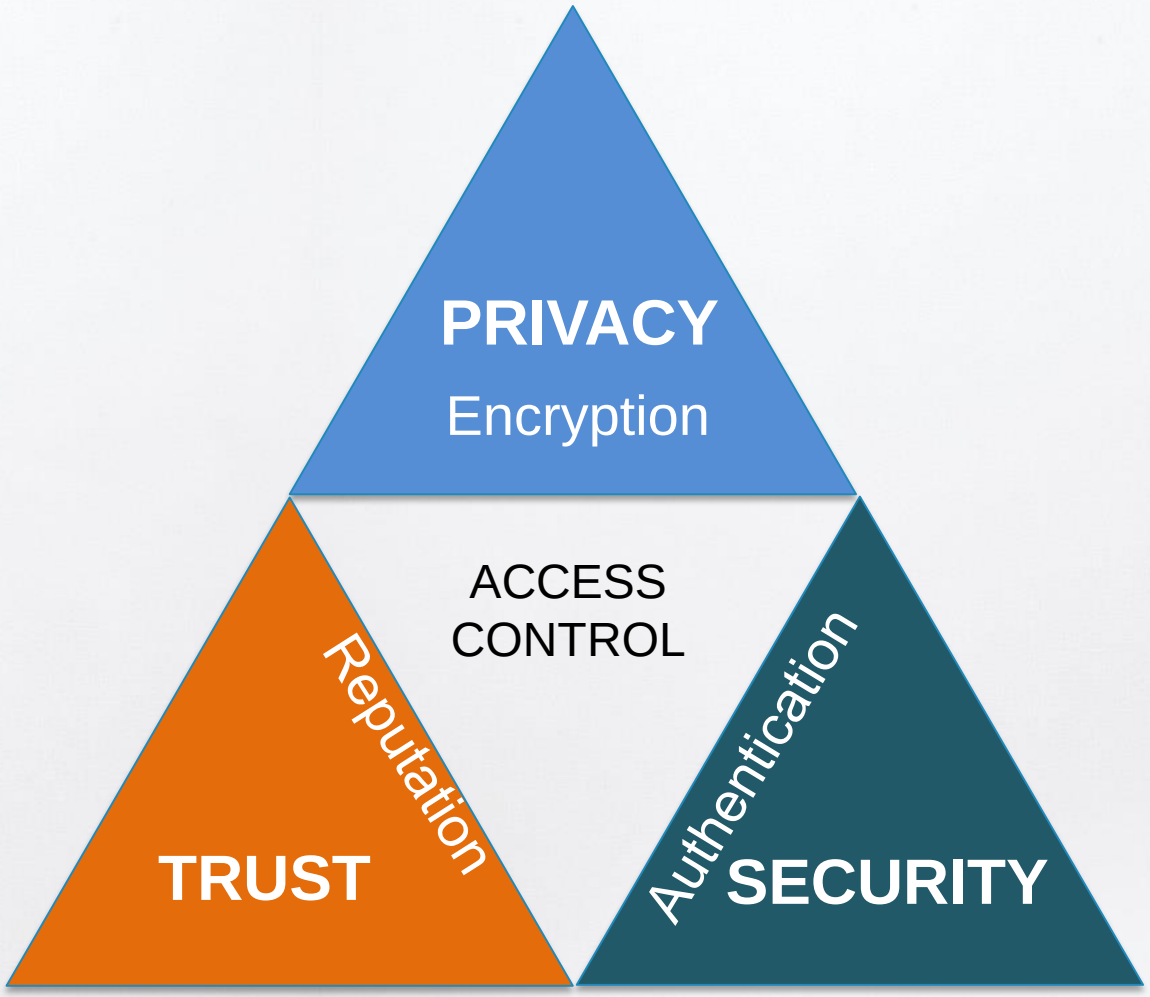


Data Security Pyramid

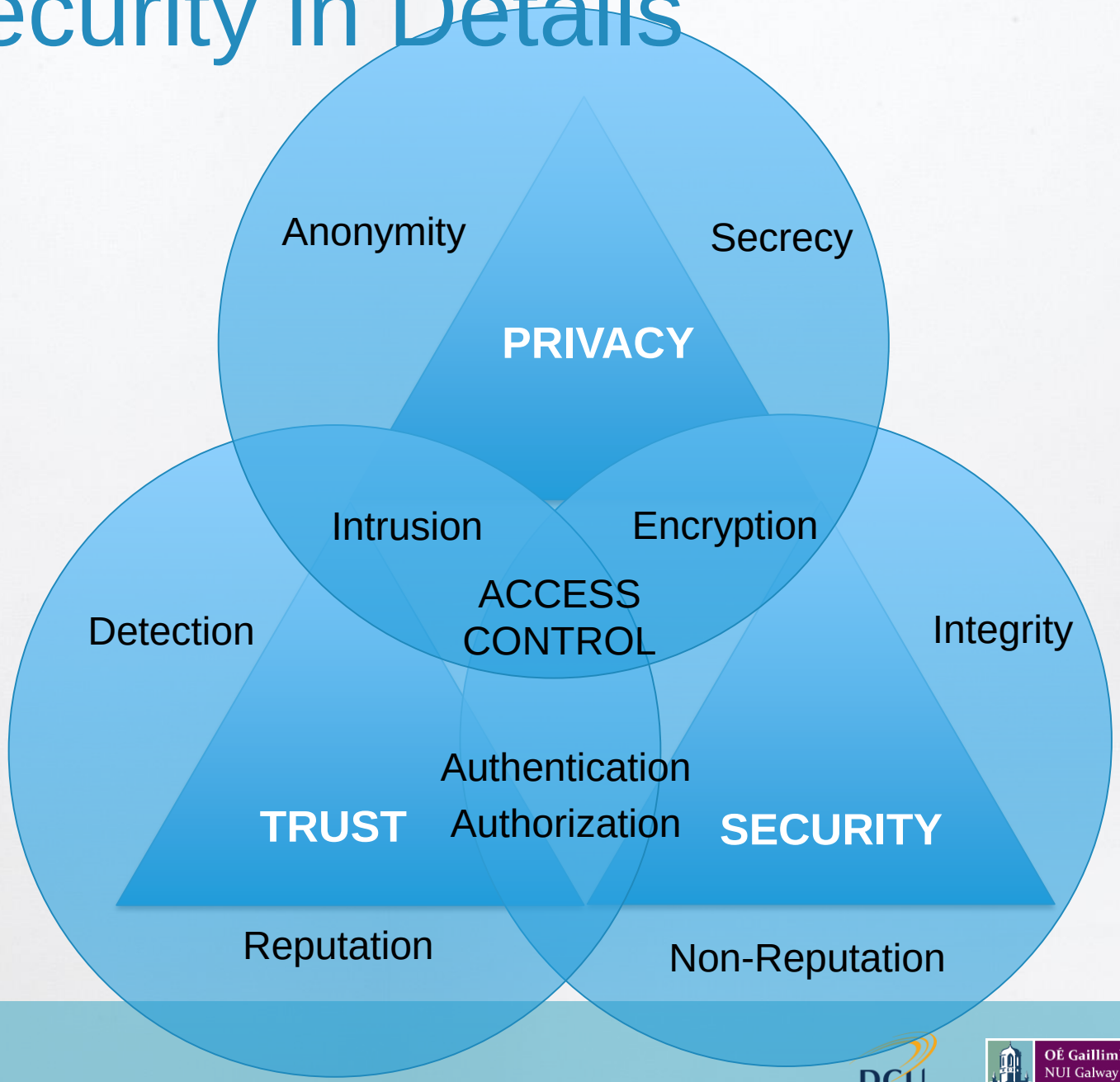




Big Data & IoT Clusters Security



Cluster Security in Details

