# “Accelerating data-driven innovation in Europe”

## BDV Reference model / TF6 Technical Priorities and SRIA
## BDV PPP Projects


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# INTRODUCTION TO BIG DATA VALUE PPP / BIG DATA VALUE ASSOCIATION (BDVA)

## The EU and Industry launched the Contractural Public Private Partnership (cPPP) on Big Data Value in 2014-10

## Big Data Value PPP: Investment

- “The European Commission and Europe's data industry have committed to invest €2.5 billion in a public-private partnership (PPP) that aims to strengthen the data sector and put Europe at the forefront of the global data race.”
- “The EU has earmarked over €500 million of investment over 5 years (2016-2020) from Horizon 2020”
- Private partners are expected to leverage this through sector investments of four times the cPPP budget (ie €2 billion)

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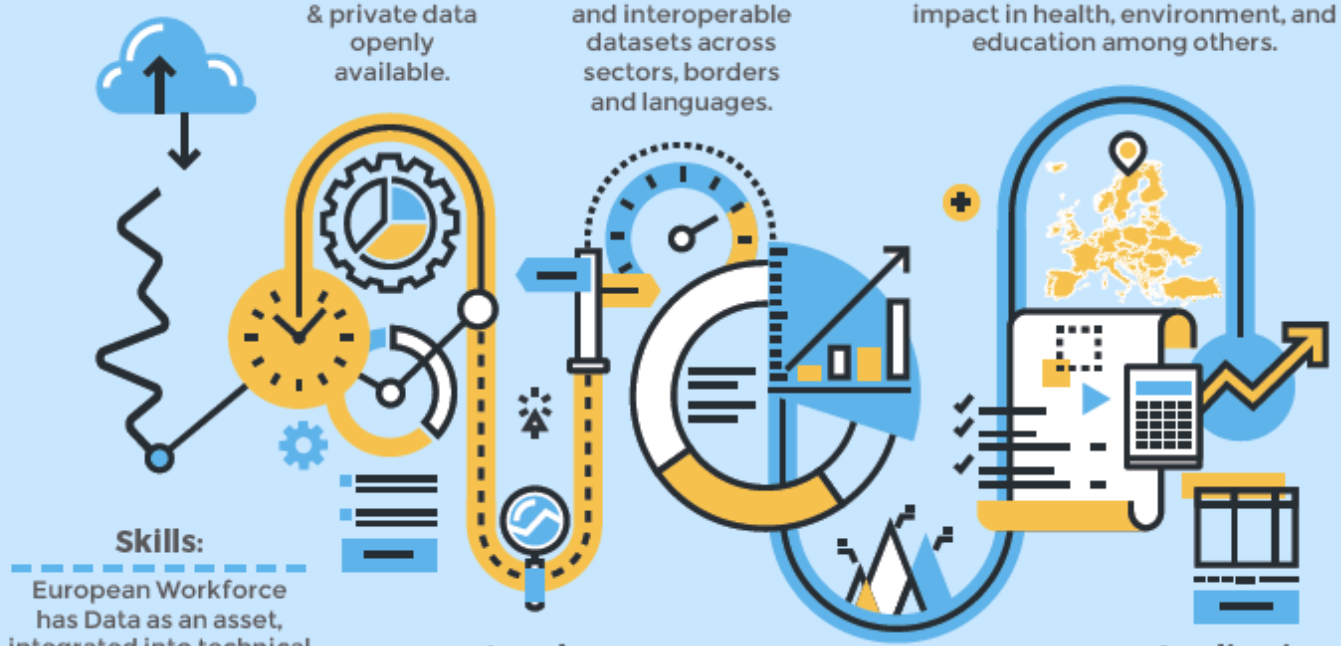
# Big Data Value Vision for 2020



**Data:**
**40** zettabytes of useful public & private data openly available.

**Technology:**
Real-time, **integrated** and interoperable datasets across sectors, borders and languages.

**Societal:**
**People** is aware of the benefits of Big Data in their real life and the positive impact in health, environment, and education among others.

**Skills:**
European Workforce has Data as an asset, integrated into technical and business degrees, and providing **100,000** jobs across Europe.

**Legal:**
A **trusted** data ecosystem in which Privacy & Security are guaranteed along the Value Chain.

**Business:**
A true EU **single Data Market** supporting EU companies to become world leaders.

**Application:**
**Thousands** of specific applications will use, exploit, monetize and benefit from Big Data.

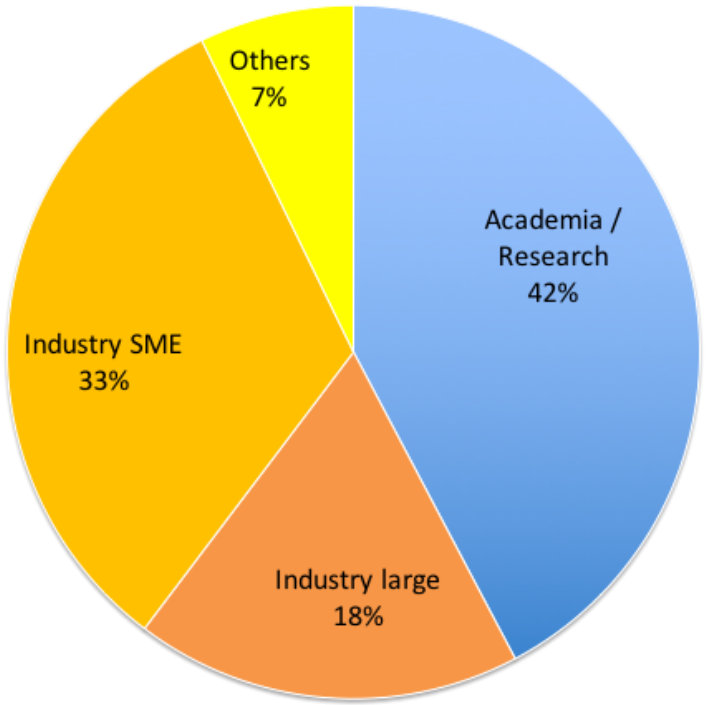

**SRIA v4.0 @www.bdva.eu**

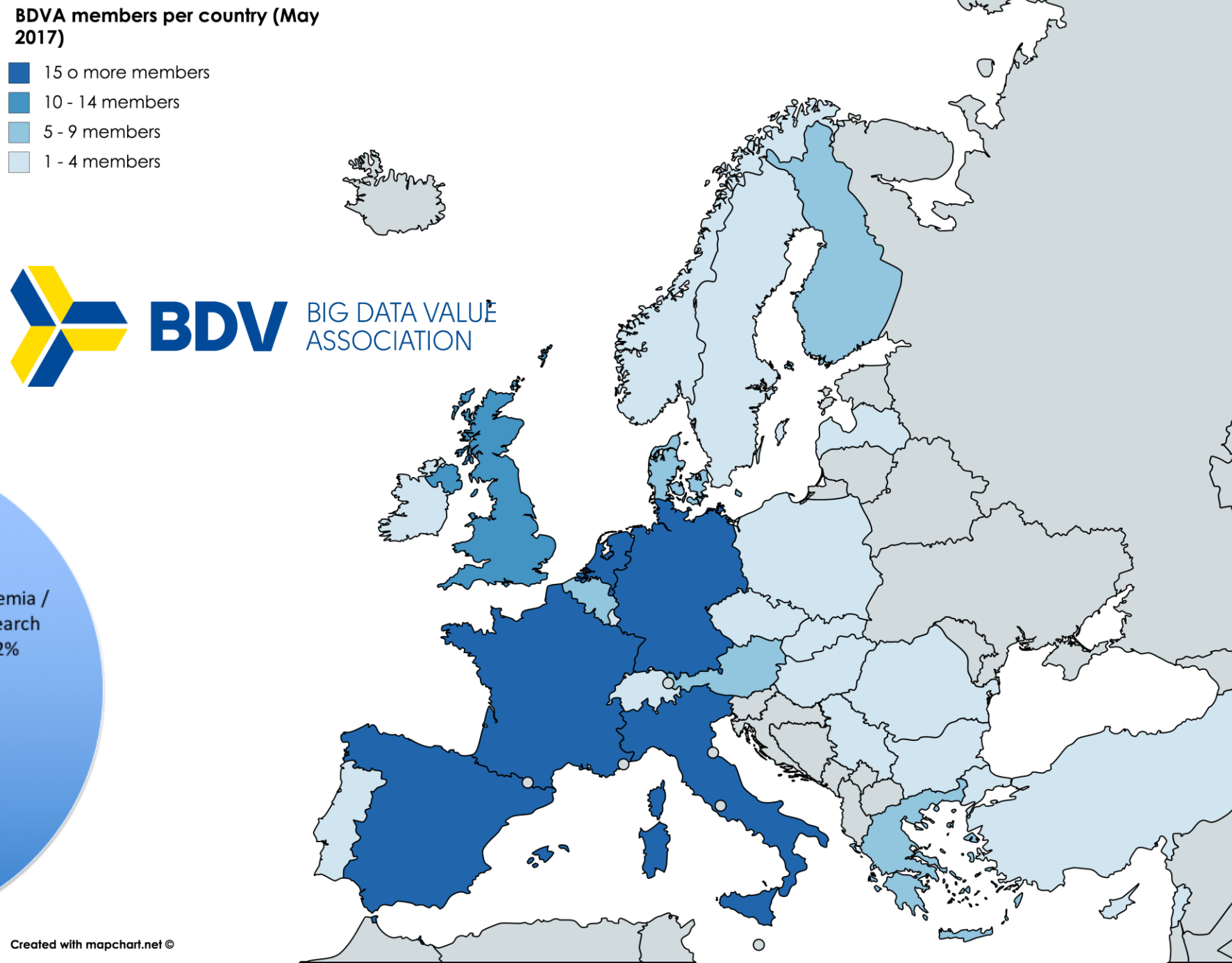
BDV BIG DATA VALUE ASSOCIATION

**Industry-driven** and fully self-financed international non–for-profit organisation under Belgian law

194 Members
- 35 Large companies
- 63 SMEs
- 82 Research institutions
- 14 Others

Present in 28 countries

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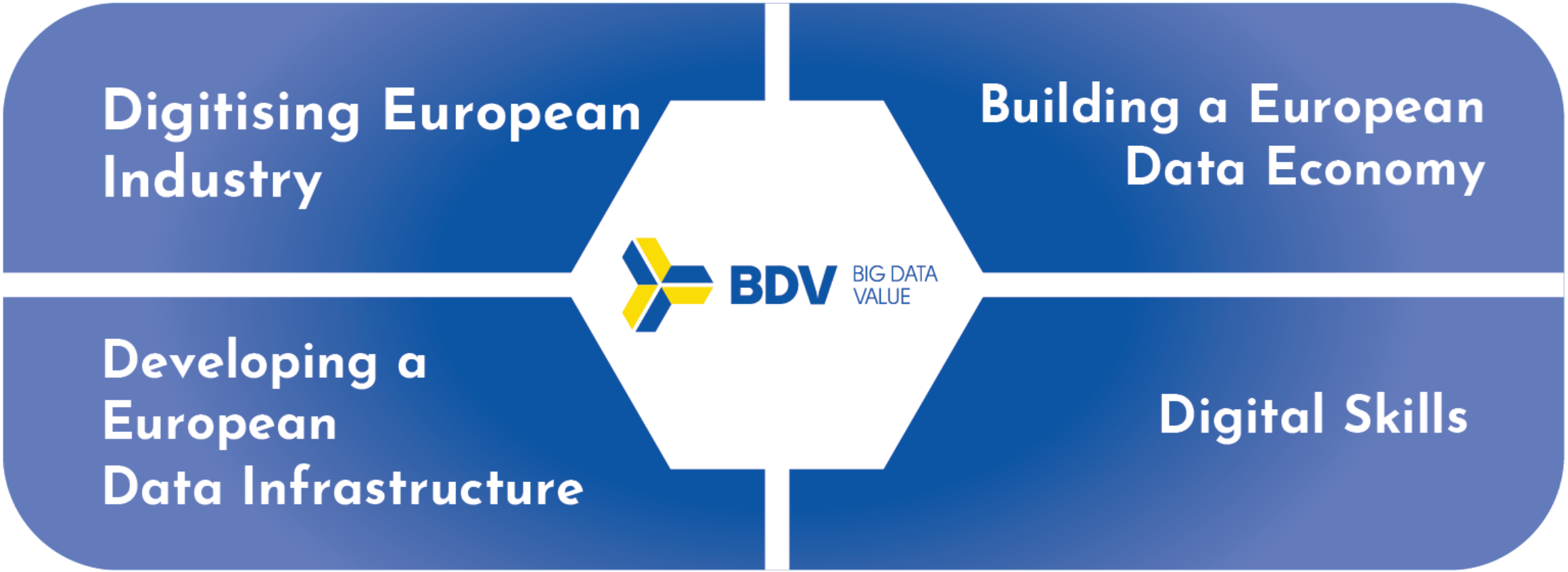
# Contributing to the  Digital Single Market Strategy Implementation

