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Technological pillars to enable Smarter (Collaborative + Inclusive) Environments: Internet of Things, Web of Data and Citizen Participation

Workshop Co-Creating of Inclusive and Mediated Public Spaces

13-16 February, Lisbon, Portugal

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http://www.morelab.deusto.es

MORE lab
envisioning future internet

Agenda

1. **Introduction: Technological and methodical pillars for Smarter Environment Enablement**
2. **Part I: Smarter Environments Theoretical Grounding**
   - What is a Smart Environment?
   - Technological enablers: IoT, Web of Data and Persuasive Technologies
   - Technology mediated Human Collaboration: need for co-creation
   - Killer application domains: Open Government & Age-friendly cities
3. **Part II: Review of core enablers for Smarter Environments**
   - Co-creation methodologies: Service Design and Design for Thinking
   - Internet of Things and Web of Things
   - Web of Data: Linked Data, Crowdsourcing & Big Data
   - Persuasive technologies and Behaviour Change
4. **Part III: Implications for CyberParks**
   - European projects on enabling Smarter Environments: WeLive, City4Age, GreenSoul
   - Reflections on the need for collaboration among stakeholders mediated with technology to realize CyberParks
5. **Conclusions and practical implications**

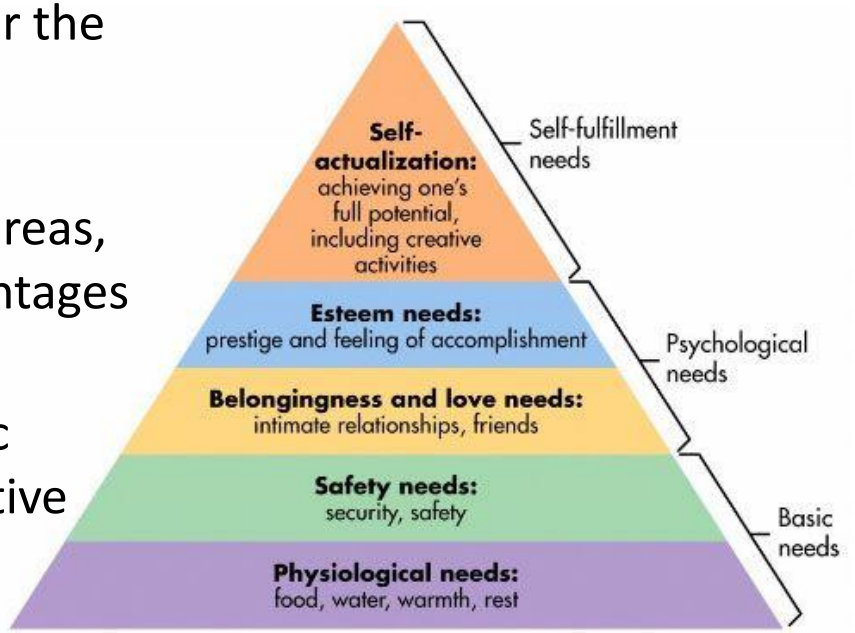
Smarter Public Open Spaces

- **Smarter Spaces**→ spaces that do not only manage their **resources more efficiently** but also are **aware of the citizens' needs**.
  - ***Human/space interactions leave digital traces*** that can be compiled into *comprehensive pictures of human daily facets*
  - ***Analysis and discovery of the information behind the big amount of Broad Data captured*** on these smart spaces deployment

Smarter Places= Co-Creation/Citizen Participation + Internet of Things + Broad Data + Analytics

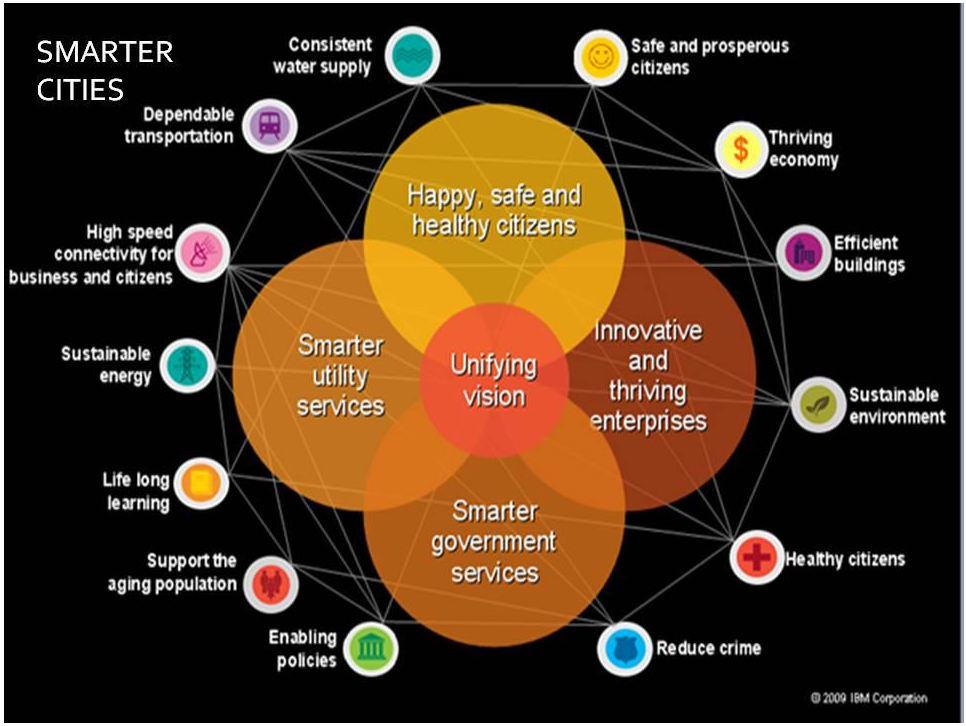
Smart Environments

- ***Smart City*** is a place where **urban services are improved** in efficiency by applying **ICT**, for the benefit of its inhabitants and economic development
- ***Smart Territories*** innovative geographic areas, able to build their own competitive advantages taking into account their context
- ***Smart Places***→ balance among economic competitiveness, social cohesion, innovative creativity, democratic governance and environmental sustainability
  - Satisfying the **basic and self-fulfilment needs in the Maslow pyramid**



Challenges for Smarter Cities

- **Enable life, work and leisure environments** which allow our self-fulfilment without disregarding basic needs and their development in welfare society
- **Answer to the urbanization demands** in a economically feasible, socially inclusive **and sustainable manner**
  - BUT… apply **traditional solutions** to the needs of urban development → **unsustainable urban ecology footprint**
    - Generate more electricity or new water resources not addressing inefficiencies in distribution



ICT as levers of Smarter Cities (I)

- ICTs will help in the urbanization and ageing problems associated to cities **iff the following 3 premises** are fulfilled:
  1. **Social equity**
  2. **Economic feasibility** and
  3. **Environmental sustainability**

- ICTs are key to leverage the existing urban infrastructure and maximize the socioeconomic throughput
  - A **more rational and extensive usage of ICT in cities and places** → a quicker and more economic fulfilment of urban challenges

ICT as levers of Smarter Cities (II): Big | Open | Personal Data

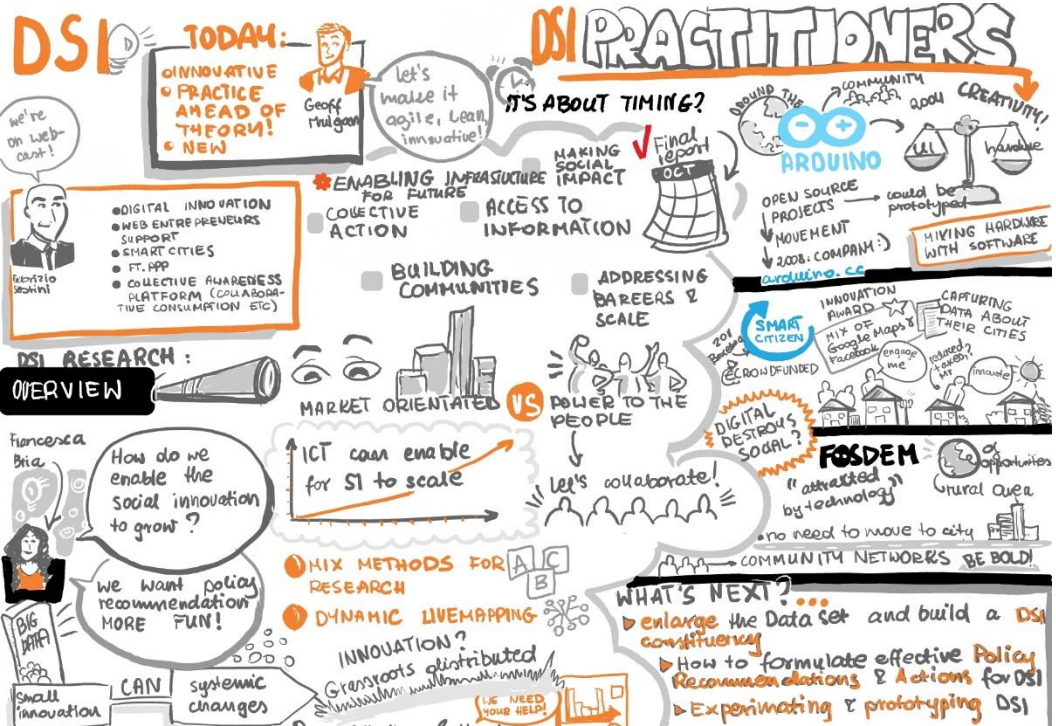
- Big potential for enterprises, social entities and governments if there is a **better usage of infrastructure and information** (IoT + Open + Personal data) **in urban environments**:
  - ***Big Data***: extensive analysis of heterogeneous urban data to **offer answers, indicators and visualizations** to help improving the decision criteria upon the challenges of cities and territory management
- It will allow us to **progress towards more disruptive approaches**
  - All agents should benefit from a more efficient usage of data processing technology to give place to ***Urban or Physical Spaces Analytics***
    - ***Great potential but huge difficulty associated!***