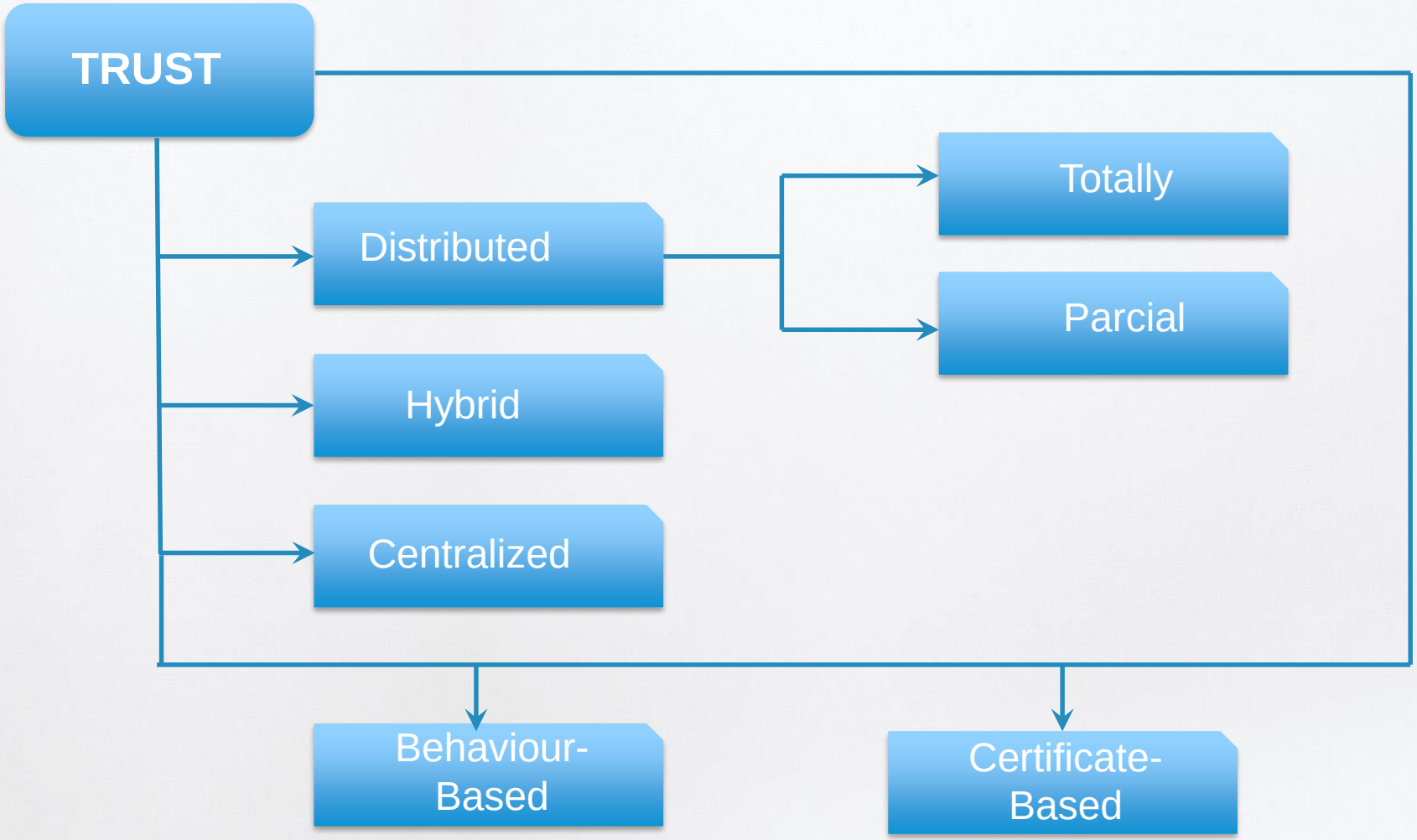


Security, Privacy and Trust Models

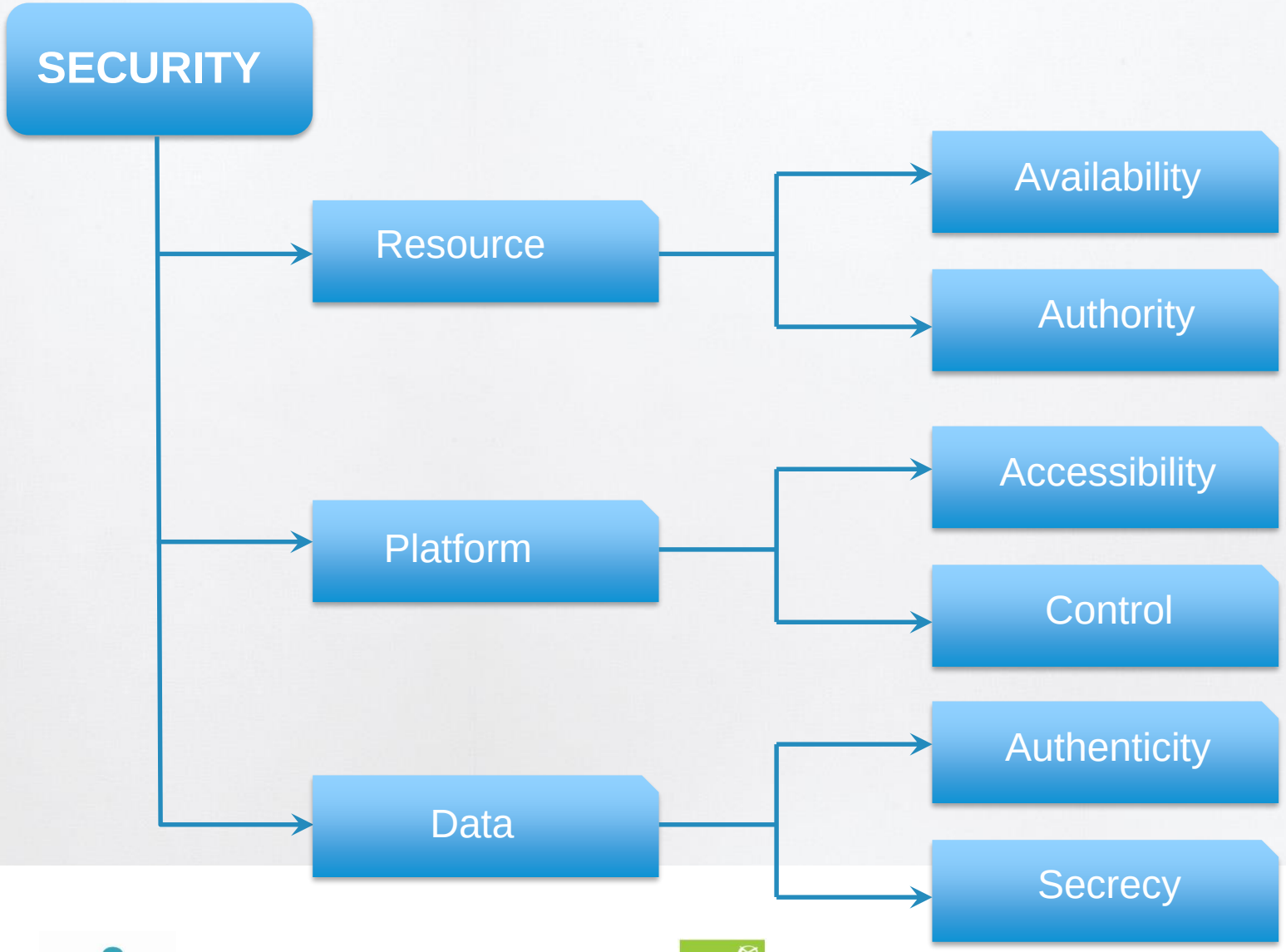
- Secure, Trustworthy and Privacy Friendly Interactions
  - Security and trustworthiness protocols
  - Implement security mechanisms at EU research level (Opinion, VITAL, FIESTA)
  - Secure service requests and interactions