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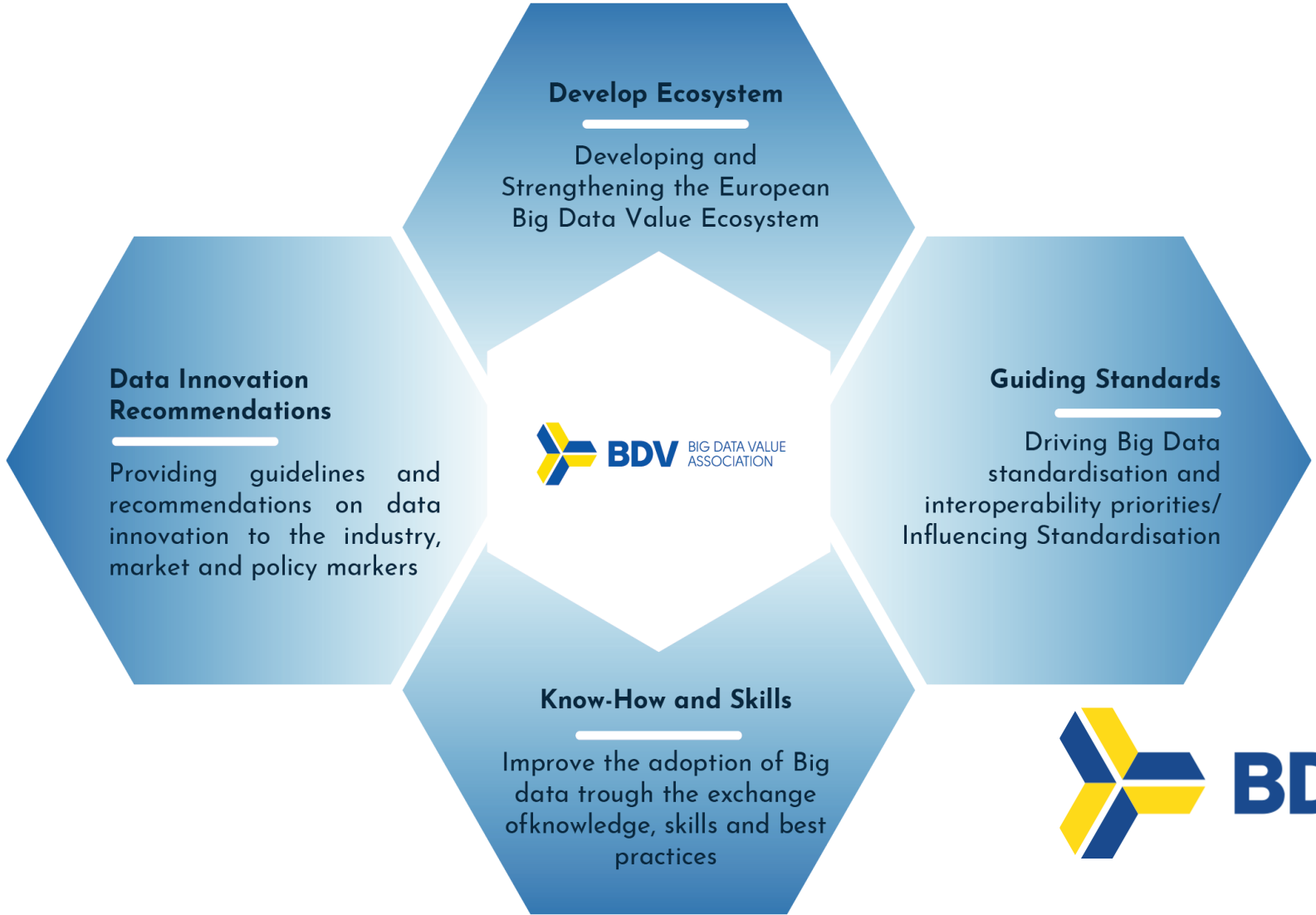
The **mission** of the BDVA is to develop the Innovation Ecosystem that will enable the data-driven digital transformation in Europe delivering maximum economic and societal benefit, and, achieving and sustaining Europe's leadership on Big Data Value creation and Artificial Intelligence.

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# BDV REFERENCE MODEL AND TECHNICAL PRIORITIES

# MAPPING WITH AIOTI HLA AND COLLABS

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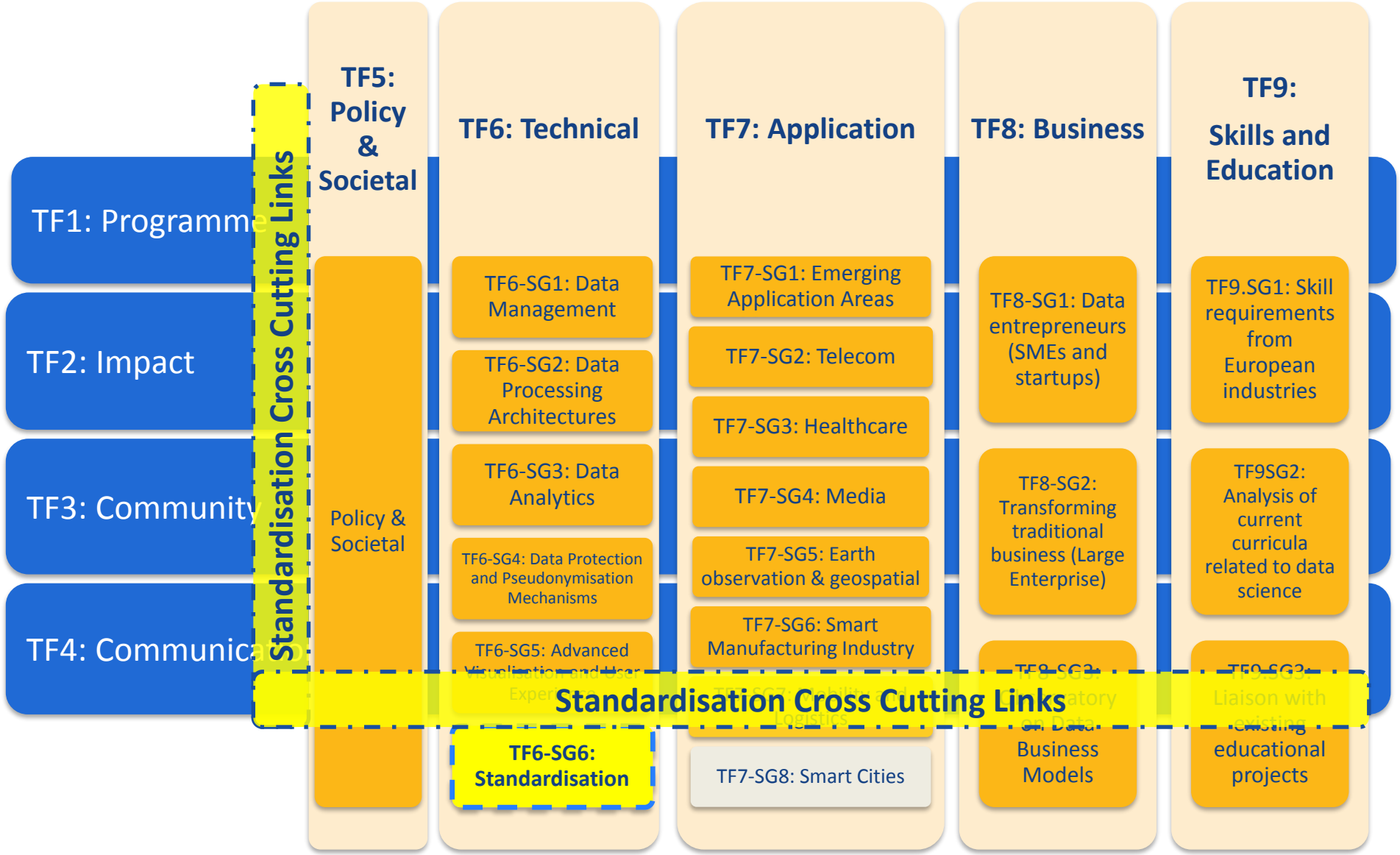
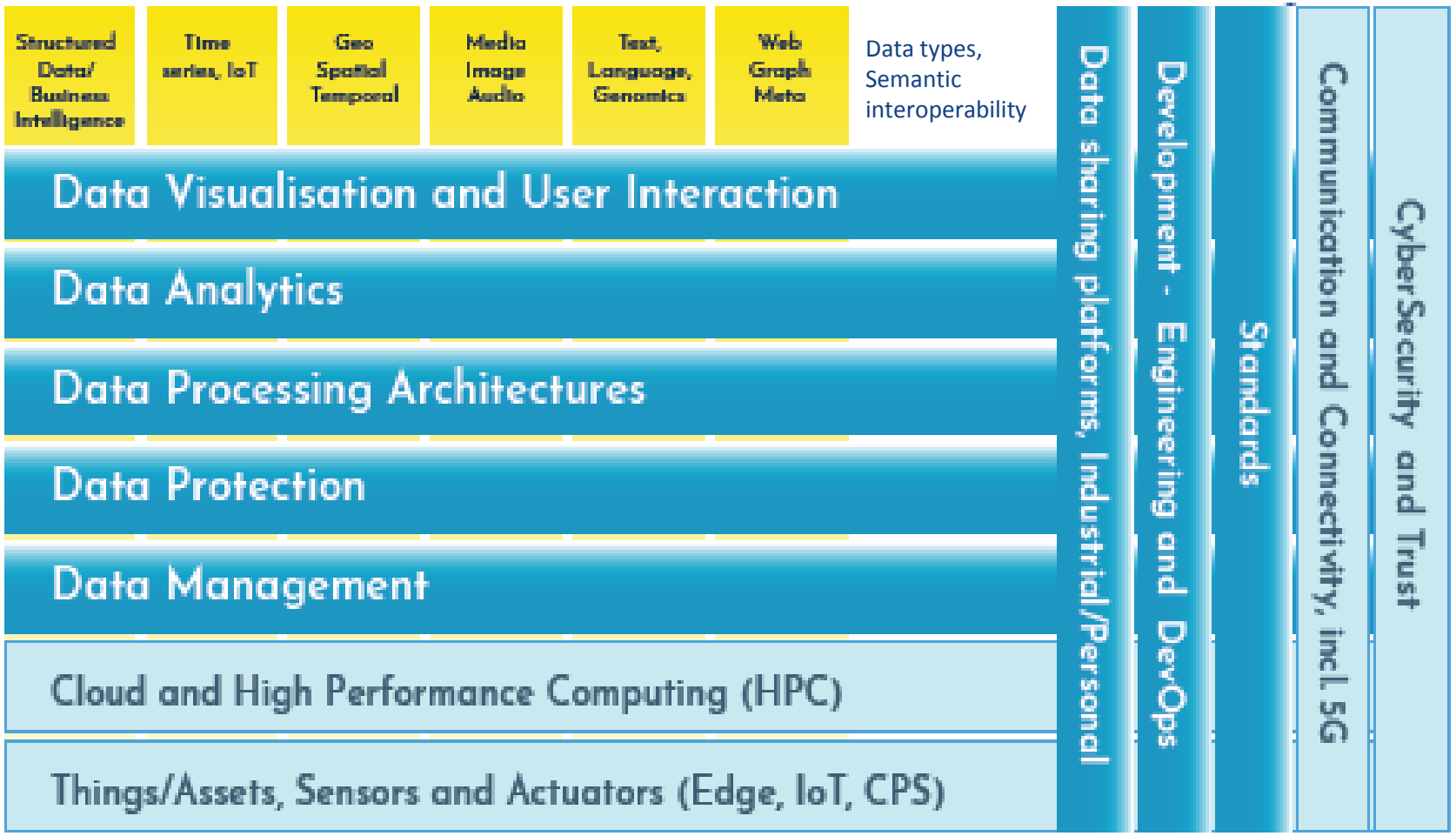
# TF6 Technical Priorities and Standardisation