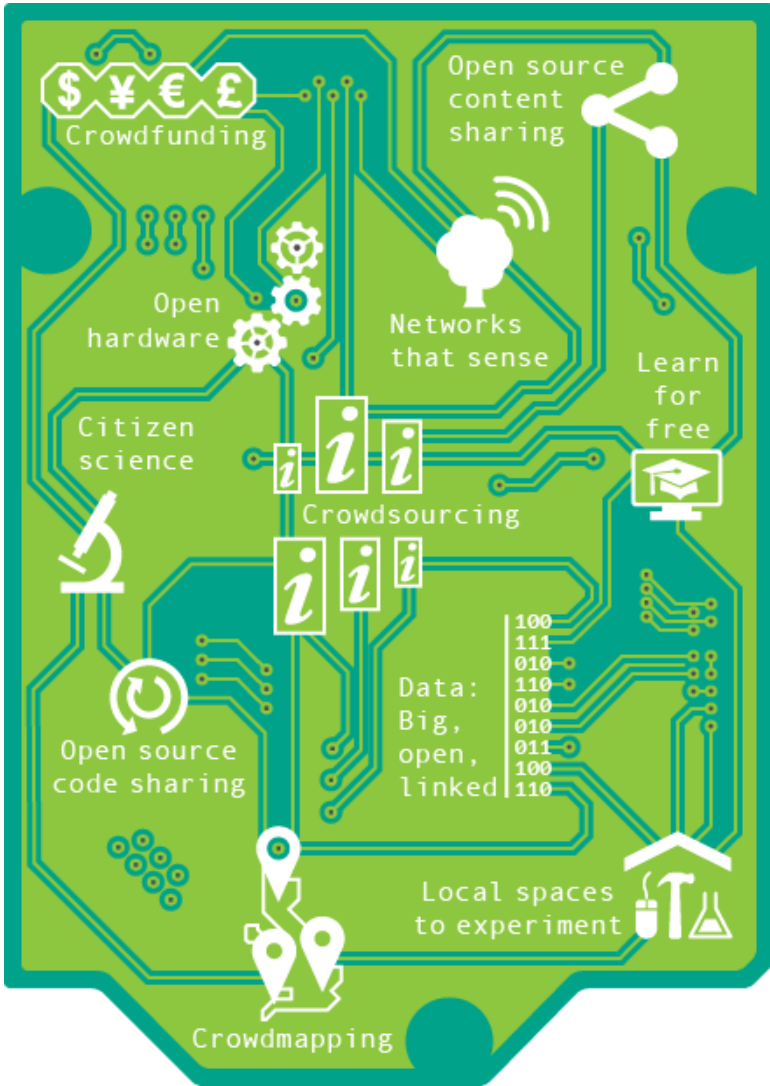
ICT as levers of Smarter Cities (III): Open Collaboration

- **Smarter environments cannot only be reached through technological solutions**
  - We have to take advantage of the **huge potential of collective intelligence** – citizenship capacity to generate knowledge through crowdsourcing techniques and **co-creation** – where ideation and production are socialized
    - **Citizens are increasibly becoming prosumers & makers!**

Social Open Innovation

- **Novel solution to a social problem** that is more effective, efficient, sustainable, or just than current solutions (**CAPS**).
  - **New** ideas (**products, services and models**) that simultaneously **meet social needs** and create new social relationships





ICT as levers of Smarter Cities (V): Ethical Implications

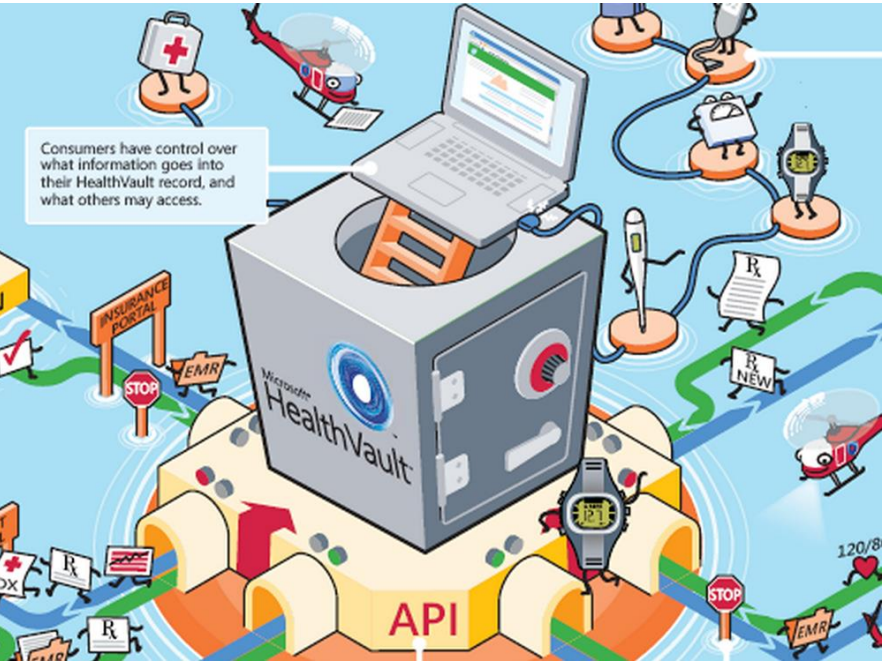
- **Personal data are the "new petrol" of XXI century**, being exploited by big corporations such as Google, Apple (publicity + marketing) **BUT …**
  - There are **multiple distributed personal data silos** among different Internet providers and institutions which **have to be interoperable**
  - There is a need for individuals to have a **greater control of their own personal data**

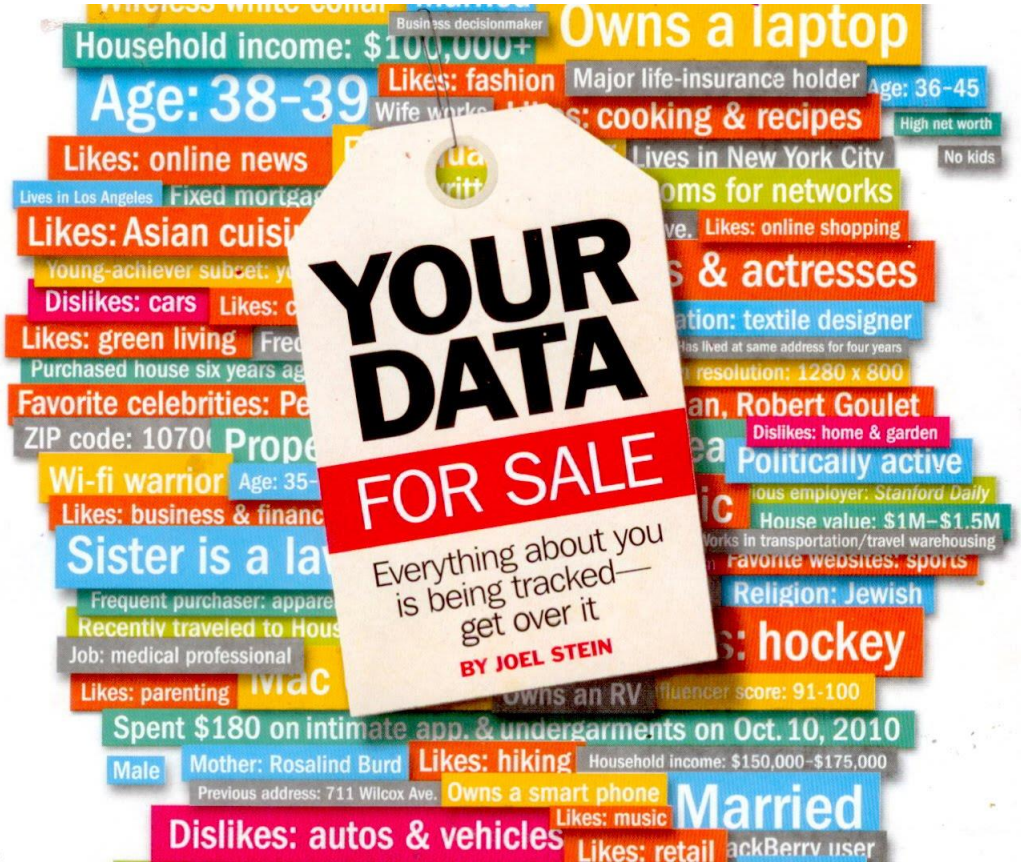
- Governments must:
  - **Regulate, protect, legislate to guarantee the rights and opportunities of such data providers** (we)
  - Legislate and manage **non-functional aspects** (***accessibility*** – technological inclusion, ***privacy***, ***data protection*** and ***ethics*** to achieve responsible technological solutions

Personal Data

> “Personal data is the new oil of the internet & the new currency of the digital world.”
>
> **MEGLENA KUNEVA**, European Consumer Commissioner

- Defined as "**any information relating to an identified or identifiable natural person** ("data subject")”





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Ambient Assisted Cities: Age-friendly Smart Cities

- The main attribute of a **Smart City** is **efficiency**
- An **Age-friendly city** is an inclusive and accessible urban environment that promotes active ageing
- The **main attributes of an Ambient Assisted (Smarter) City** are:
  - **Livable**
  - **Accessible**
  - **Healthy**
  - **Inclusive**
  - **Participative**

[WHO Global Network of Age-friendly Cities]

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The need for Participative Cities

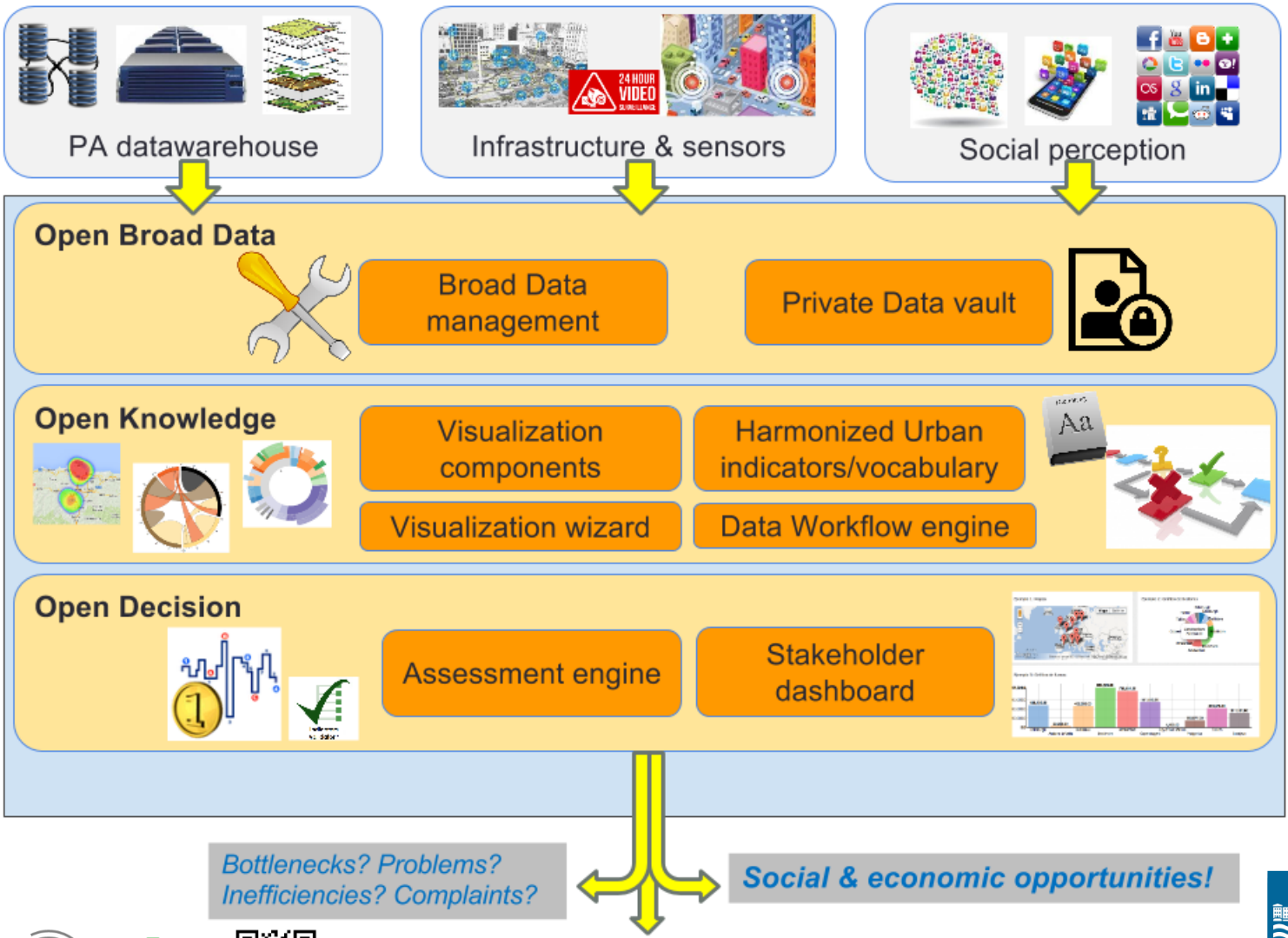
- **Not enough with the traditional resource efficiency approach** of Smart City initiatives
  - **"City appeal and dynamicity"** will be key to attract and retain citizens, companies and tourists
  - Only possible by **user-driven and centric innovation**:
    - **The citizen should be heard, EMPOWERED!**
      - » Urban apps to enhance the experience and interactions of the citizen, by taking advantage of the city infrastructure
    - The **information generated by cities and citizens must be linked** and processed
      - » How do we correlate, link and exploit such humongous data for all stakeholders' benefit?
        - Demand for **Big (Linked) Data for enabling Urban Analytics!!!**