- Main Results
  - Investigated existing security frameworks and protocols
  - Centralized authentication and authorization framework
  - Implementation of CAS for OpenIoT
  - Integration of CAS with LSM storage
  - Security client API and tag libraries for integration

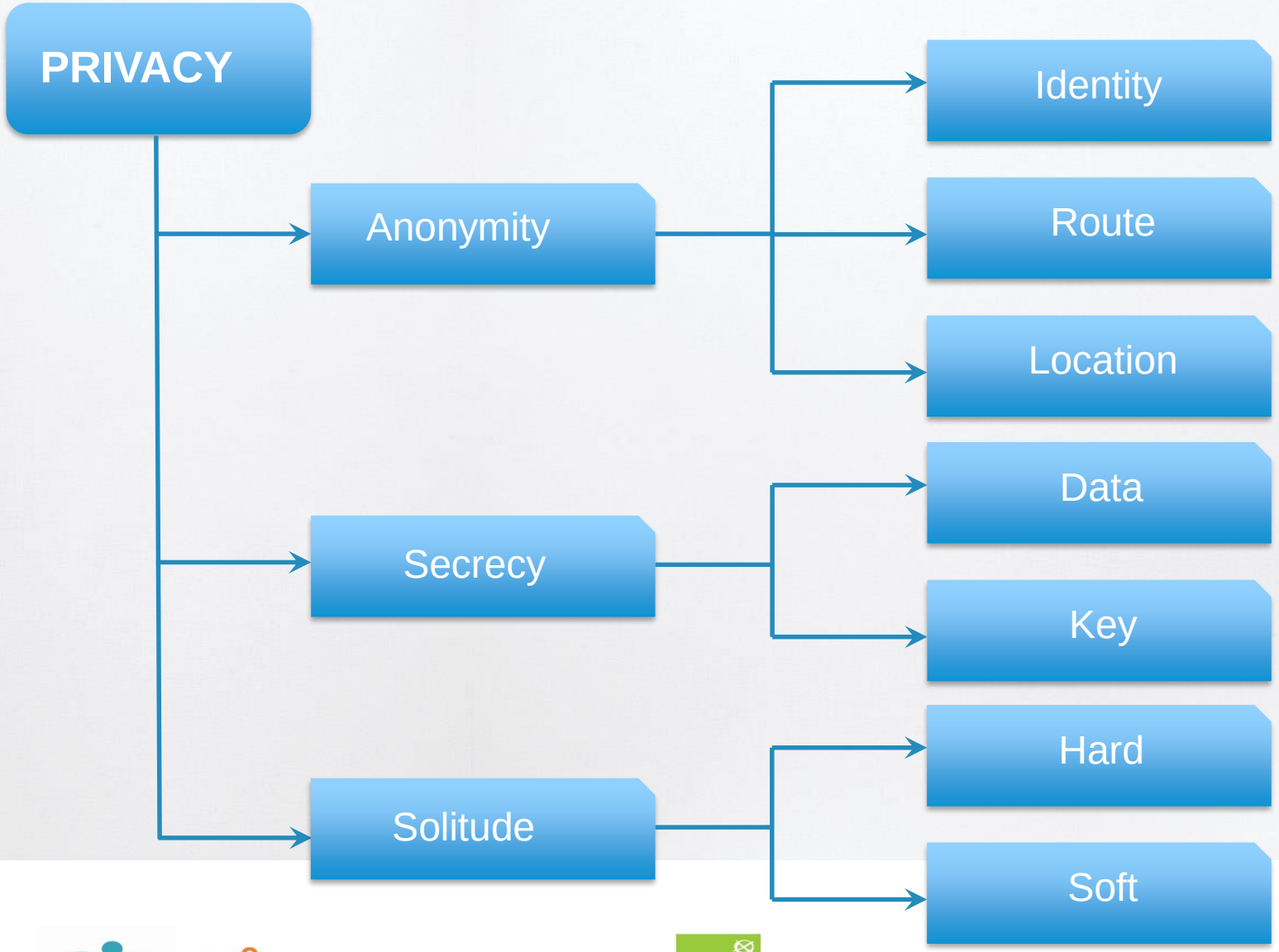
Trust Cross Domain Terminology



Security Cross Domain Terminology