# BDV – Big Data and Analytics/Machine Learning Reference Model



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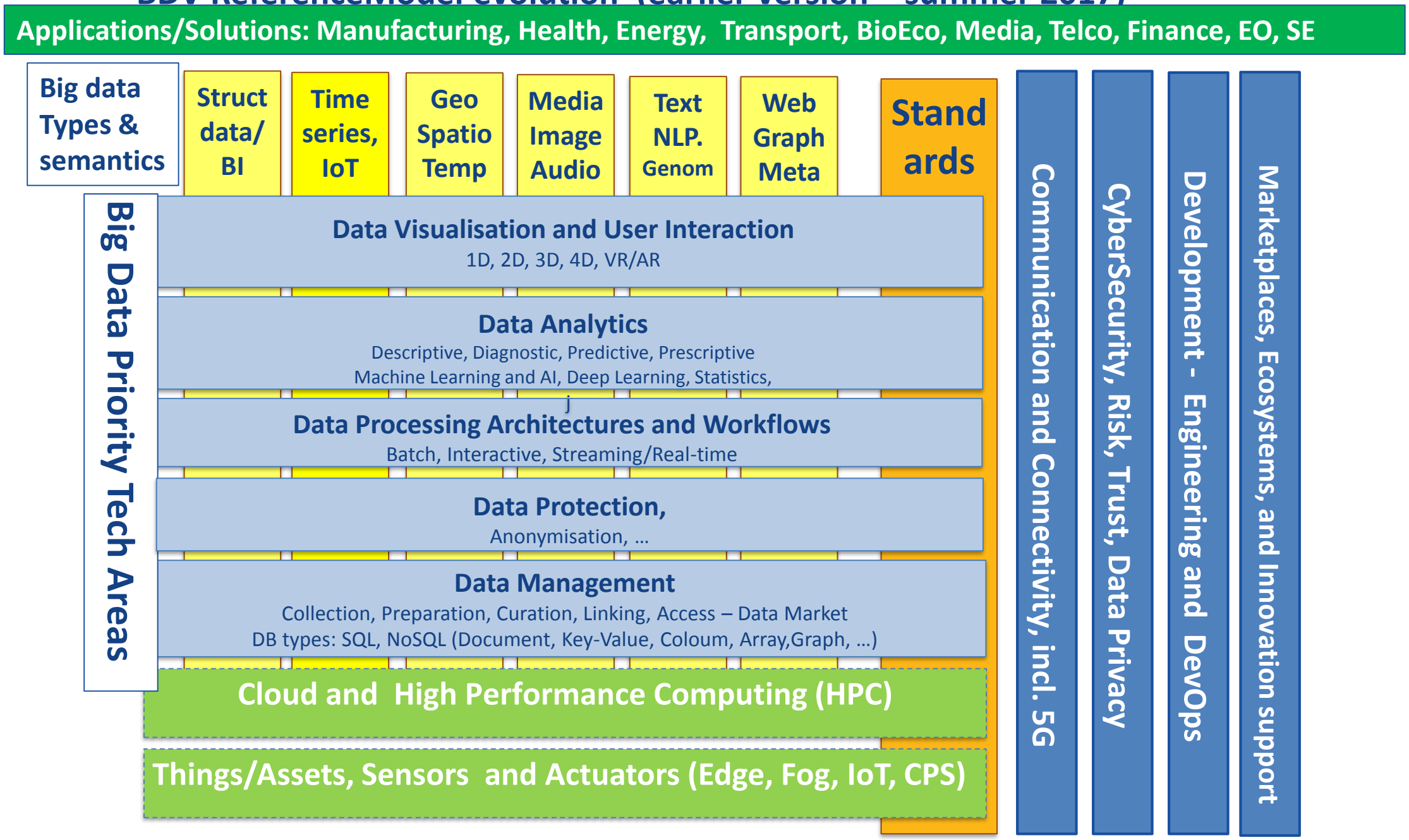
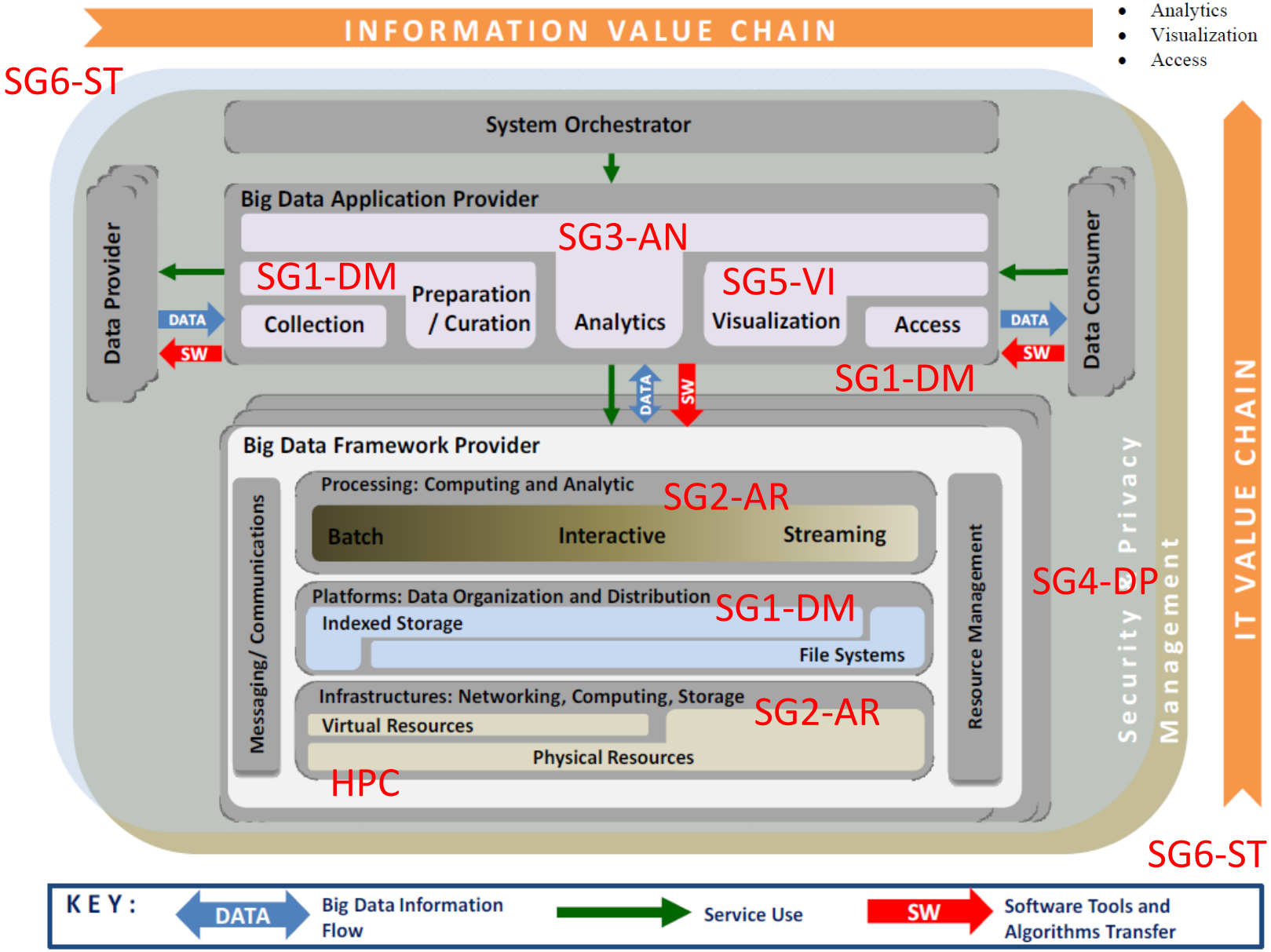
# BDV ReferenceModel evolution (earlier version – summer 2017)



Initial ISO JTC1/WG9 – from
NIST Big Data Reference Architecture

with BDVA SGs Technical Priorities

- Collection
- Preparation
- Analytics
- Visualization
- Access

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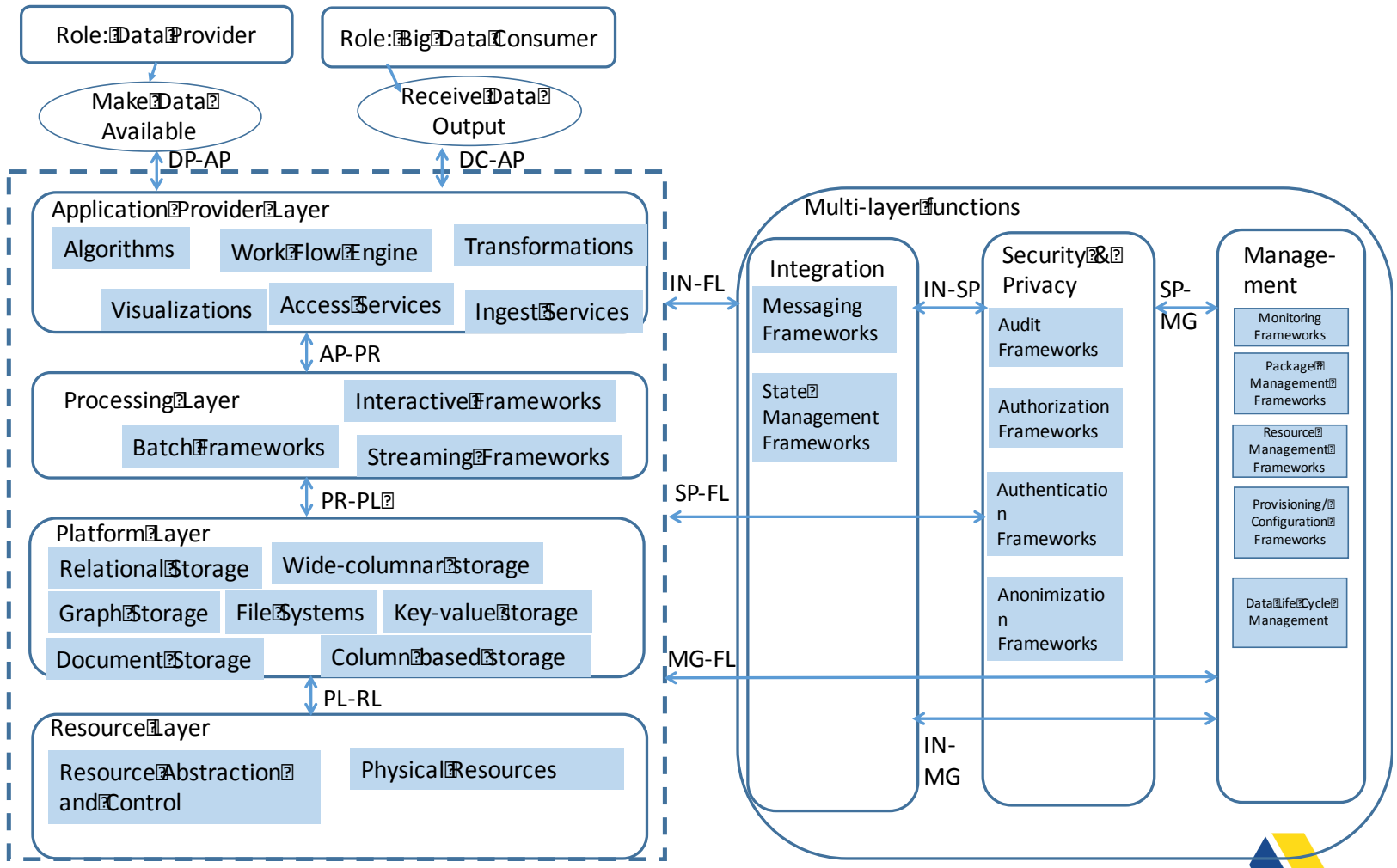
# Latest ISO JTC1 WG9 Big Data Reference Architecture