Broad Data Analytics

- **Broad Data aggregates data from heterogeneous sources**:
  - Open Government Data repositories
  - User-supplied data w/social networks or apps (**OSM, Wikipedia**)
  - Public private sector data or
  - End-user private data

- **Huge potential on correlating and analysing Broad Data**:
  - Leverage **digital traces left by citizens** in their daily interactions with the city **to gain insights** about why, how and when they do things
  - We can progress **from Open City Data to Open Data Knowledge**
    - Energy saving, improve health monitoring, optimized transport system, filtering and recommendation of contents and services

From Open Data to Open Knowledge



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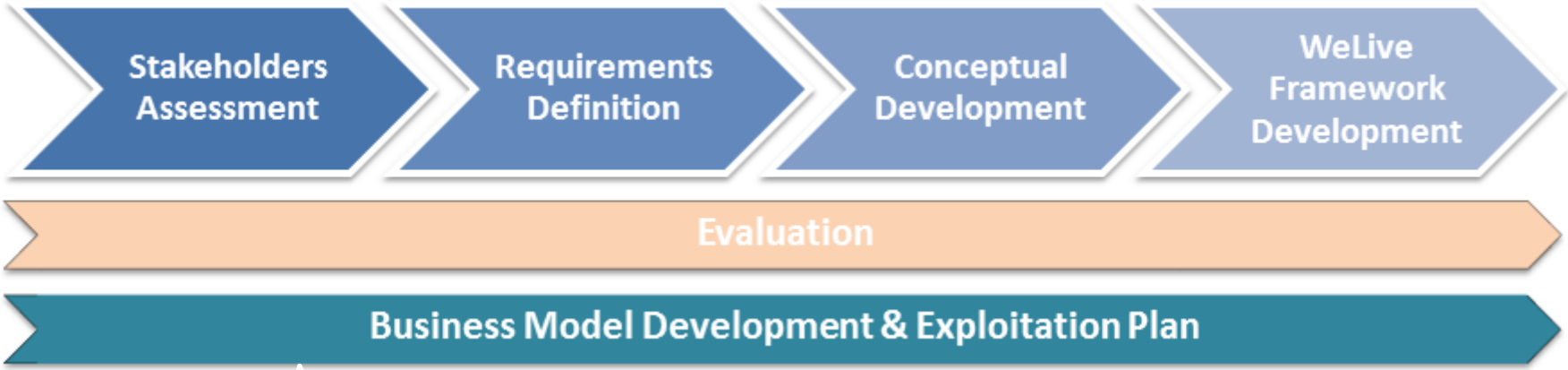
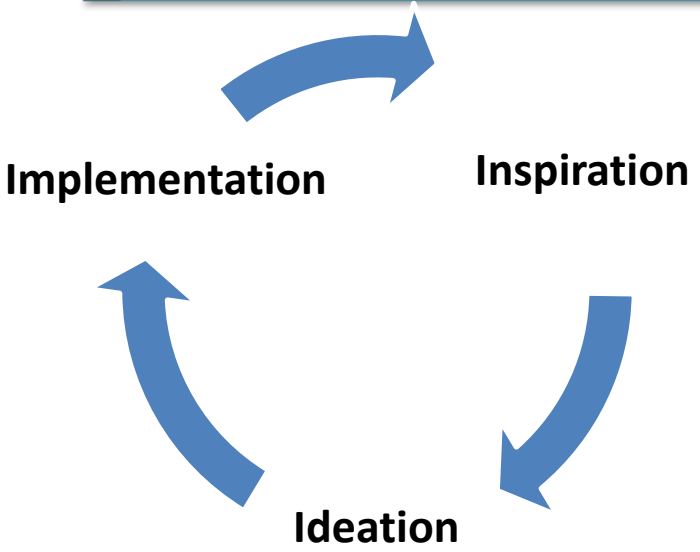
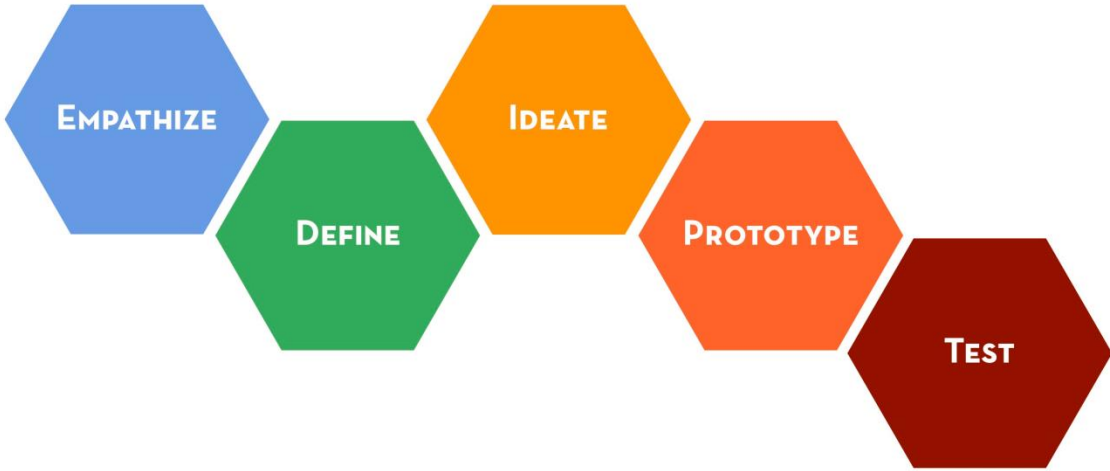
Co-Creation of public services: service design approach through Design Thinking