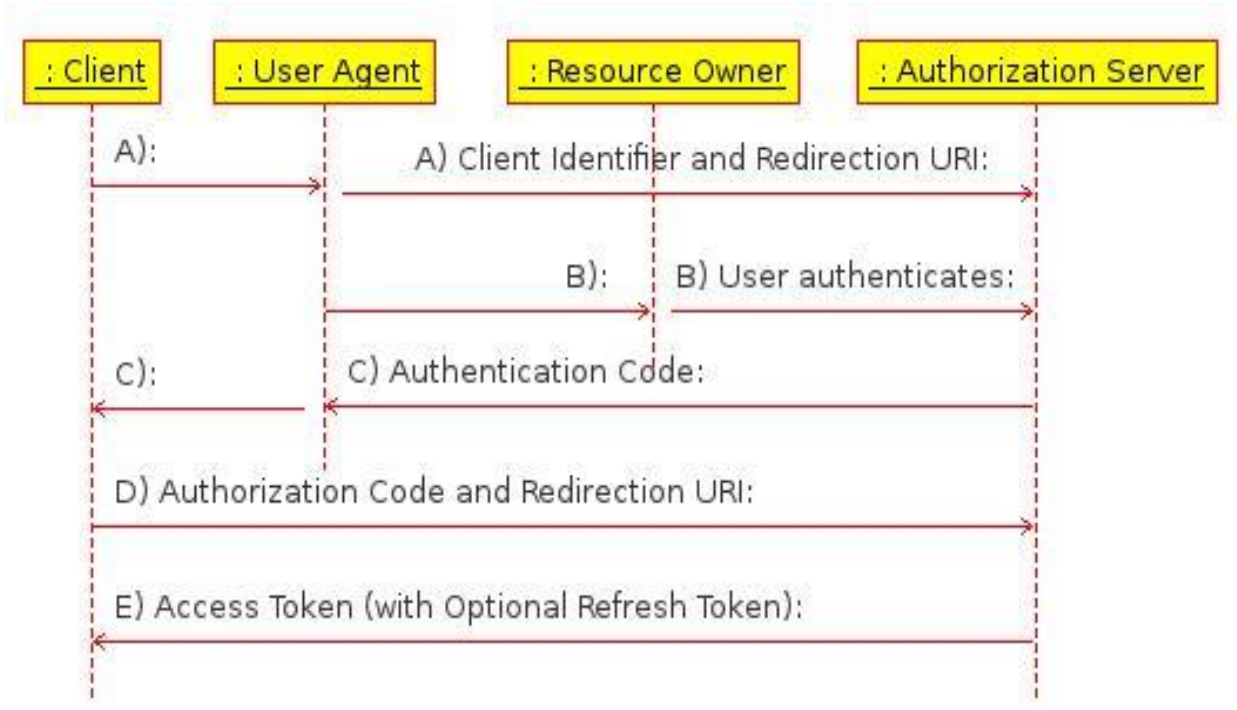


Privacy Cross Domain Terminology



Authentication Algorithm Diagram

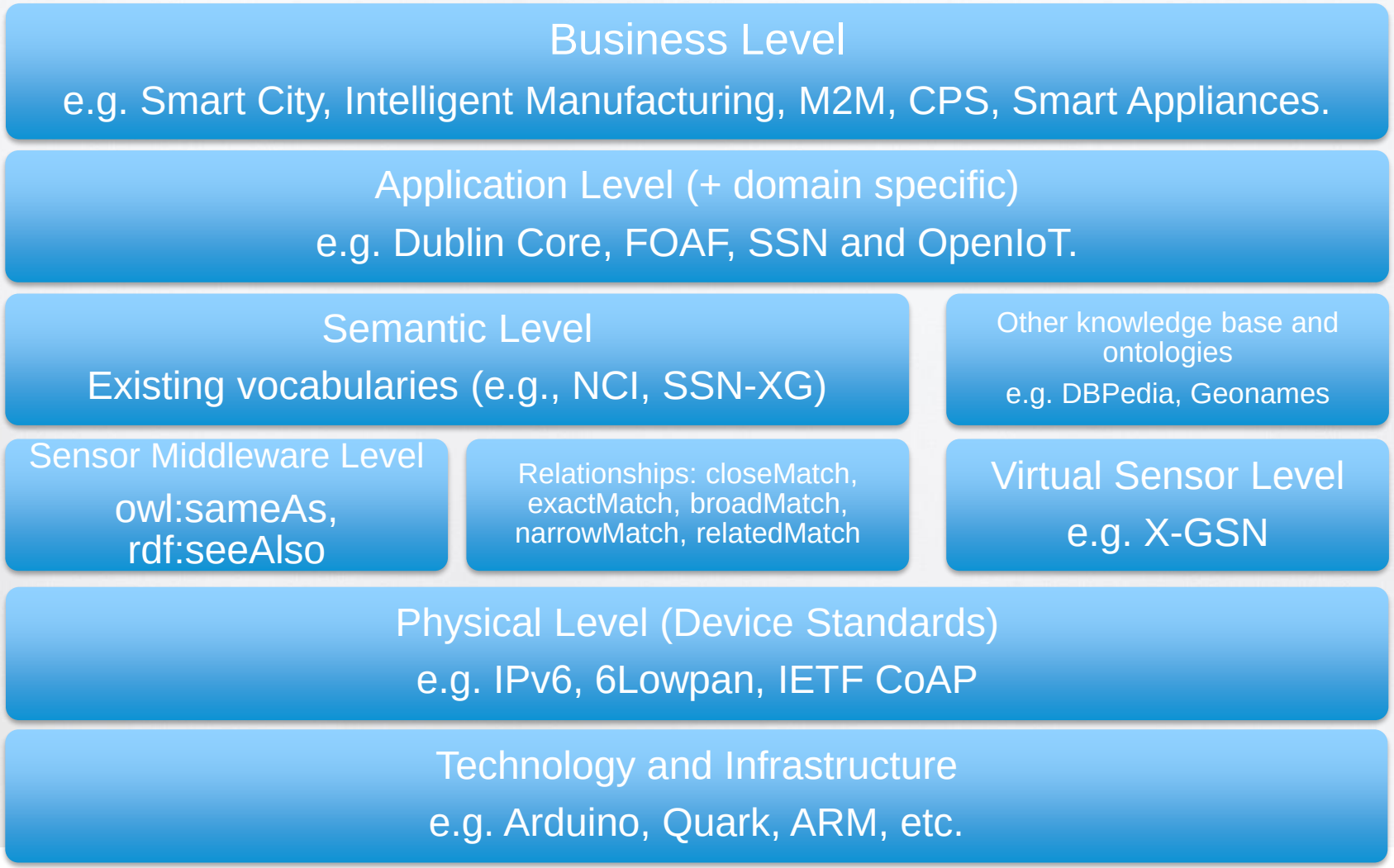
OpenIoT Security Architecture with CAS – OAuth 2.0 Protocol



OAuth 2.0 abstract authentication and authorization flow

- Centralized Authentication Server CAS for all OpenIoT applications
- Based on open standard framework for authorization OAuth
- Applications not burdened with credentials handling
- Role and permission authorization managed by CAS

Internet of Things Stack



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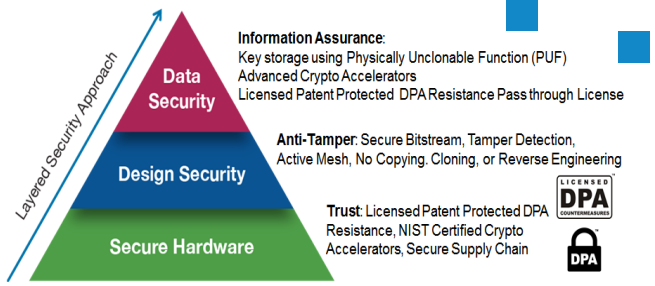
SEVENTH FRAMEWORK PROGRAMME
sfi
Ireland's EU Structural Funds Programmes 2007 - 2013
Co-funded by the Irish Government and the European Union
IRCSET