Big Data Standards Workshop and ISO JTC 1 WG9 meeting, with BDVA Dublin, 15-22 August 2017

(See also forthcoming ISO JTC SC42 Artificial Intelligence)

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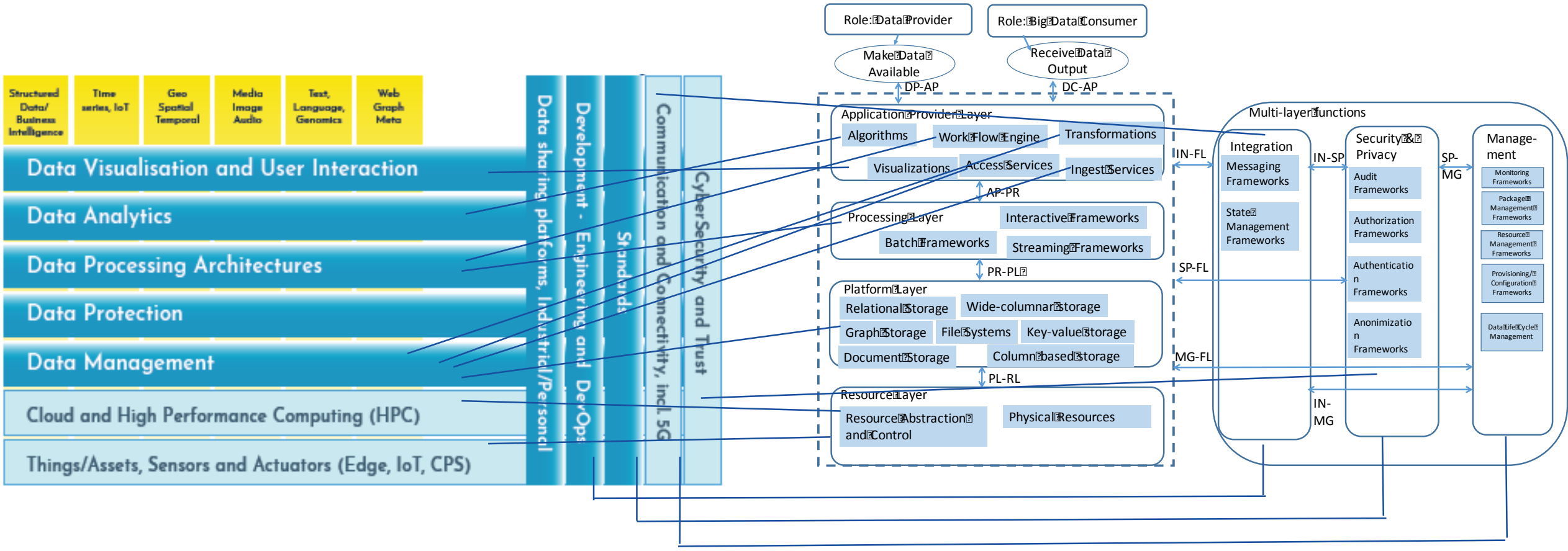
# BDVA Reference Model vs ISO WG9 Big Data Reference Architecture

## Updates/changes from the BDVA Reference Model will be submitted into the ISO process

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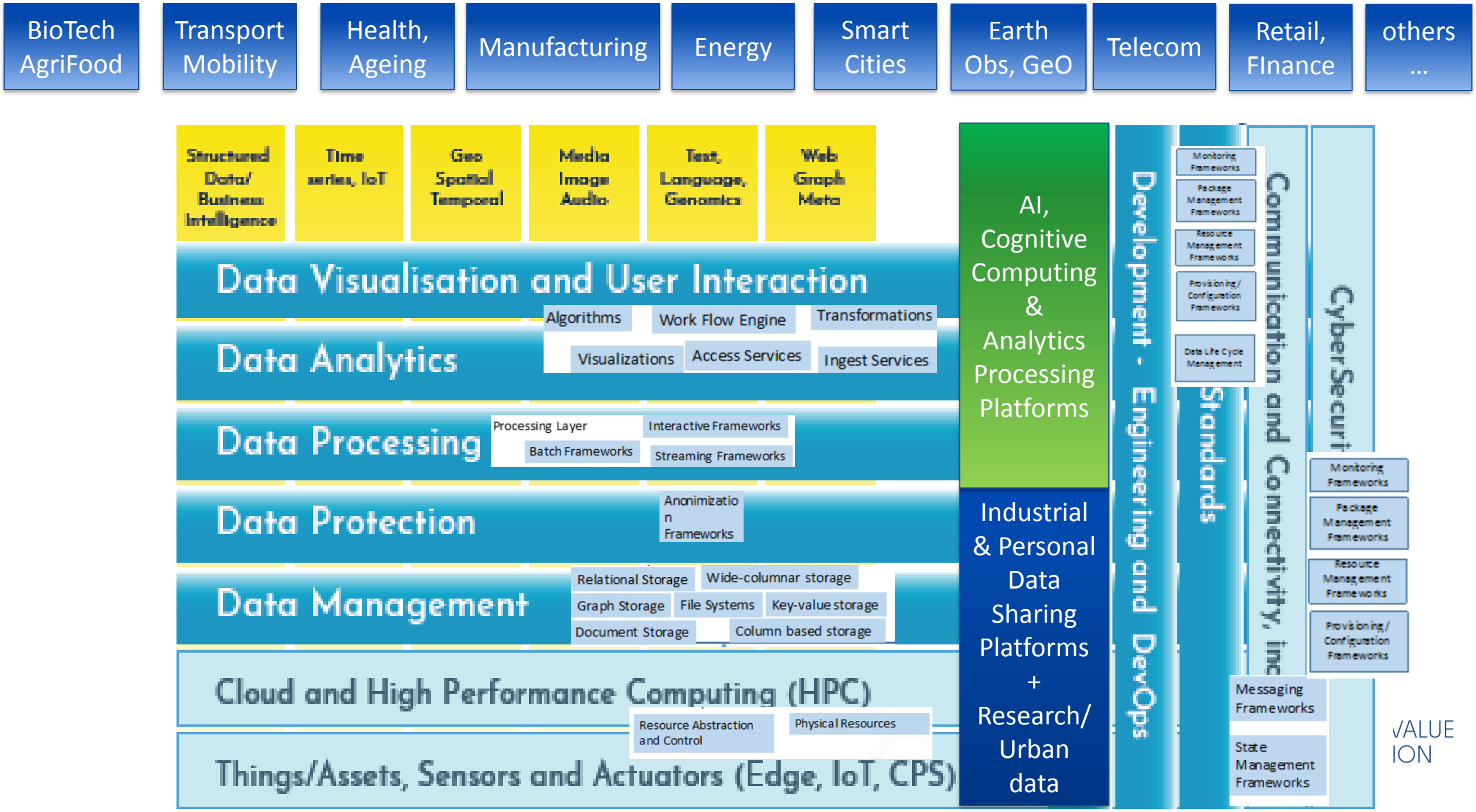
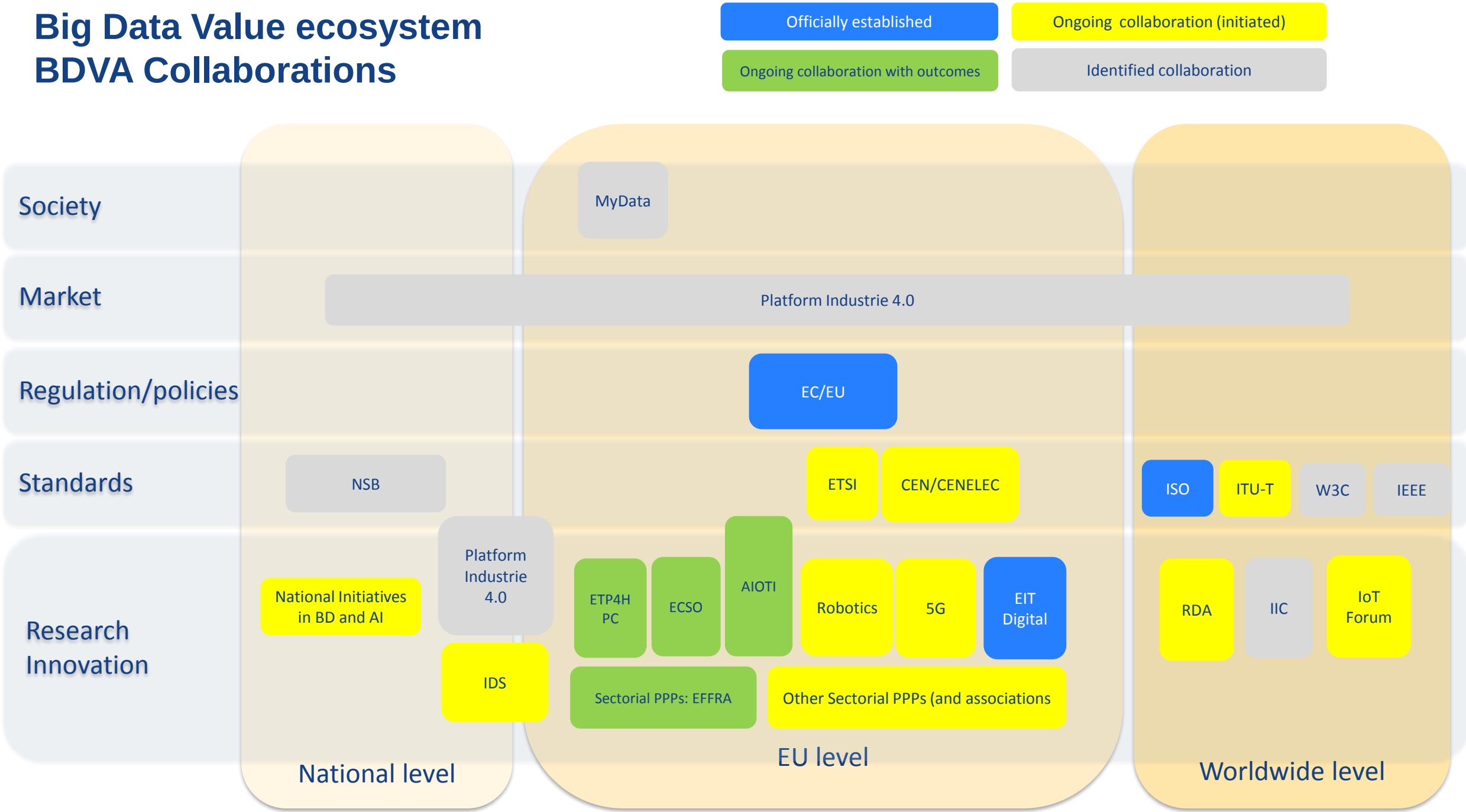
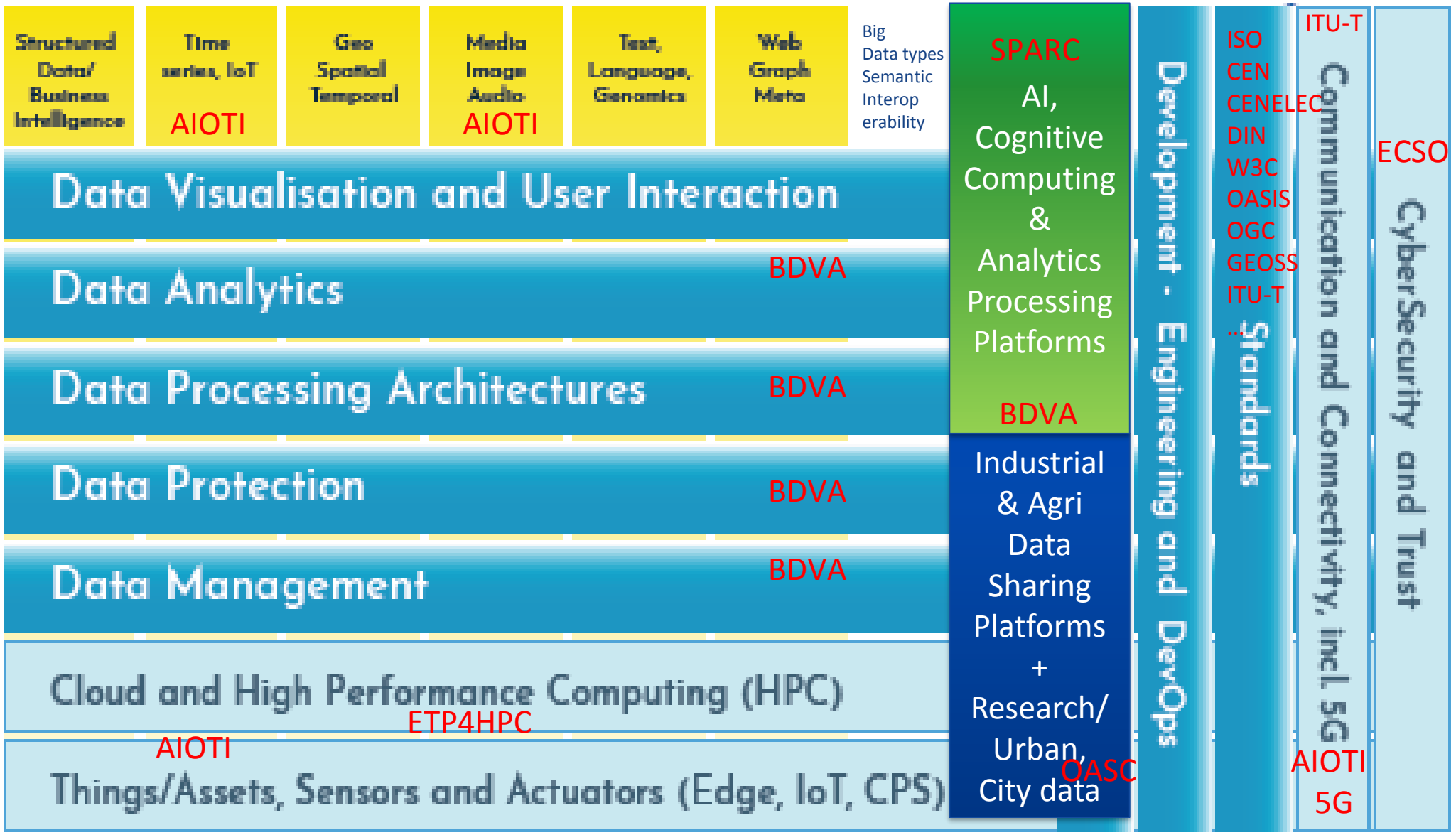