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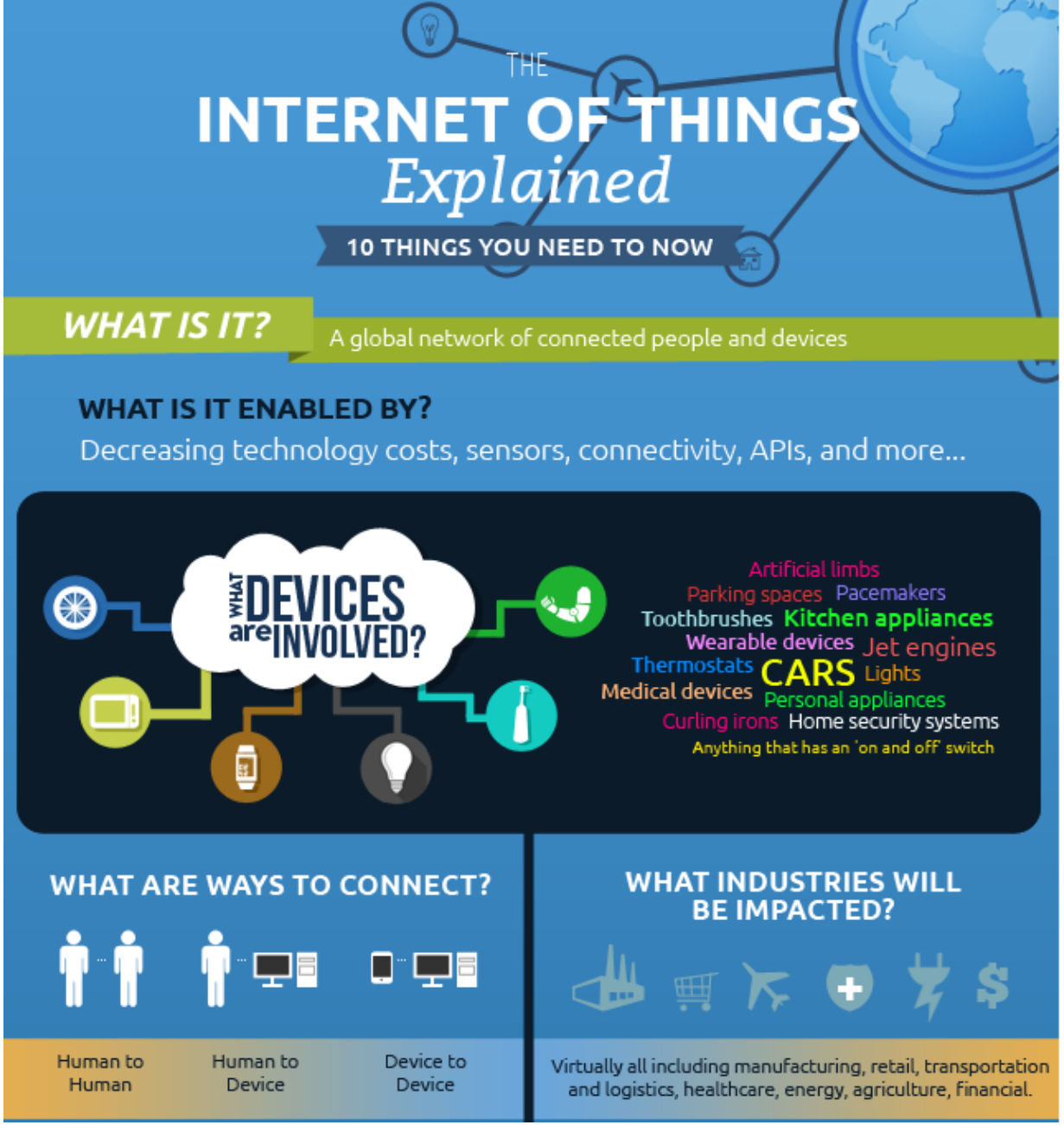
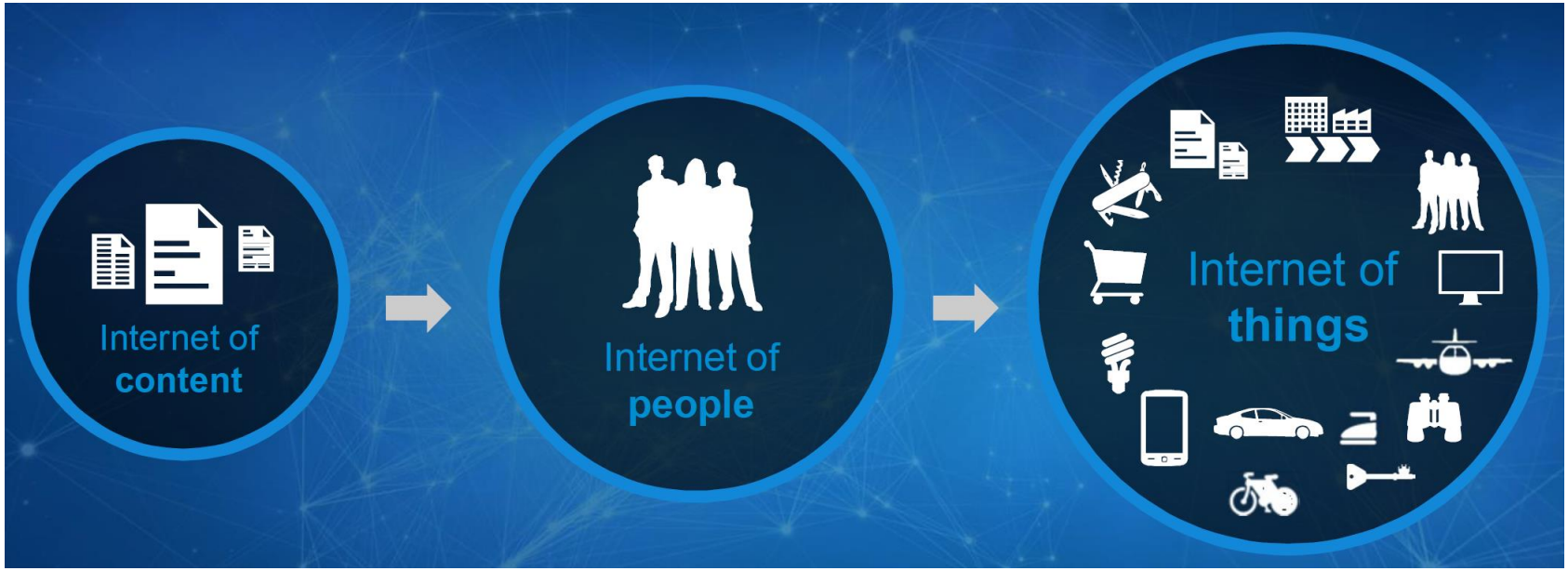

THE
INTERNET OF THINGS
Explained
10 THINGS YOU NEED TO NOW
WHAT IS IT?
A global network of connected people and devices
WHAT IS IT ENABLED BY?
Decreasing technology costs, sensors, connectivity, APIs, and more...
WHAT DEVICES are INVOLVED?
Artificial limbs
Parking spaces
Pacemakers
Toothbrushes
Kitchen appliances
Wearable devices
Jet engines
Thermostats
CARS
Lights
Medical devices
Personal appliances
Curling irons
Home security systems
Anything that has an 'on and off' switch
WHAT ARE WAYS TO CONNECT?
Human to Human
Human to Device
Device to Device
WHAT INDUSTRIES WILL BE IMPACTED?
Virtually all including manufacturing, retail, transportation and logistics, healthcare, energy, agriculture, financial.

Internet of Things … connecting information, people and things

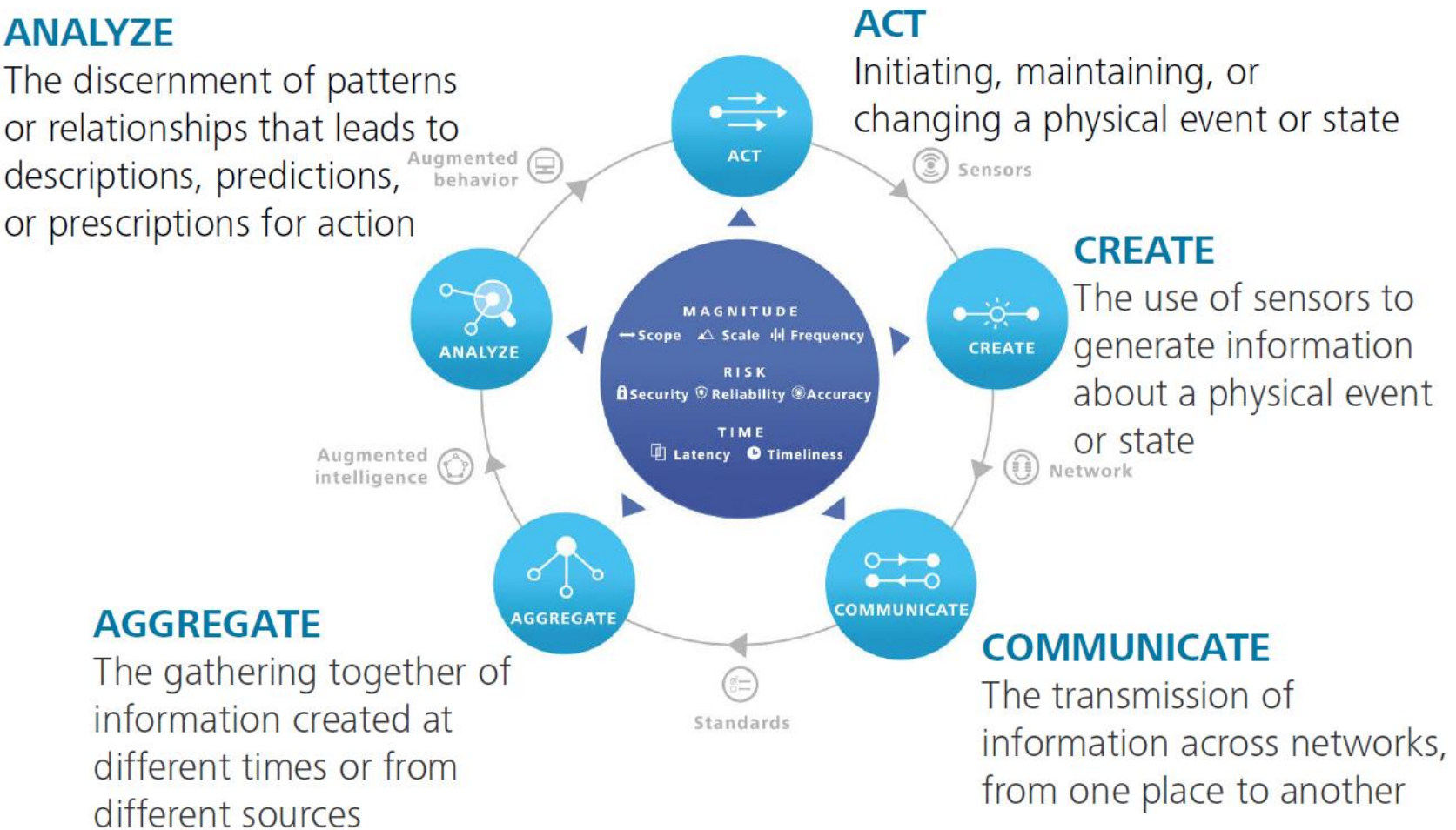


6 facts about IoT

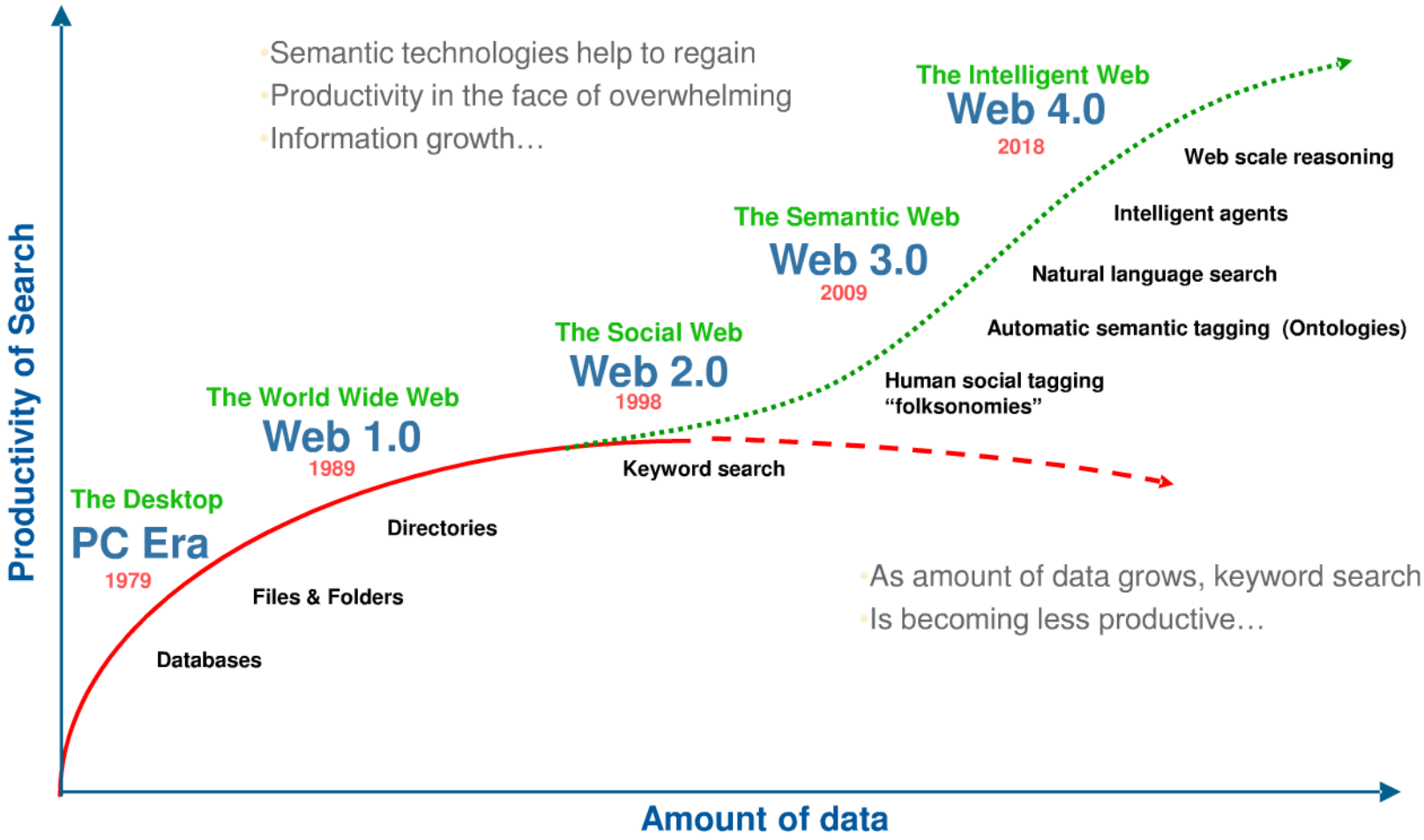
1. IoT is the term used to describe **any kind of application that connected and made "things" interact through the Internet**
2. IoT is a communication network connecting **things which have naming, sensing and processing abilities**
3. IoT is the **next stage of the information revolution**, i.e. the inter-connectivity of everything from urban transport to medical devices to household appliances
4. Intelligent **interactivity between human and things to exchange information & knowledge** for new value creation
5. IoT is **not just about gathering of data but also about the analysis** and use of data
6. IoT is not just about "smart devices"; it is **also about devices and services that help people become smarter**