Internet of Things Stack

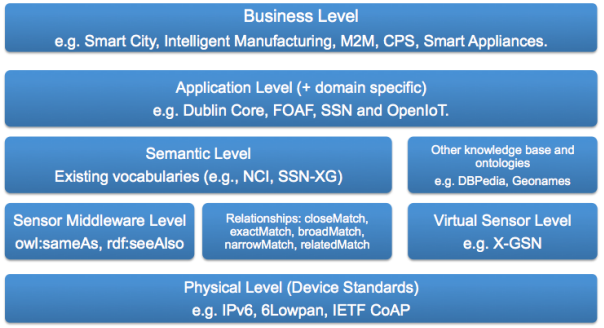
Insight
www.insight-centre.org

IoT Security

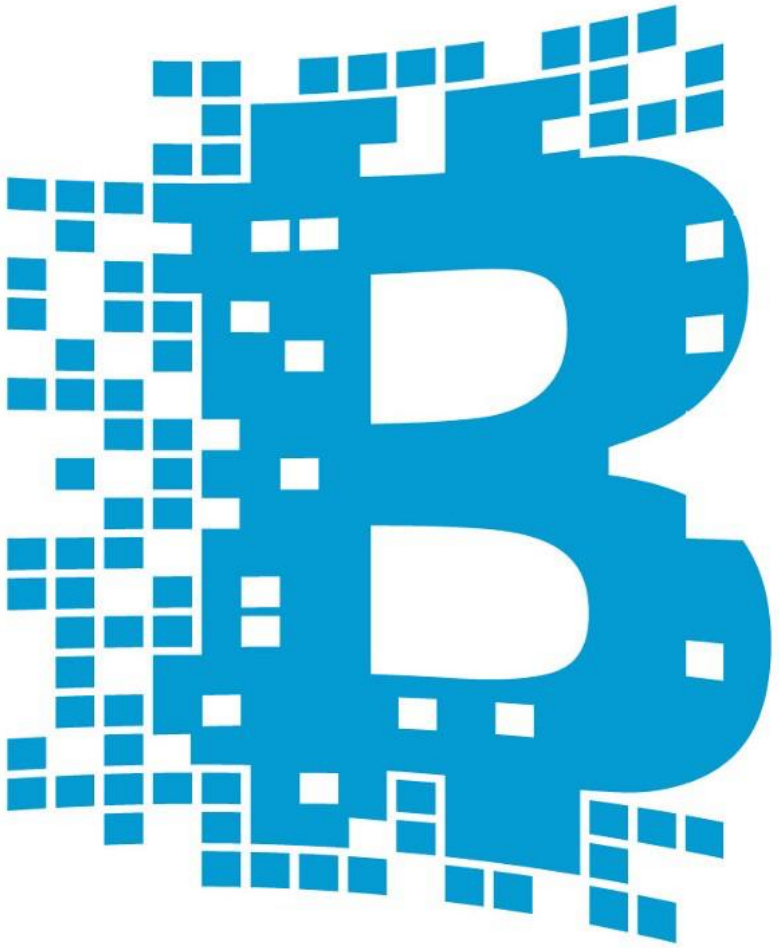


IoT Stack

IEEE Internet of Things



IoT CAS Implementations



Data Security

Platform Security

Network Security

Hardware Security

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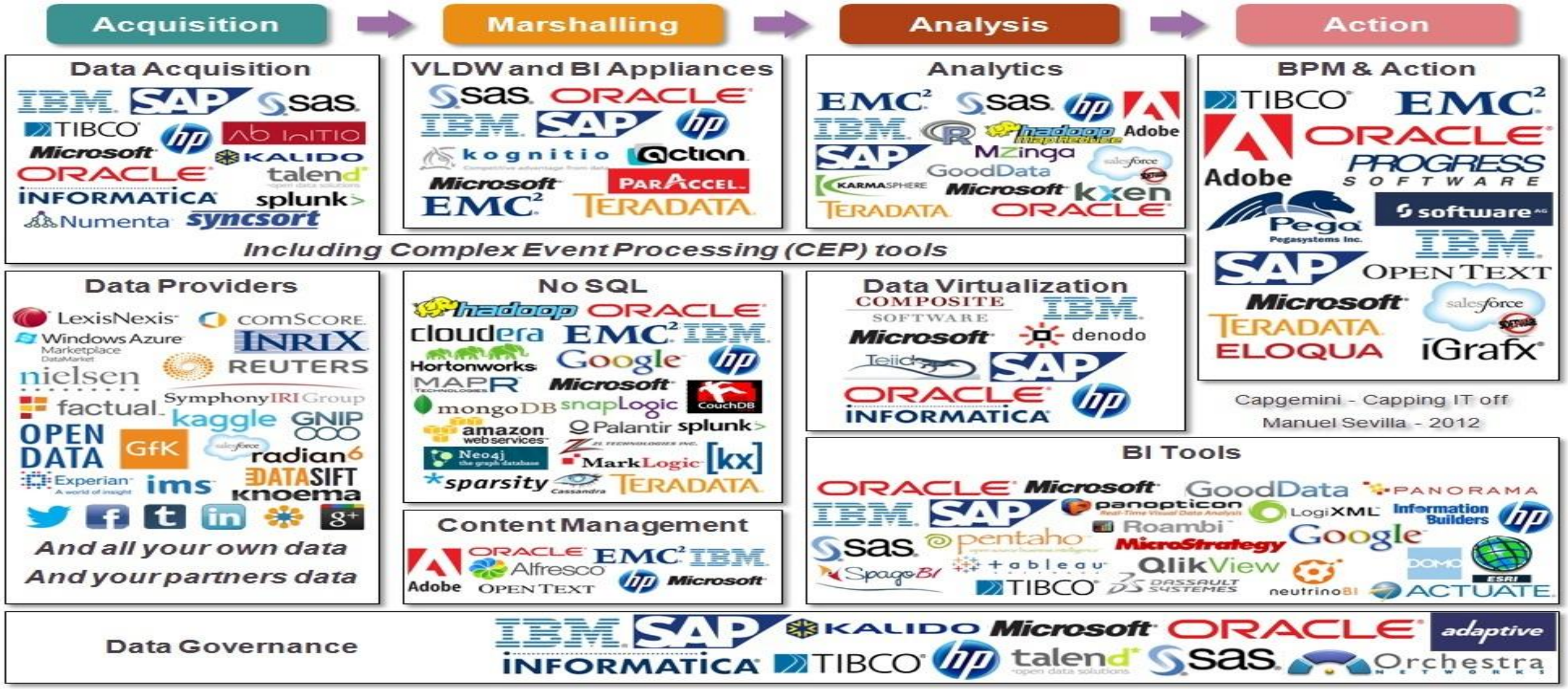
IRCSET Investing in People and Ideas