BioTech AgriFood
Transport Mobility
Health, Ageing
Manufacturing
Energy
Smart Cities
Earth Obs, GeO
Telecom
Retail, FInance
others ...
Structured Data/ Business Intelligence
Time series, IoT
Geo Spatial Temporal
Media Image Audio
Text, Language, Genomics
Web Graph Meta
Data Visualisation and User Interaction
Data Analytics
Algorithms
Work Flow Engine
Transformations
Visualizations
Access Services
Ingest Services
Data Processing
Processing Layer
Interactive Frameworks
Batch Frameworks
Streaming Frameworks
Data Protection
Anonimizatio n Frameworks
Data Management
Relational Storage
Wide-columnar storage
Graph Storage
File Systems
Key-value storage
Document Storage
Column based storage
Cloud and High Performance Computing (HPC)
Resource Abstraction and Control
Physical Resources
Things/Assets, Sensors and Actuators (Edge, IoT, CPS)
AI, Cognitive Computing & Analytics Processing Platforms
Industrial & Personal Data Sharing Platforms + Research/ Urban data
Development - Engineering and DevOps
Monitoring Frameworks
Package Management Frameworks
Resource Management Frameworks
Provisioning/ Configuration Frameworks
Data Life Cycle Management
Standards
Communication and Connectivity, inc
Cyber Securi
Monitoring Frameworks
Package Management Frameworks
Resource Management Frameworks
Provisioning/ Configuration Frameworks
Messaging Frameworks
State Management Frameworks
VALUE
ION

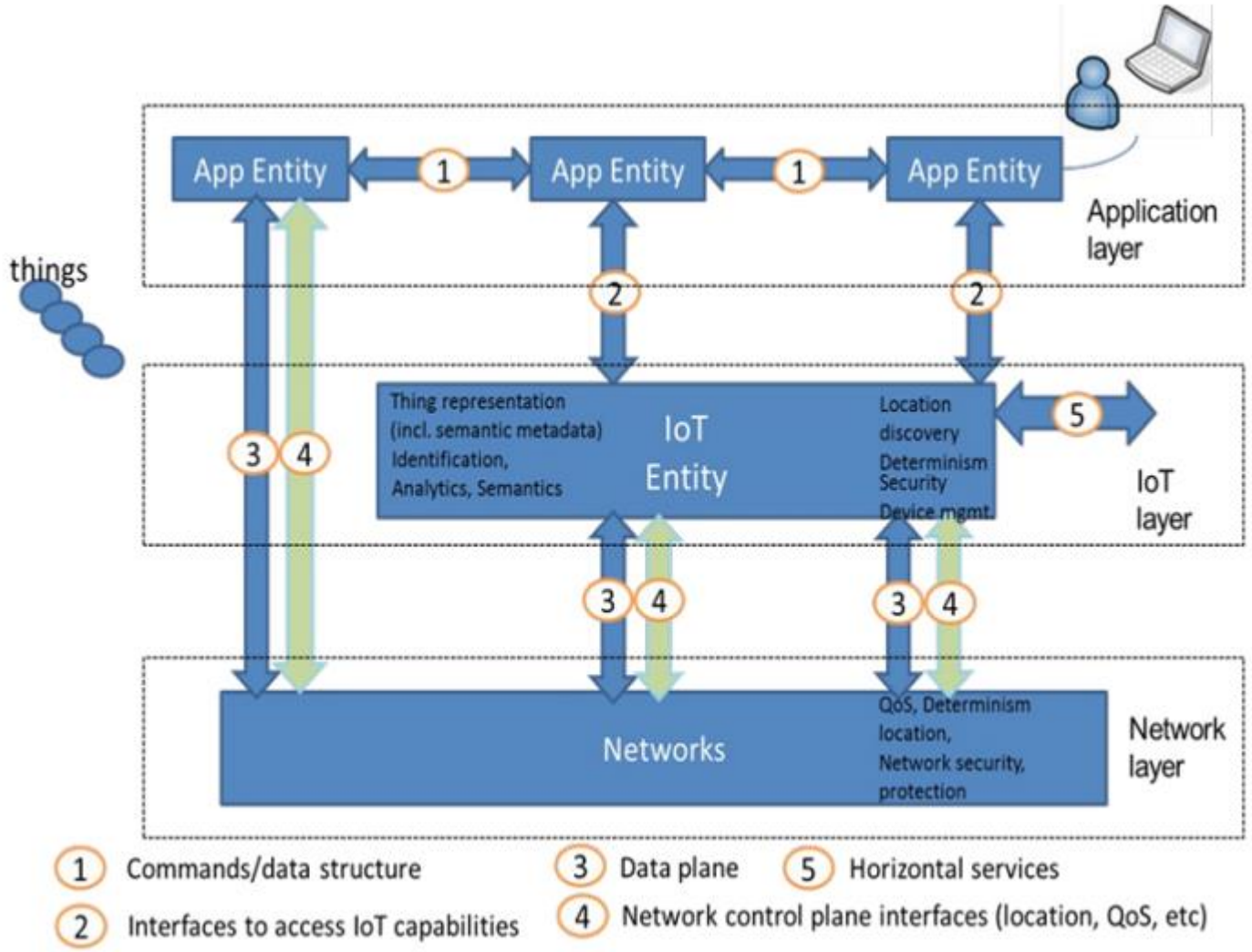
# Big Data Value ecosystem
# BDVA Collaborations



# Some mapping of collaborations in BDV Reference Model



# AIOTI High Level Architecture (HLA)

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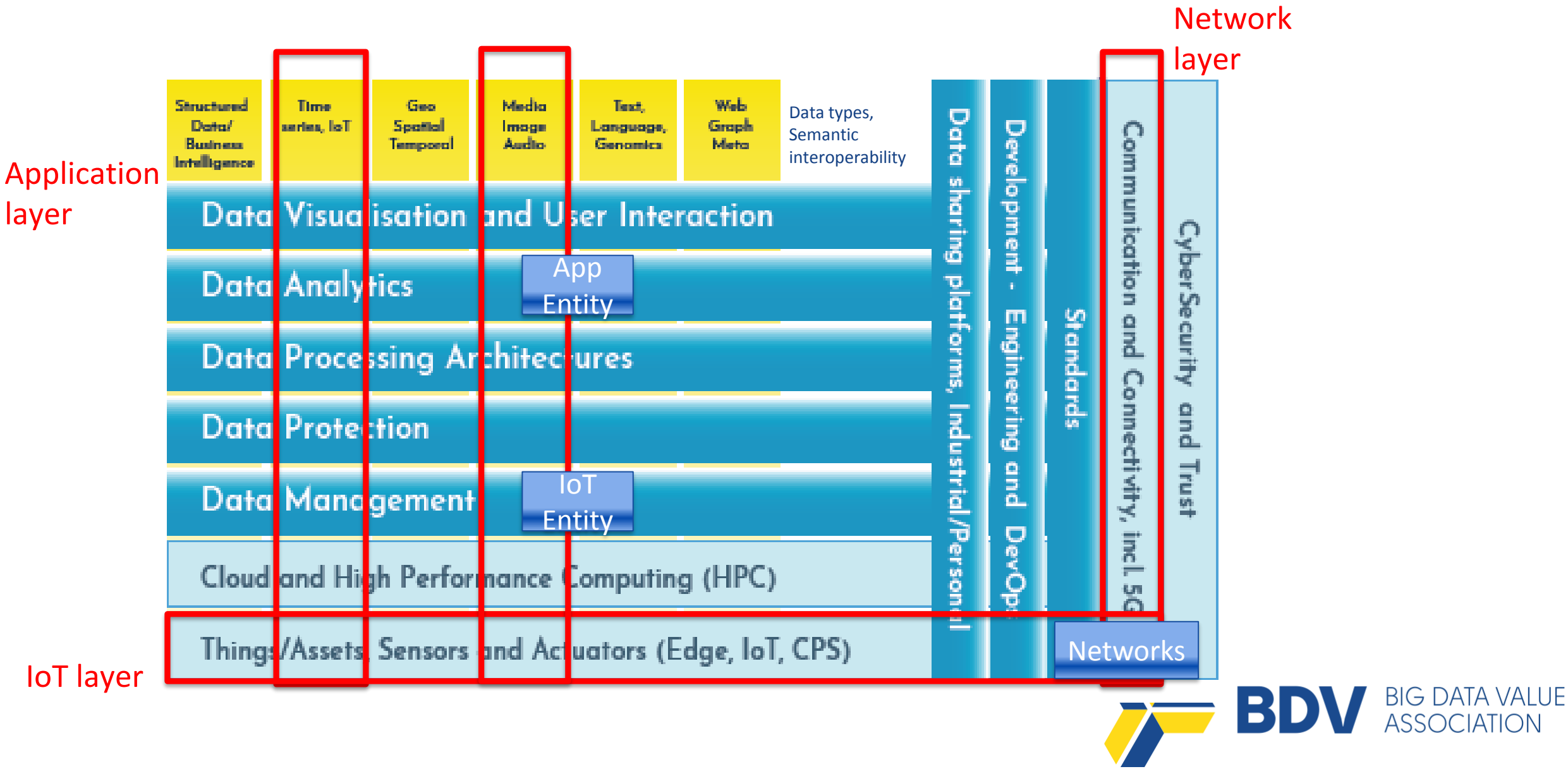
# BDV Reference Model - AIOTI WG03 HLA Mapping