Value of IoT

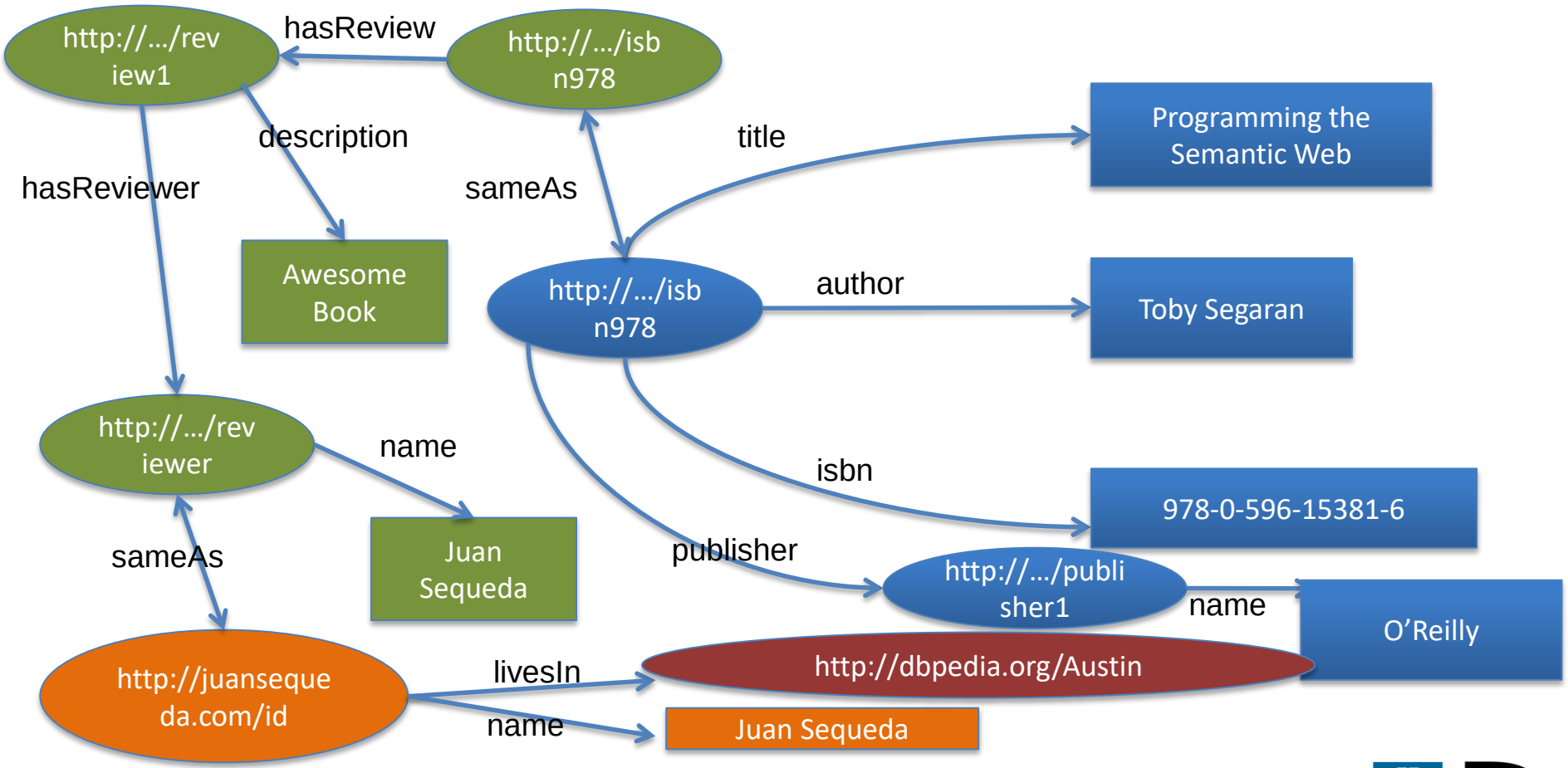
- Information within the Internet of Things creates value in a never-ending value loop consisting of 5 stages (CREATE … to ACT):