Insight Centre for Data Analytics

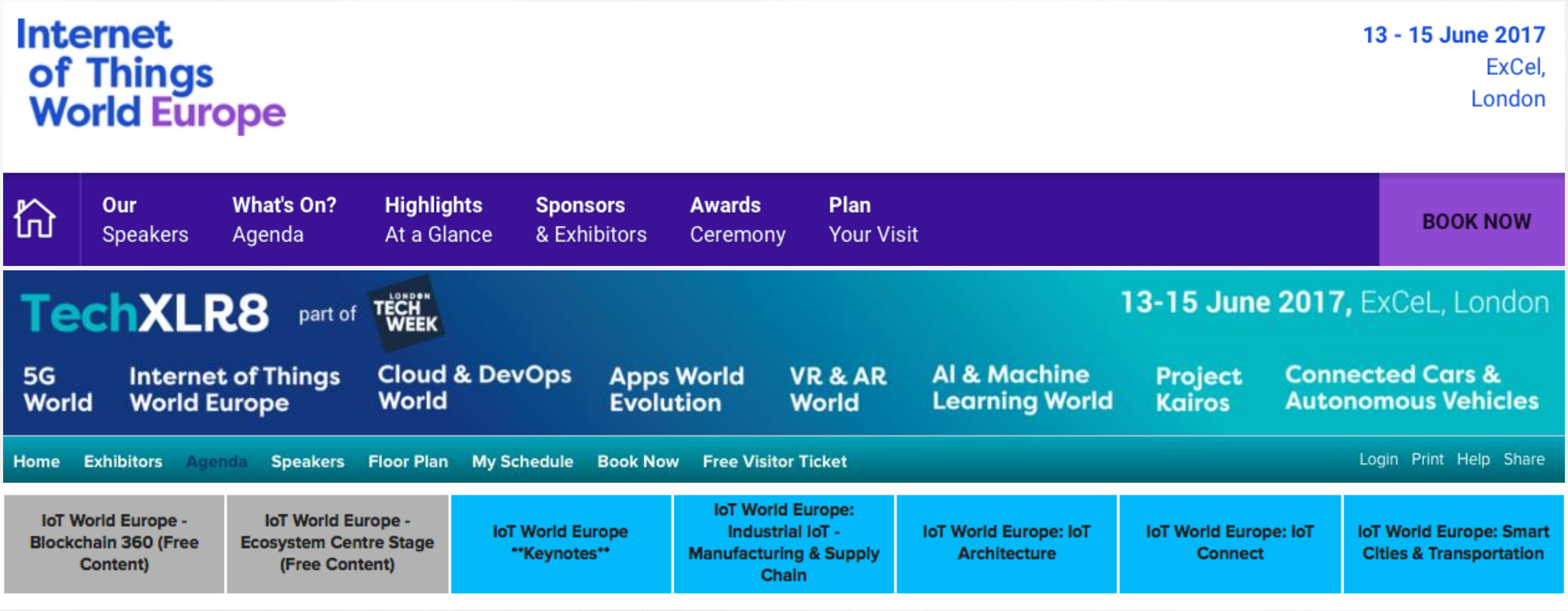
Big Data Industries Landscape



CONCLUSIONS

- Big Data is an explicit element in the IoT.
- Bid Data Management strategies are yet in need to be in place before launching Applications for Big Data.
- Internet of Things enable Big Data Generation.
- Big Data analytics remains as open challenge for knowledge generation.
- IoT and Big Data focus area remains in platforms interoperability.
- Technoclogy for Big Data Semantics requires more research work.

Blockchain Industries World



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Dr. Martin Serrano
Principal Investigator and Data Scientist
Insight Centre for Data Analytics, Ireland
<martin.serrano@nuigalway.ie>

Thank You!