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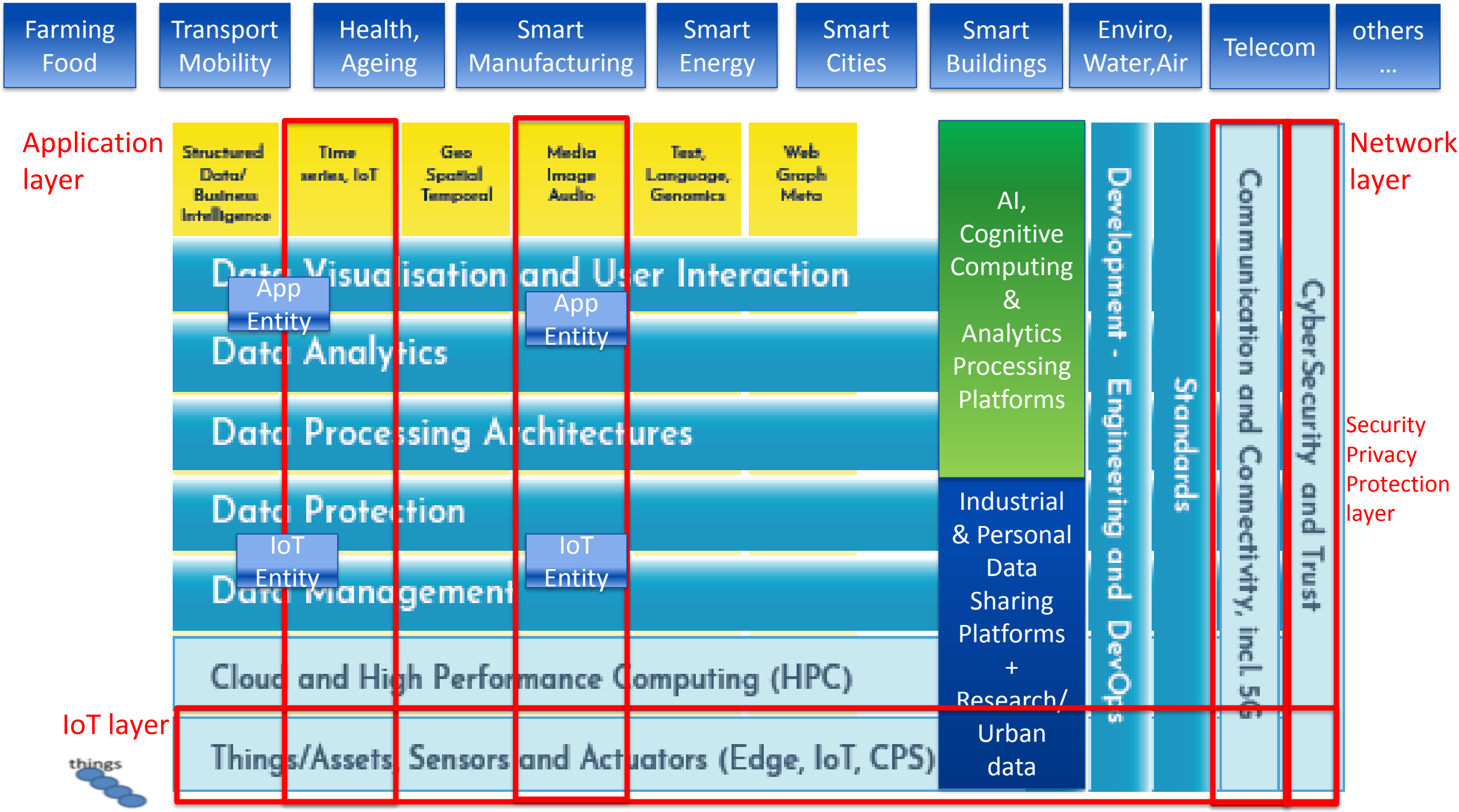

Farming Food
Transport Mobility
Health, Ageing
Smart Manufacturing
Smart Energy
Smart Cities
Smart Buildings
Enviro, Water,Air
Telecom
others ...
Application layer
Network layer
Structured Data/ Business Intelligence
Time series, IoT
Geo Spatial Temporal
Media Image Audio
Text, Language, Genomics
Web Graph Meta
Data Visualisation and User Interaction
App Entity
App Entity
Data Analytics
Data Processing Architectures
Data Protection
IoT Entity
IoT Entity
Data Management
Cloud and High Performance Computing (HPC)
Things/Assets, Sensors and Actuators (Edge, IoT, CPS)
AI, Cognitive Computing & Analytics Processing Platforms
Industrial & Personal Data Sharing Platforms + Research/
Urban data
Development - Engineering and DevOps
Standards
Communication and Connectivity, incl. 5G
CyberSecurity and Trust
Security Privacy Protection layer
IoT layer
things

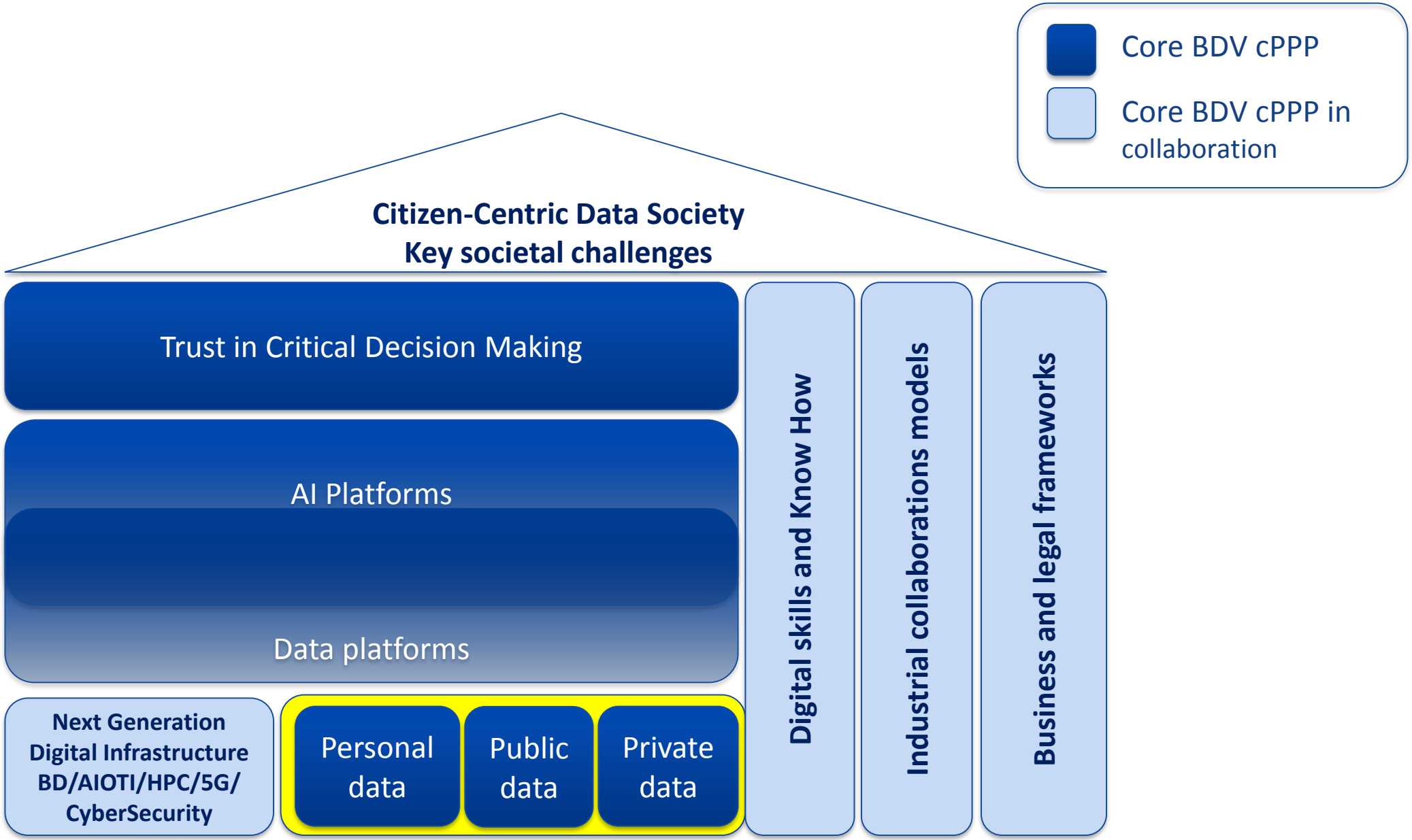
## Project –
## use case template

## (from ISO JTC1 WG9,
## used for BDVA and HPC use-cases)

*Could be harmonised with use case templates from other groups ?*

| | | |
|---|---|---|
| Use case Title | | |
| Vertical (area) | | |
| Author/Company/Email | | |
| Actors/ Stakeholders and their roles and responsibilities | | |
| Goals | | |
| Use case Description | | |
| Current Solutions | Compute(System) | |
| | Storage | |
| | Networking | |
| | Software | |
| Data Characteristics | Data Volume | |
| | Data velocity | |
| | Data variety/data types (Structured, Time series/IoT, Image/Video/Audio, Geo/Spatial, Text/NLP/Genomics, Graph/Network | |
| | Data variability | |
| Data processing and analytics/machine learning characteristics | Data volatility | |
| | Data veracity | |
| | Data monetary value | |
| | Data visualization | |
| | Structured and unstructured data | |
| | Scaling | |
| | Distributed file system | |
| | Distributed data processing – Batch, Realtime, Interactive | |
| | Analytics, Machine Learning | |
| Big data Specific Challenges (Gaps) | | |
| Security and Privacy Requirements | | |
| Highlight issues for generalizing this Use case (e.g. for ref. architecture) | | |
| More Information (URLs) | | |