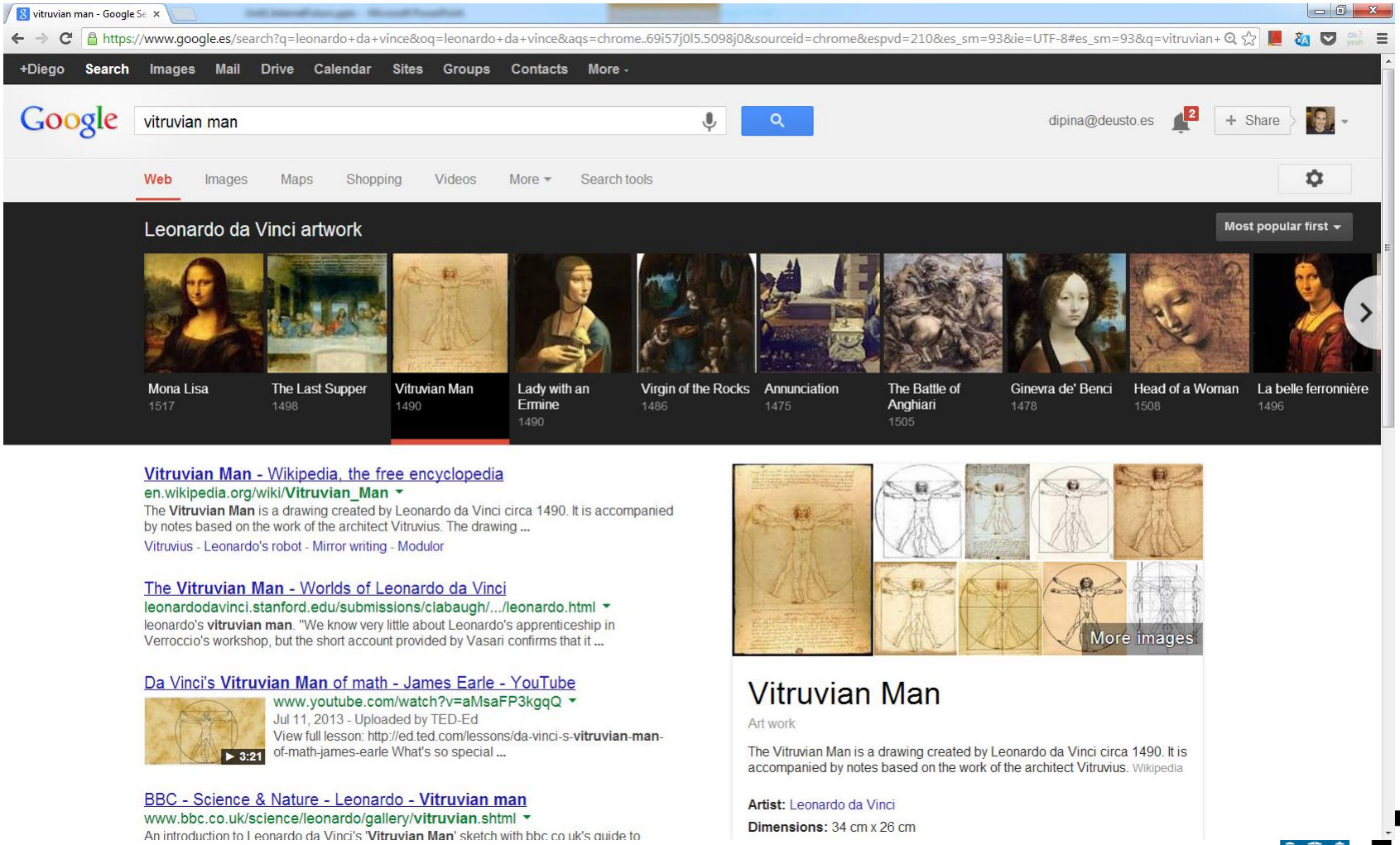
Evolution of the Web



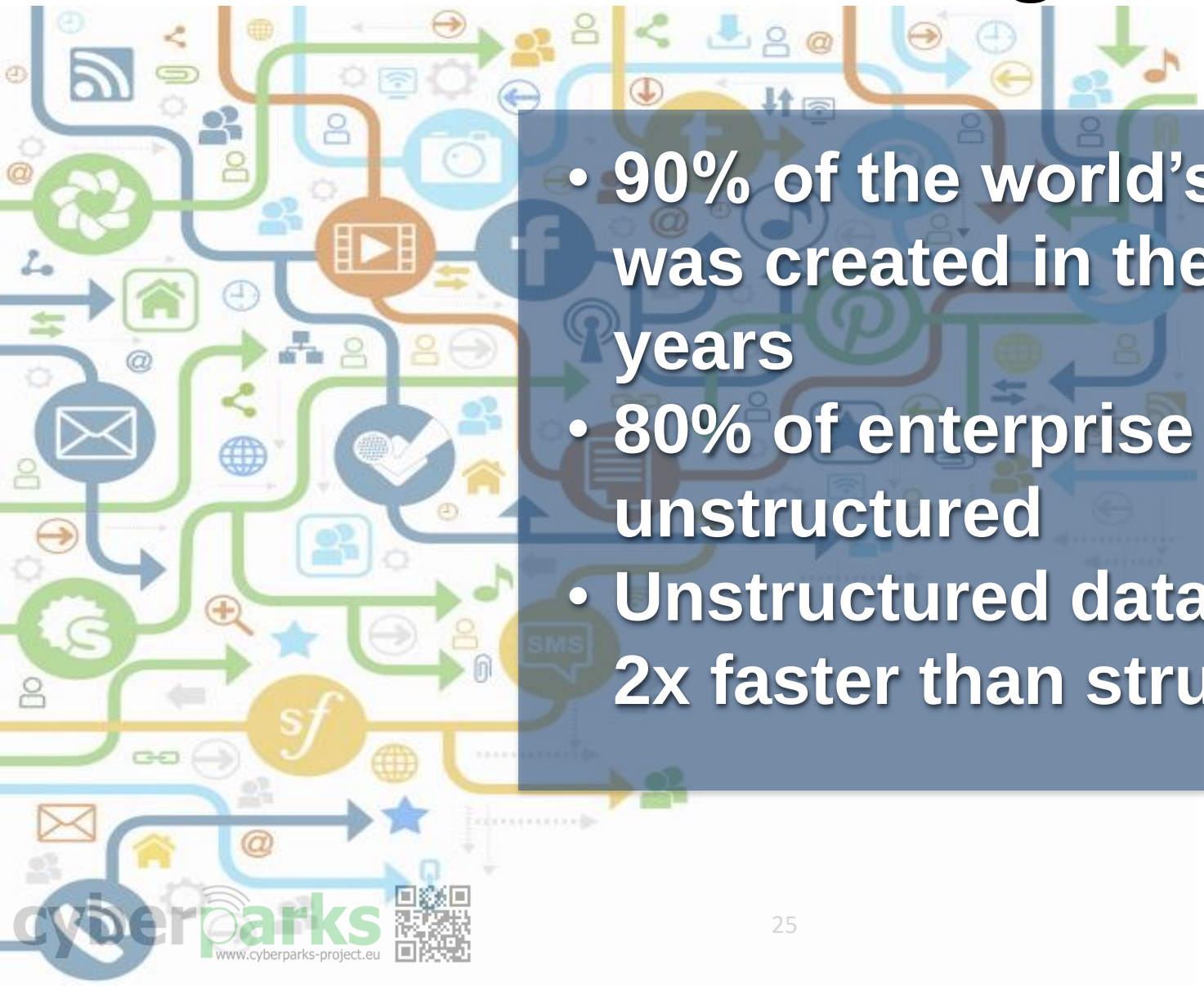
Linked Data Example



Google Knowledge Graph

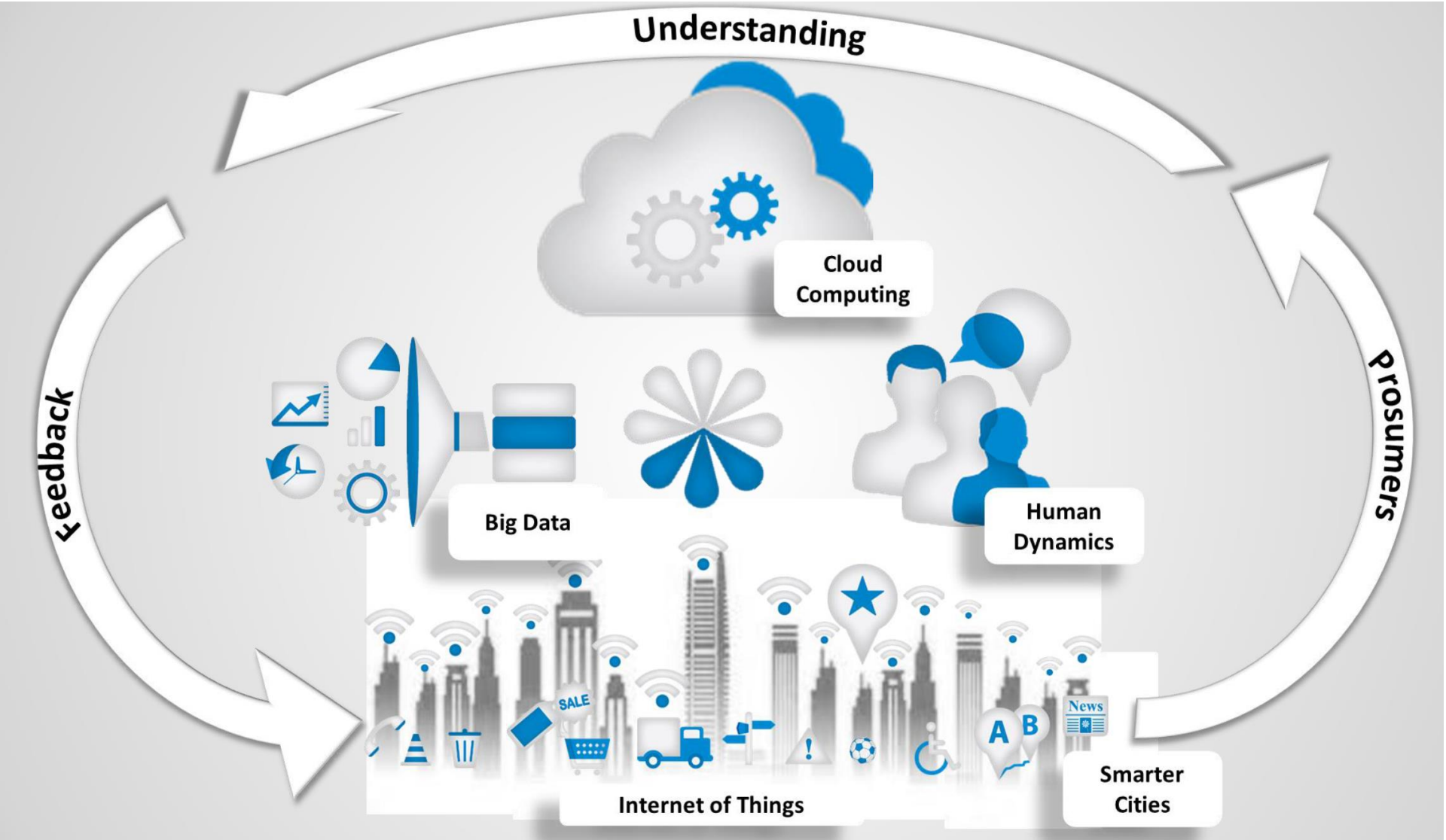


Data has changed

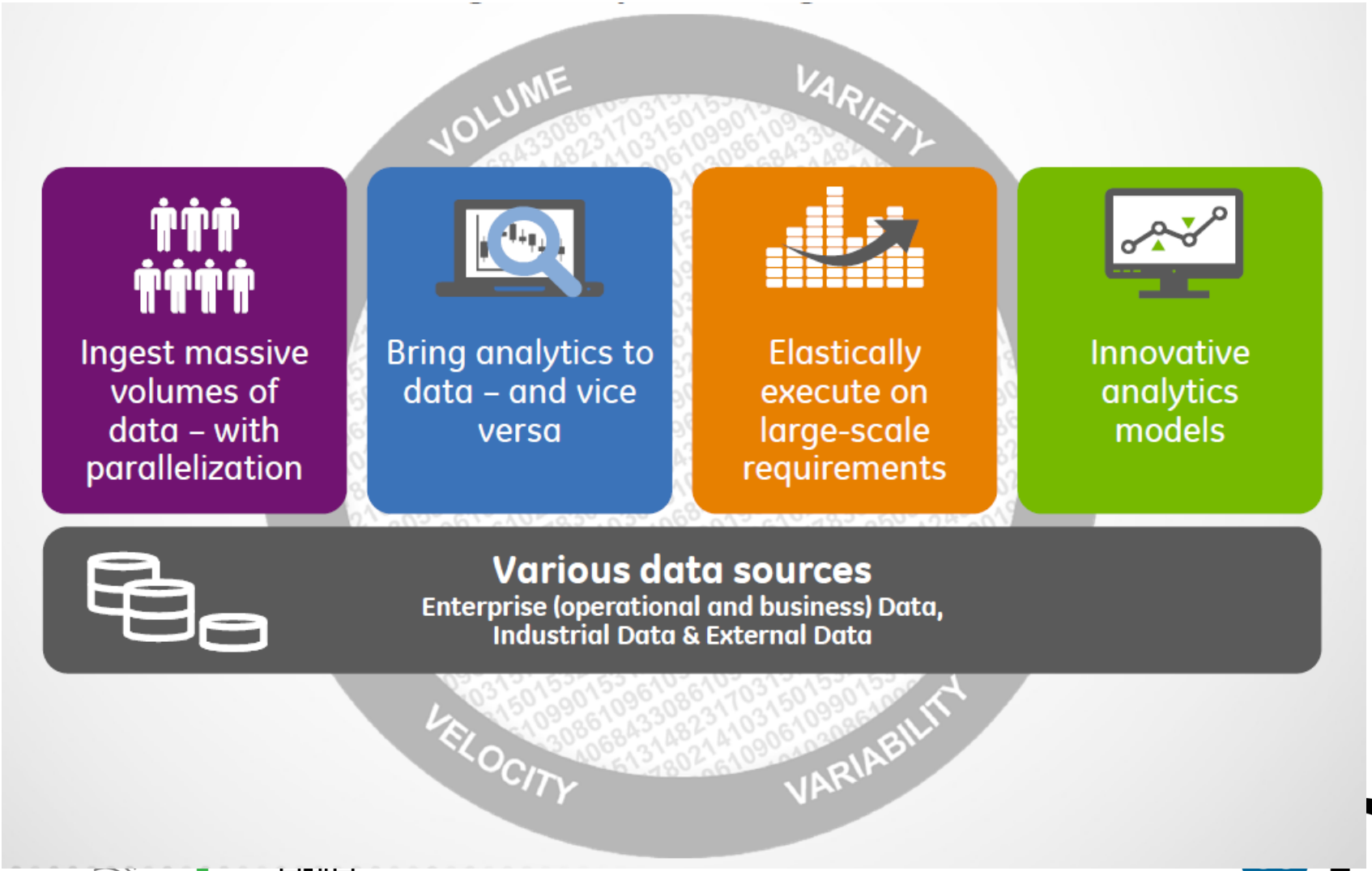


- 90% of the world's data was created in the last two years
- 80% of enterprise data is unstructured
- Unstructured data growing 2x faster than structured

Analytics in the Smart City: Data-driven decision making

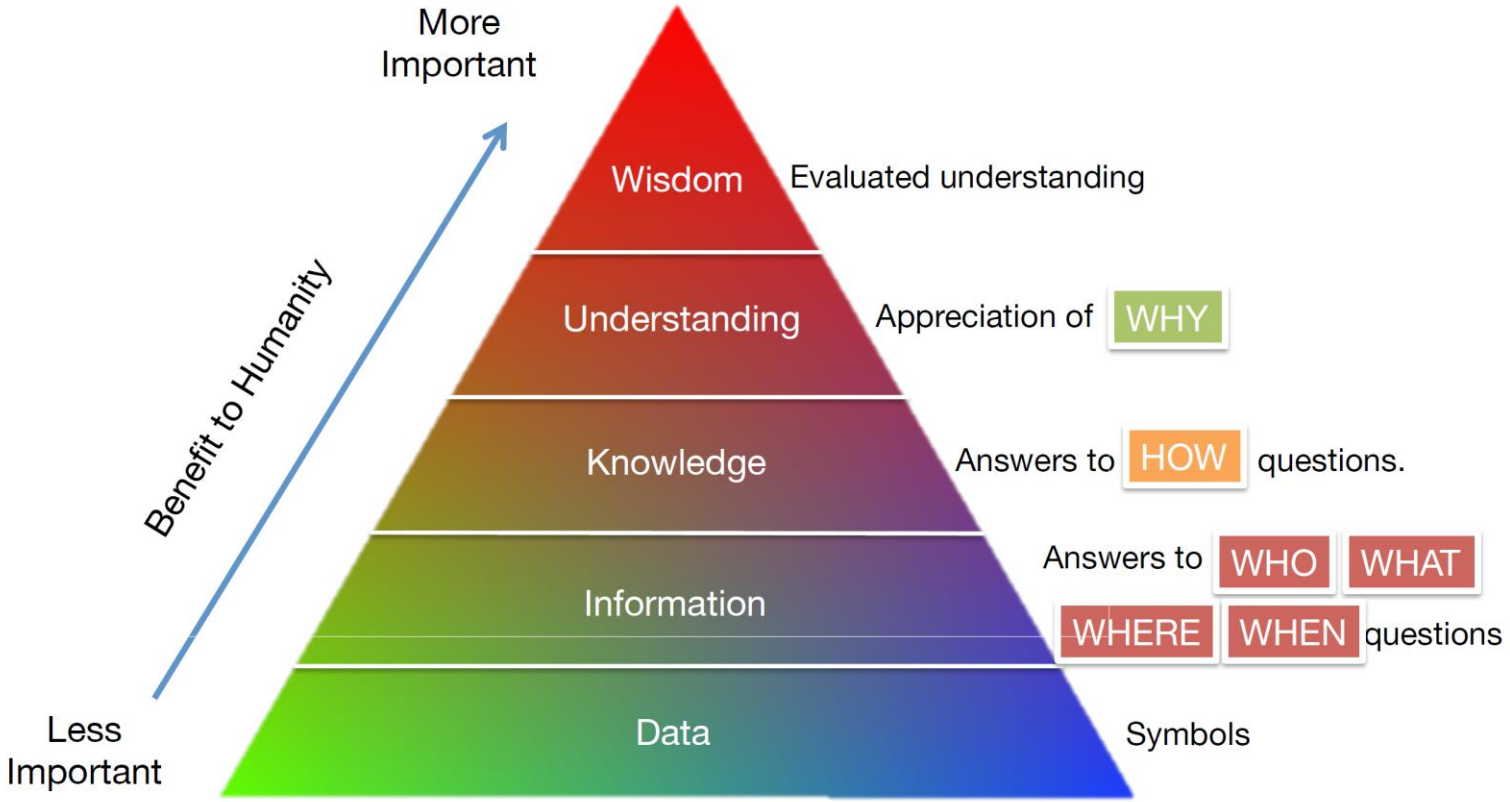


Big Data's 4 Vs

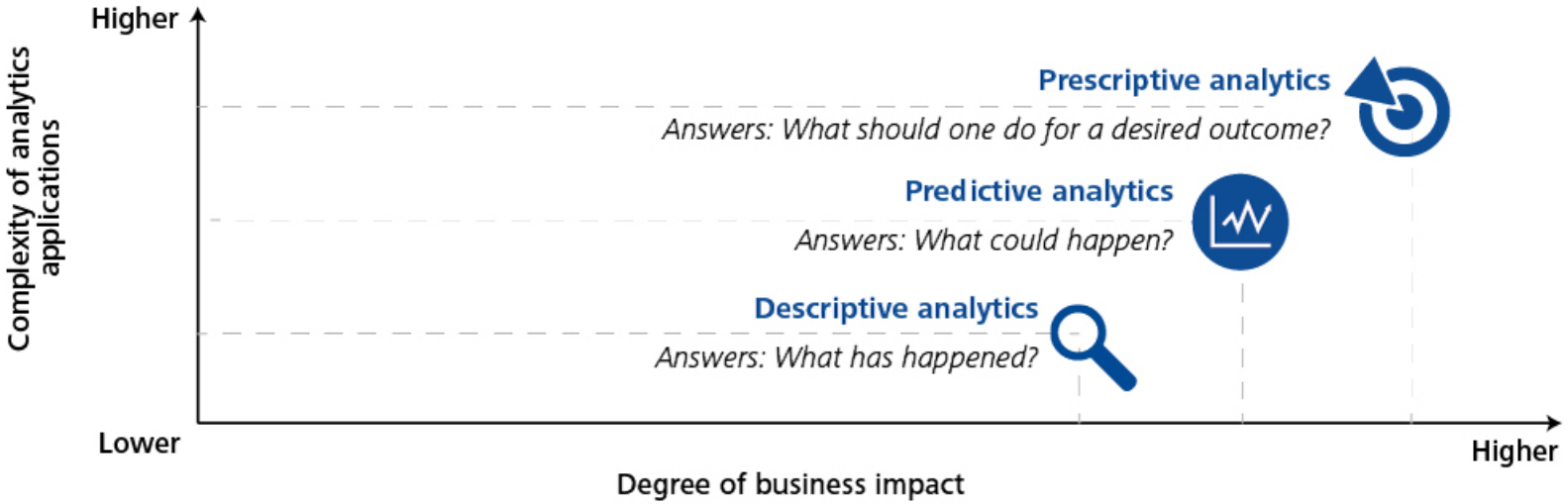


IoT & Big Data enabling Smart Spaces

- The more data that is created, the better understanding and wisdom people can obtain



Types of Analytics (I)



Degree of business impact represents the shift from post-mortem analysis to informed future planning based on past experiences. The shift in the basis of decision making from hindsight to insight and foresight could help companies move closer to a business objective.

Complexity of analytics applications refers to the algorithmic sophistication of analytics tools used and characteristics (for example, scale, scope, and frequency) of data sets used.

The shift from descriptive to predictive and prescriptive analytics requires increasingly complex analytics applications (data scientists, large and clean data sets, big data tools); however, the higher degree of business impact should prompt companies to ascend the analytics stack and leverage the copious amount of data to aid decision making and action.

Graphic: Deloitte University Press | DUPress.com

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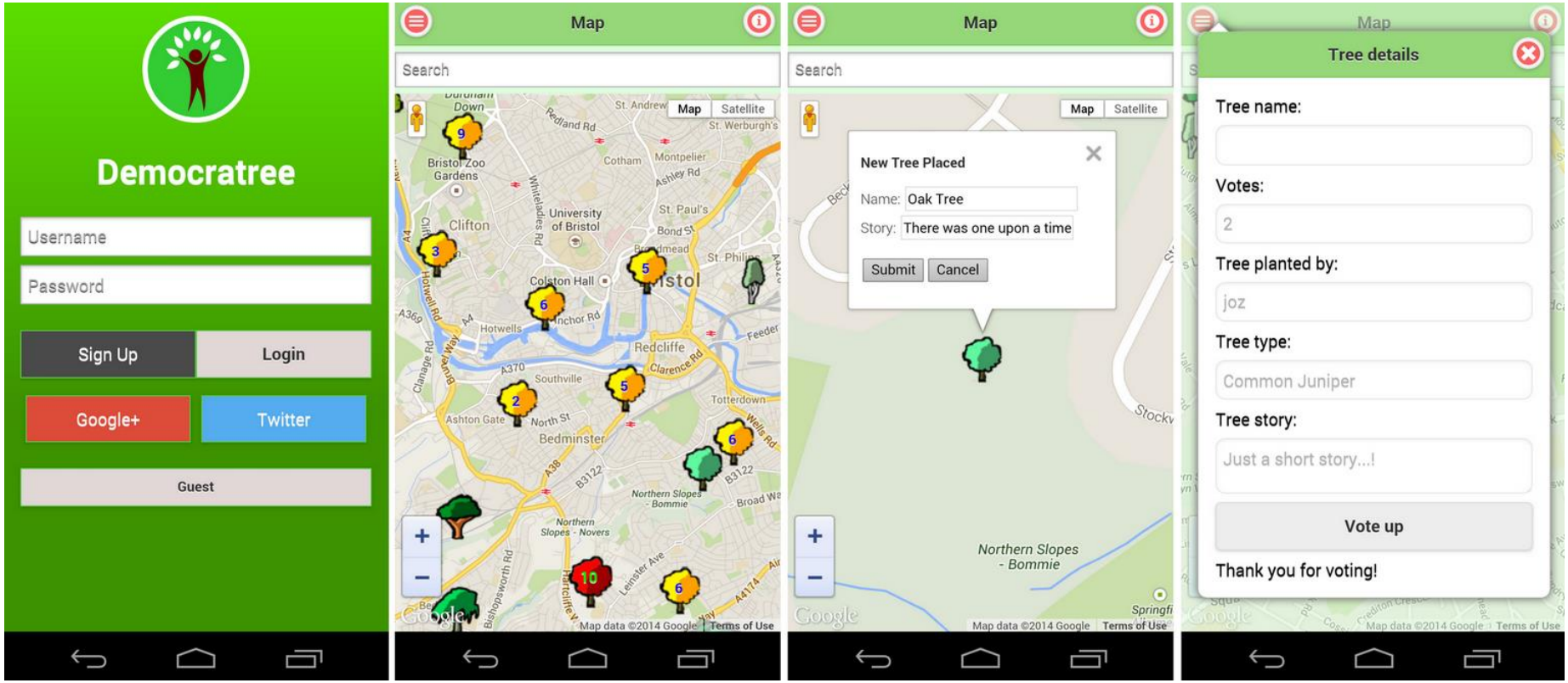
IES Cities Project

European CIP project 2013-2016, Bristol, Majadahonda, Trento & Zaragoza involved

- The **IES Cities** project **promotes user-centric mobile micro-services that exploit open data and generate user-supplied data**
  - **Hypothesis**: *Users may help on improving, extending and enriching the open data in which micro-services are based*
- Its **platform aims** to:
  - **Enable user supplied data to complement**, enrich and enhance **existing datasets** about a city
  - **Facilitate the generation of citizen-centric apps** that exploit urban data in different domains