# Big Data Value post-2020: Main pillars



# BDV PPP IMPLMENTATION
# SOME PPP PROJECT EXAMPLES

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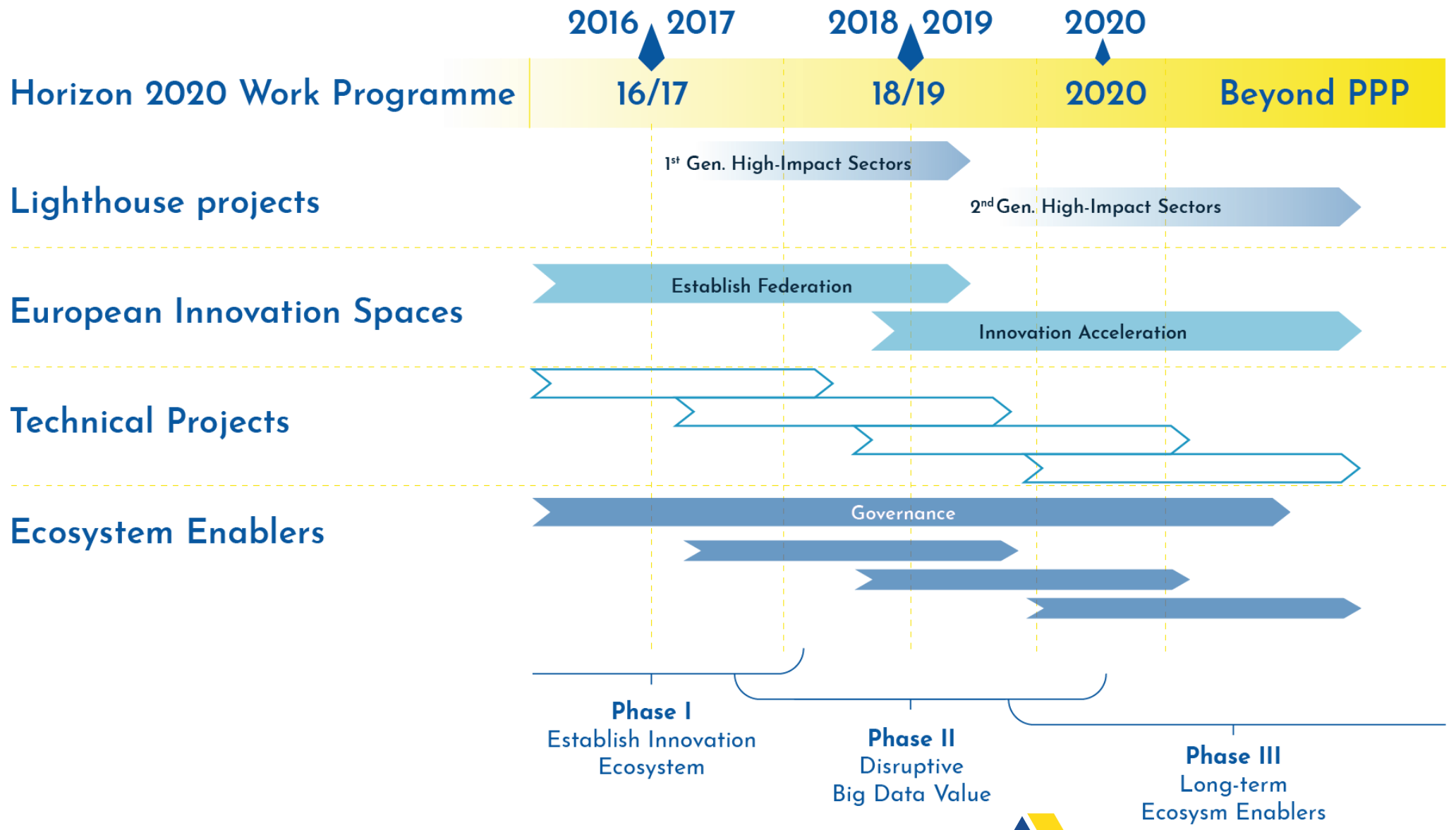
# BDV PPP Roadmap

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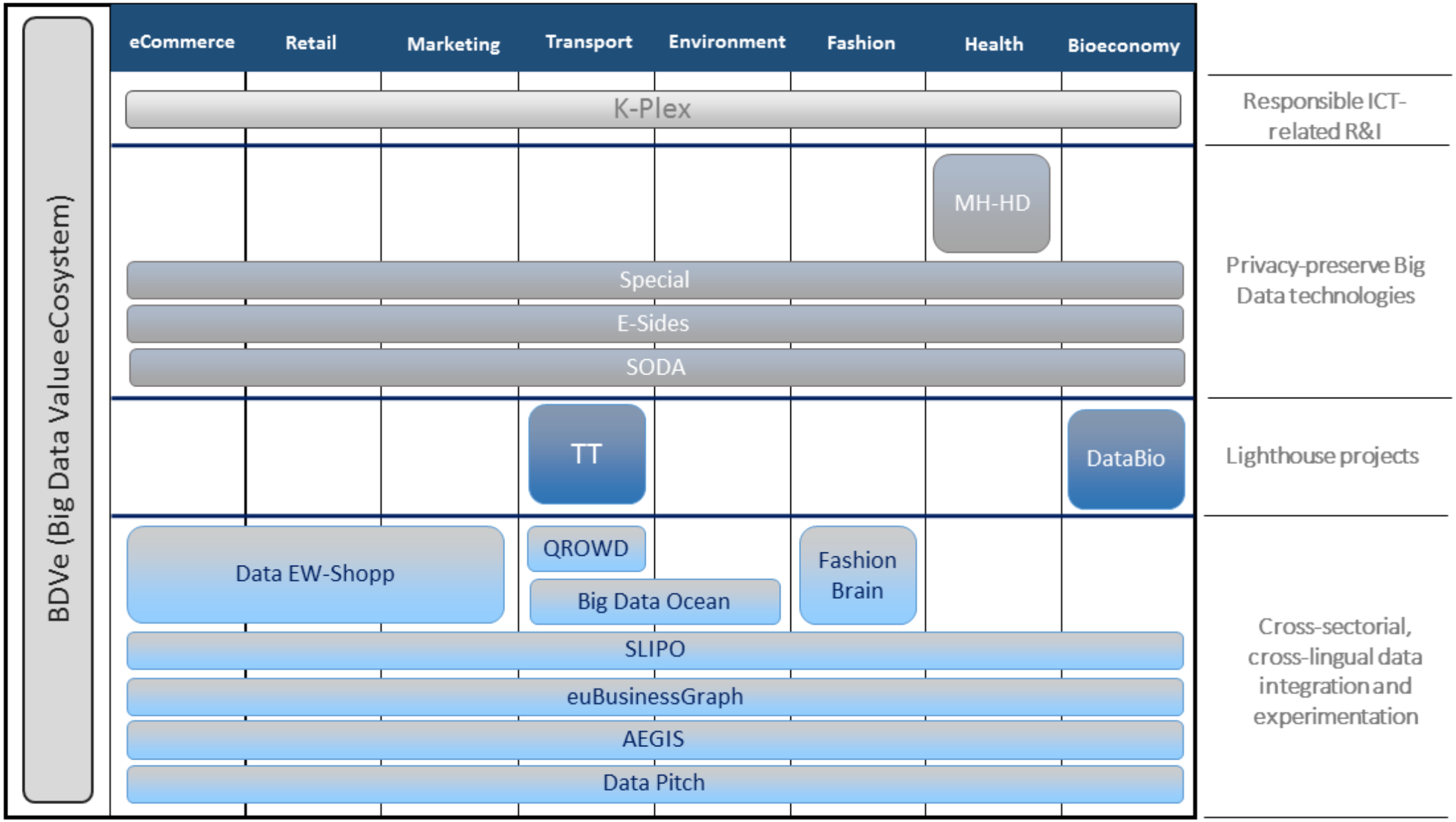
# **BDV PPP Implementation projects** (H2020-ICT-2016)



# **BDV PPP Implementation projects** (H2020-ICT-2016-2017) (33 projects)

BDV PPP implementation website: **www.big-data-value.eu**

**Data Incubators /**
Data Platforms
**(IA)**

Topic:
**ICT-14-WP2016-2017**

**N=15**

**Lighthouse Projects /**
Large scale pilots / test-beds
**(IA)**

Topic:
**ICT-15-2016-2017**

**N=4**

**Technical Projects**
**(RIA)**

Topic:
**ICT-18-2016**
**ICT-16-2017**

**N=12**

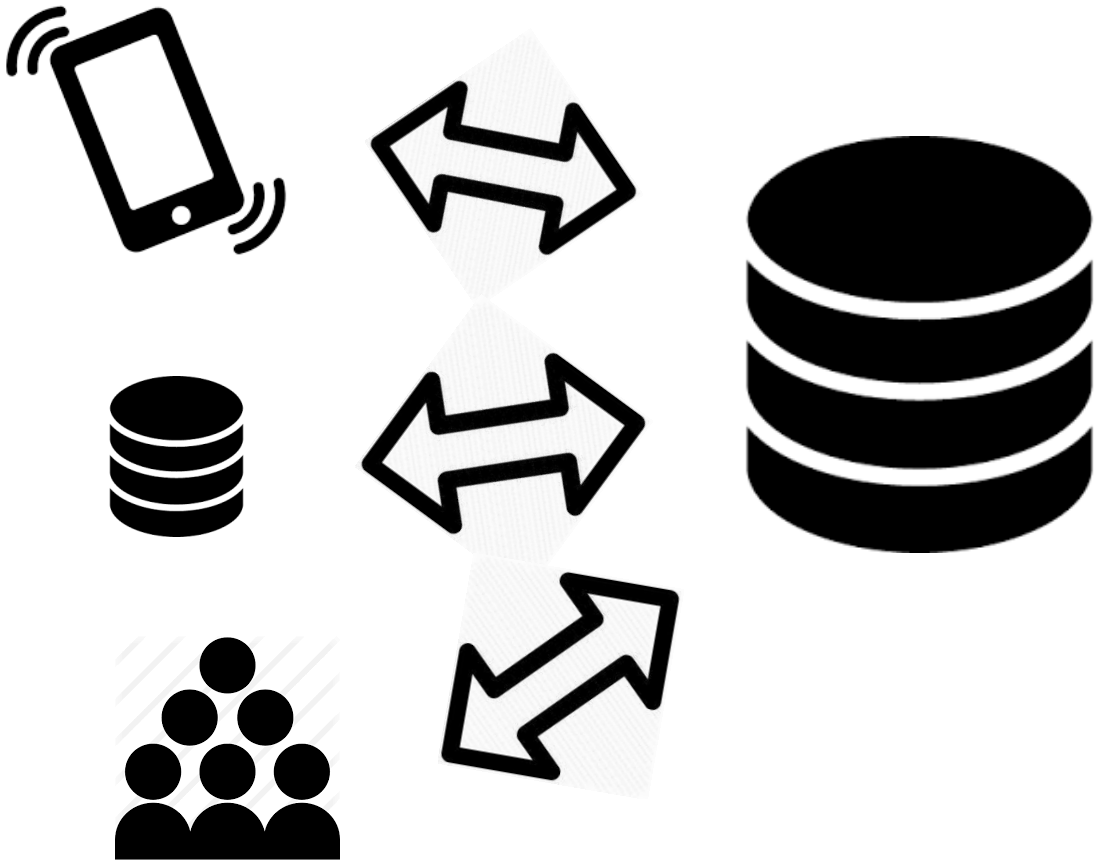
**Collab. & Support Actions (CSA)**
Topic: **ICT-17-2016-2017**

**N=2**

ALUE
ON

# Human factor on urban mobility Data Value Chain

## For data collection and integration



We deliver tools to:

- Collect data from engaged citizens (i-Log app)
- Integrate data into a data lake from disparate sources (Pentaho Kettle, Karma integration, URI-fication, RDF-ization)
- Data collection from crowd-workers

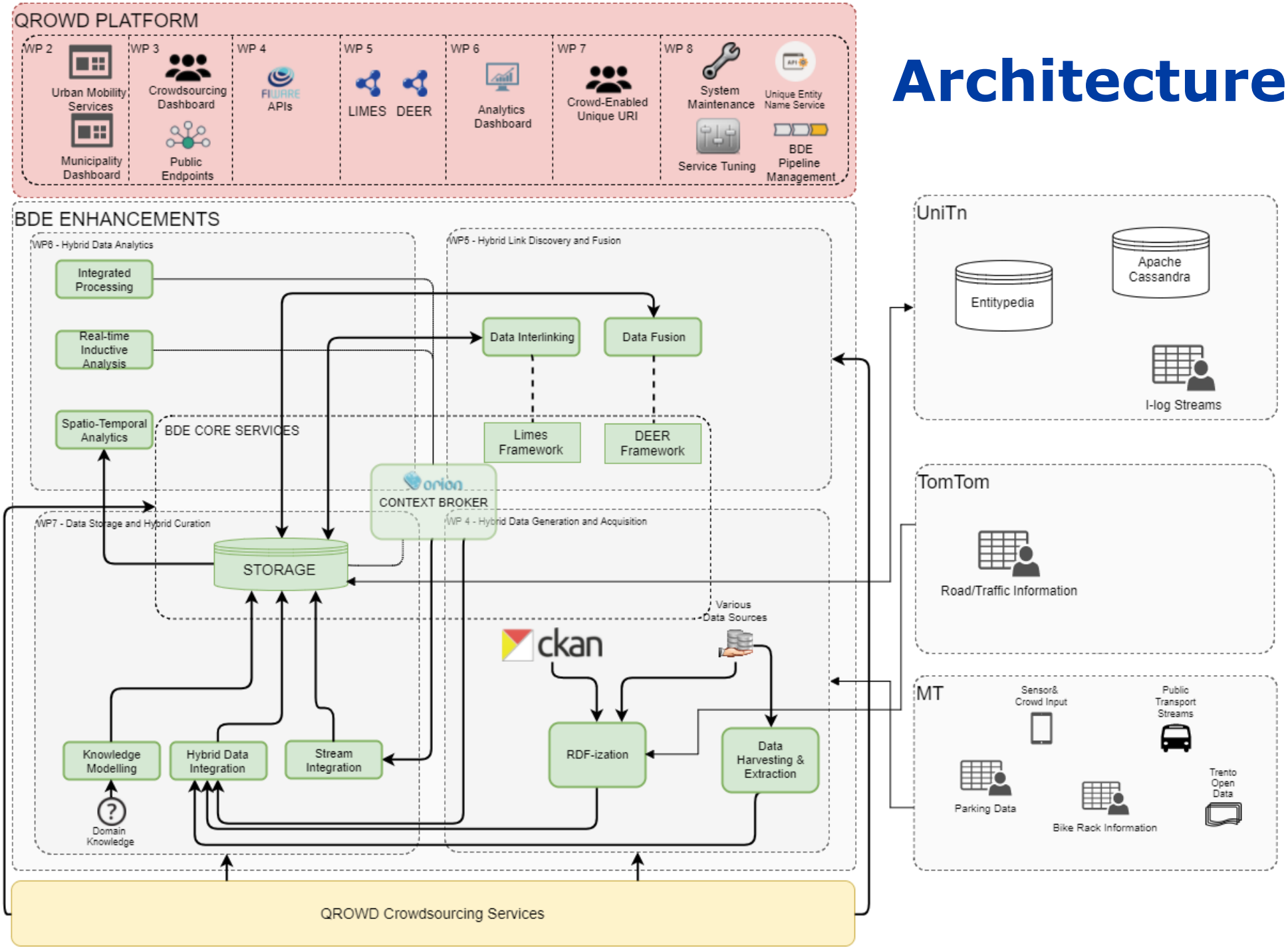
BIG DATA VALUE PPP

# Main data sources

## Two main data providers: Municipality of Trento and TomTom

- Open data from Trento Municipality and Region (i.e. city–bus stops, bike racks…-, )
- Stream data (often managed by 3rd parties) from some urban traffic sensors and data streams in Trento (i.e. parking occupation, bus positions…).
- Historical data about mobility in the area from Trento and TomTom (i.e. several years of TomTom devices in the area, weather conditions,
- Crowdsourced data

# Architecture view




Using standards and existing tools as much as possible.

- FIWARE and OASC-compliant
- Big Data Europe
- CKAN, RDF

# Human factor on urban mobility Data Value Chain

## Data Acquisition

•**Getting data from citizens**, i.e. by completing data infrastructure (locating bike racks) and measuring occupancy of parking groups that are not

## Data Analysis

- By helping in the **training phase**: i.e. citizens with an extra incentive can provide data with more frequent and precise labels, that can be used as training sets for machine algorithms
- **Confirming the predictions** of transportation mode made by the machine, opening the door to improving the quality of the machine prediction on the go

## Data Curation

- **Curate data on mobility infrastructure**. i.e. in Trento, data about disabled parking spots is incomplete, needs to be verified and curated

## Data Linking and Integration

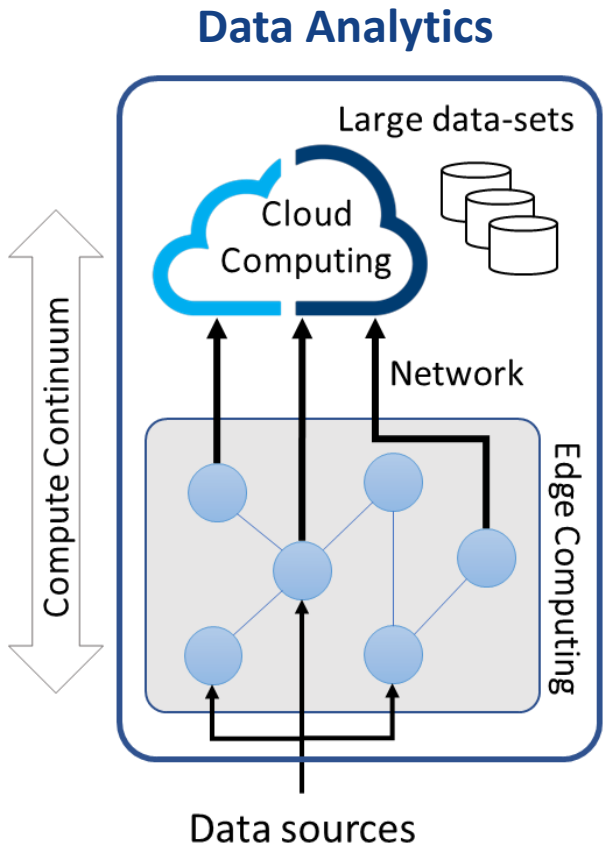
- Detection of **inconsistencies**: i.e. when trying to merge several data sources
- **Entity resolution, disambiguation, missing data**: i.e. a mobility point appears at one position in the council's data, in a slightly different in Open Street Map, not at all on TomTom's map

CLASS

EDGE AND CLOUD COMPUTATION:
A HIGHLY DISTRIBUTED SOFTWARE
FOR BIG DATA ANALYTICS

## Main Contribution

- Towards a **fully distributed architecture** which edge and cloud computing resources are coordinated
- Develop a **novel software architecture** capable of
  1. **Distribute and coordinate** big-data workloads with real-time requirements along the compute continuum
  2. **Combine** data-in-motion and data-at-rest analytics
  3. **Increase productivity** in terms of programmability, portability/scalability and (guaranteed) performance




BIG DATA VALUE PPP

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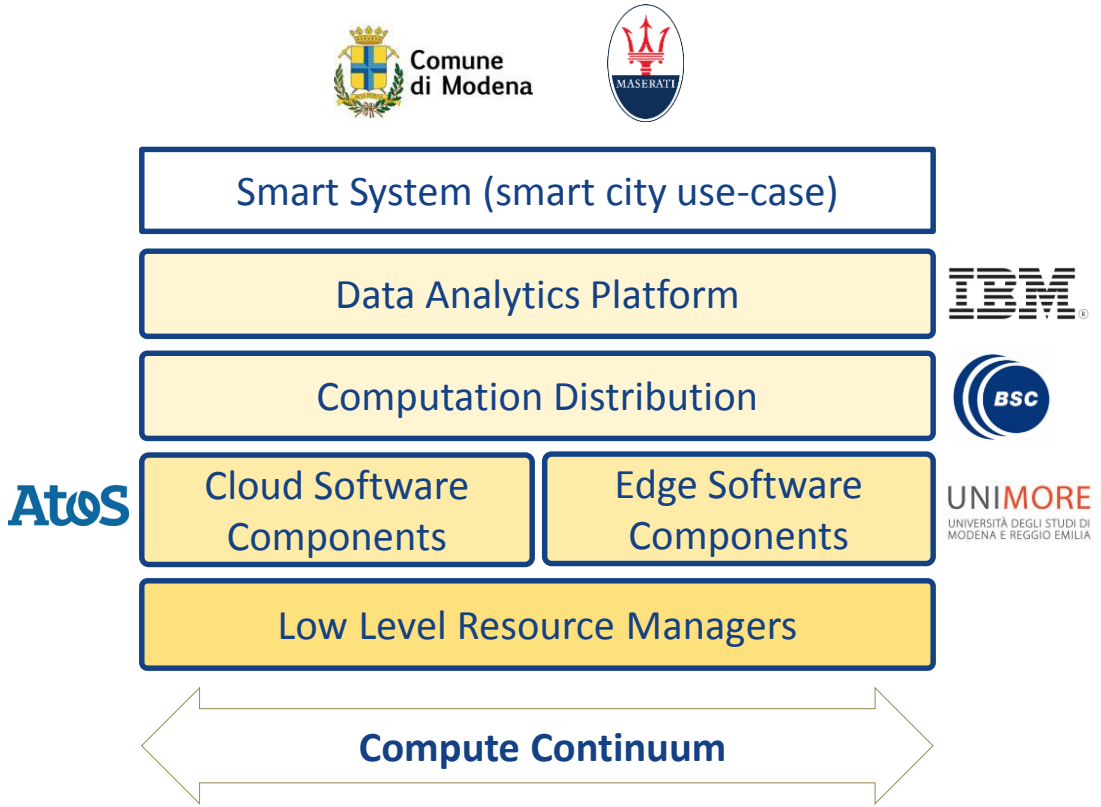
## Software Development Framework

Integrate technologies from different computing domains into a single development framework

1. Combine of SoA data-in-motion and data-at-rest **analytics** solutions
2. Apply **high-performance** techniques to distribute computation across edge/cloud resources
3. Apply of **timing analysis** techniques
4. Use the most advanced parallel heterogeneous **embedded** platforms



CLASS

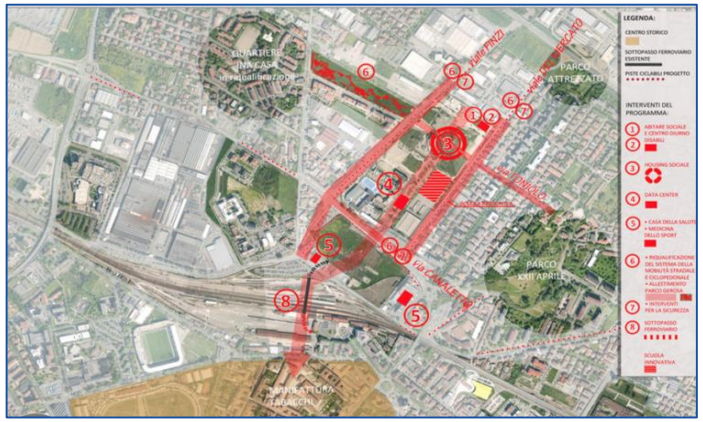
EDGE AND CLOUD COMPUTATION:
A HIGHLY DISTRIBUTED SOFTWARE
FOR BIG DATA ANALYTICS

## Smart City Use-case

- Deployed on a real urban area in the city of Modena (Italy) with several highly-connected cars
  1. Intelligent traffic management, acting on traffic lights and smart road signals
  2. Advanced driving assistance systems

- **Data analytics** and **real-time** requirements
- **11.4 GB/s** of heterogeneous data-sets considering 3 cars and a 1 km$^2$ sensing area

## Automotive Smart Area



V2X connectivity + sensors

Prototype car intended to be used

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**Further Information:**

BDVA: http://www.bdva.eu/
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info@core.bdva.eu

@BDVA_PPP #Bigdatavalue #Bigdata

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