Bristol's Democratree App



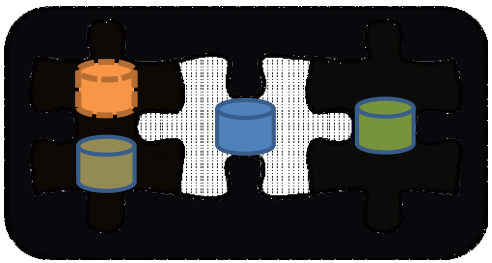
What´s WeLive (I)

H2020 project
2015-2018,
Bilbao, Helsinki, Novi Sad and
Trneto councils involved

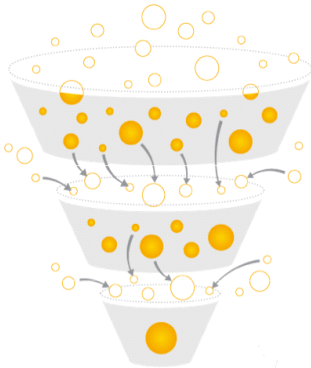
WeLive

A novel **We-Government ecosystem** of tools (Live) that is easily deployable in different PA and which promotes **co-innovation** and **co-creation** of **personalised public services** through **public-private partnerships** and the **empowerment of all stakeholders** to actively take part in the value-chain of a municipality or a territory

Open Data



Open Services



Open Innovation

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http://welive.eu

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WeLive proposes…

Transform the current e-government approach into…

WeLive Open and Collaborative Government Solution = We-government + t-government + l-government + m-government

We-	t-	l-	m-
All stakeholders are treated as peers and prosumers	Providing Technology tools to create public value	To do more with less by involving other players and the PA as orchestrator	Utilisation of mobile tech. for public services delivery

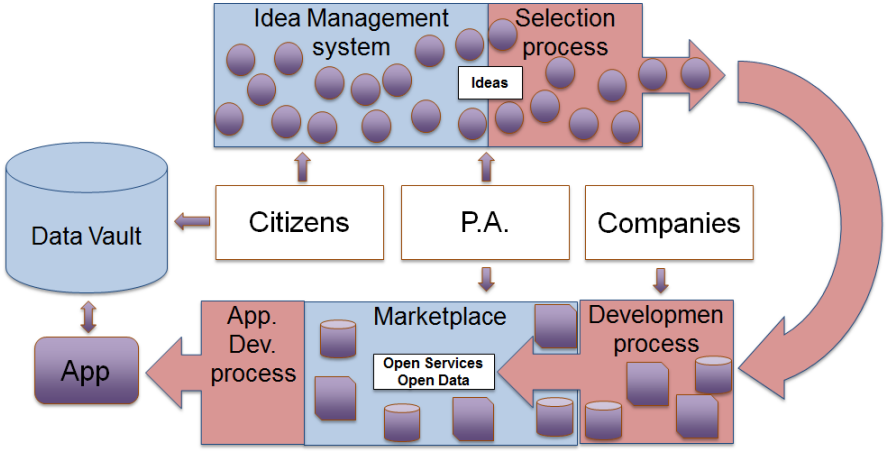
How? (I)

Stakeholder Collaboration + Public-private Partnership → IDEAS >> APPLICATIONS >> MARKETPLACE

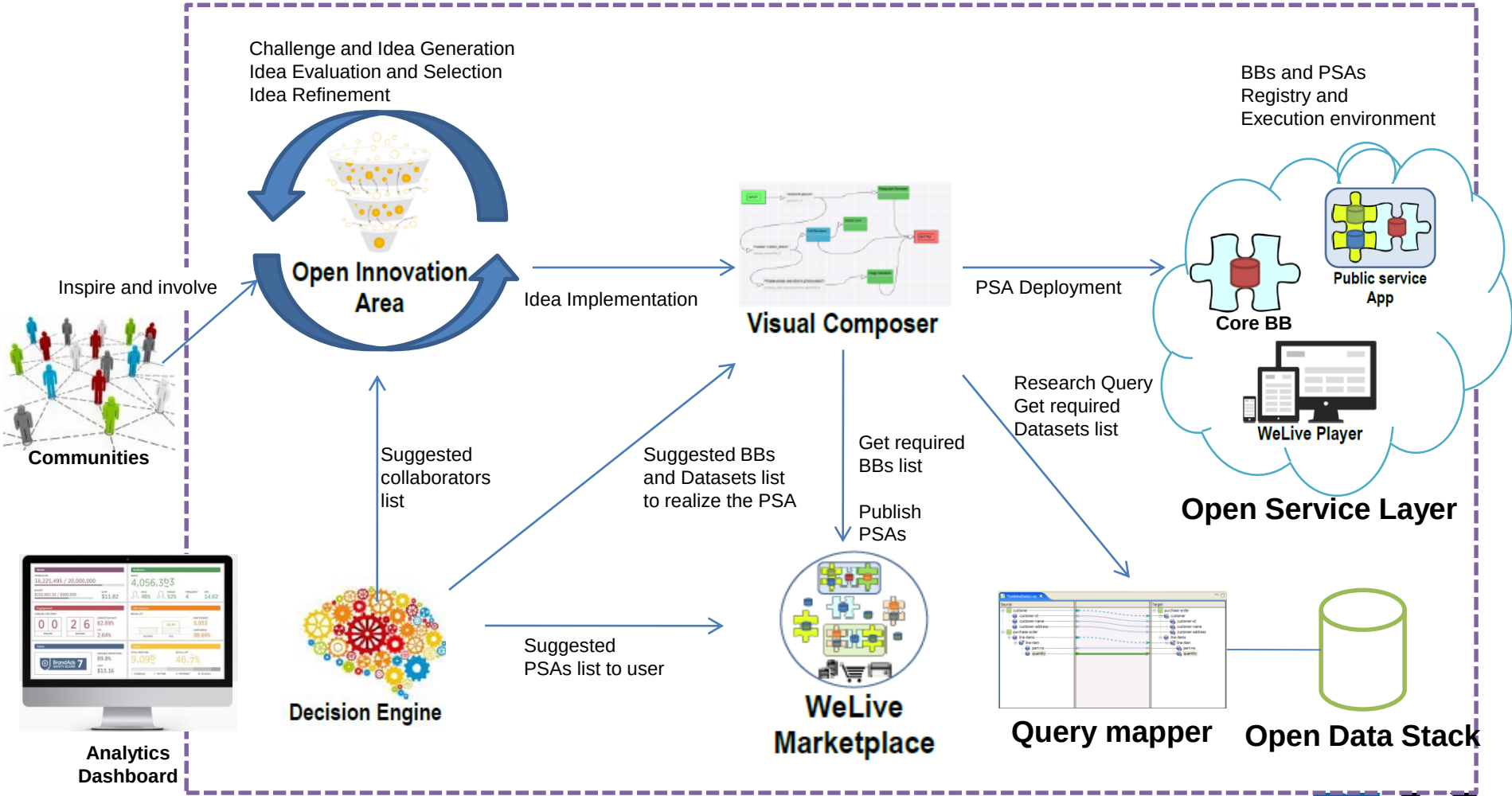
1 **WeLive offers tools to transform the needs into ideas**

2 **Tools to select the best Ideas and create the B. Blocks**

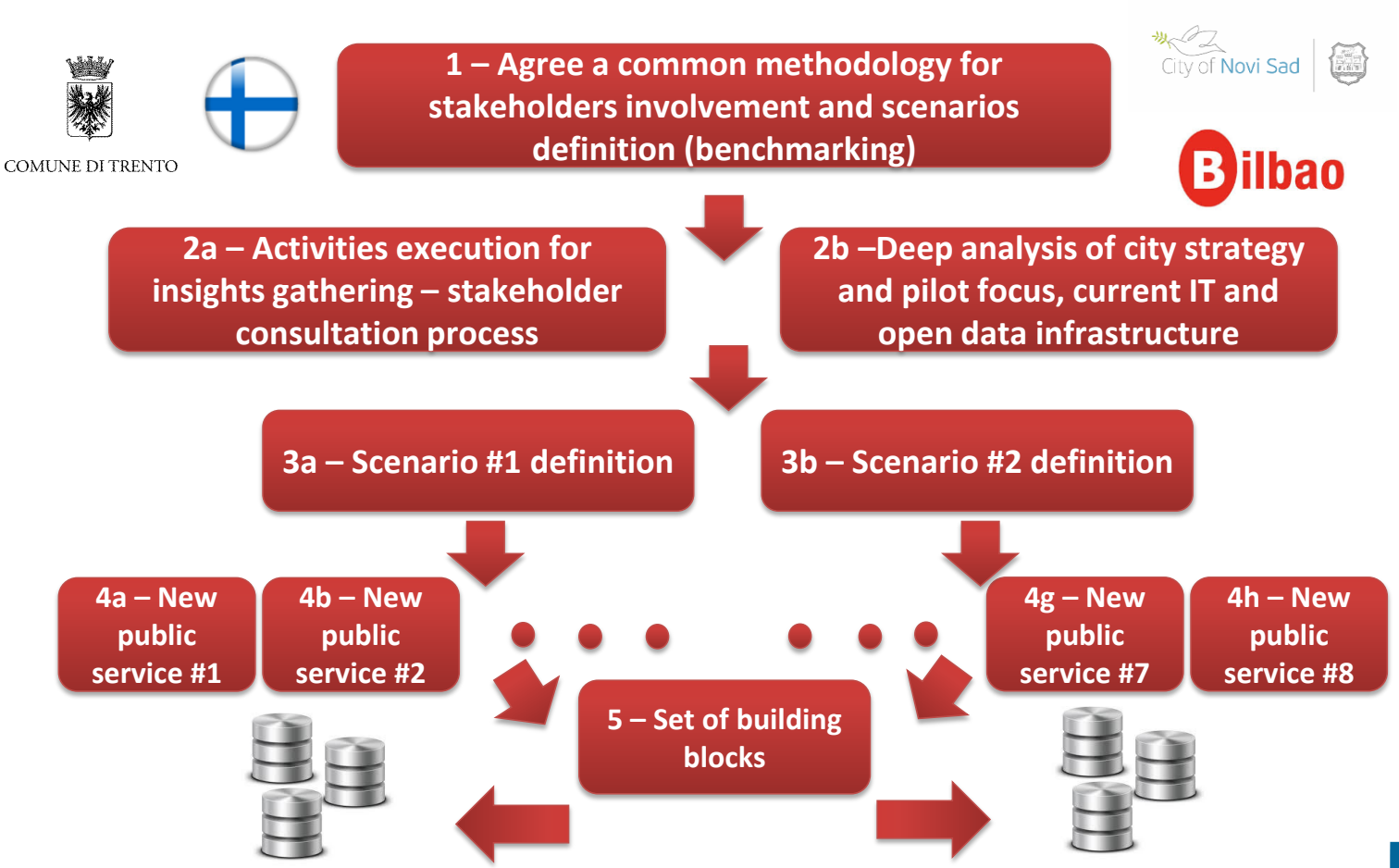
3 **A way to compose the Building Blocks into mass market Applications which can be exploited through the marketplace**



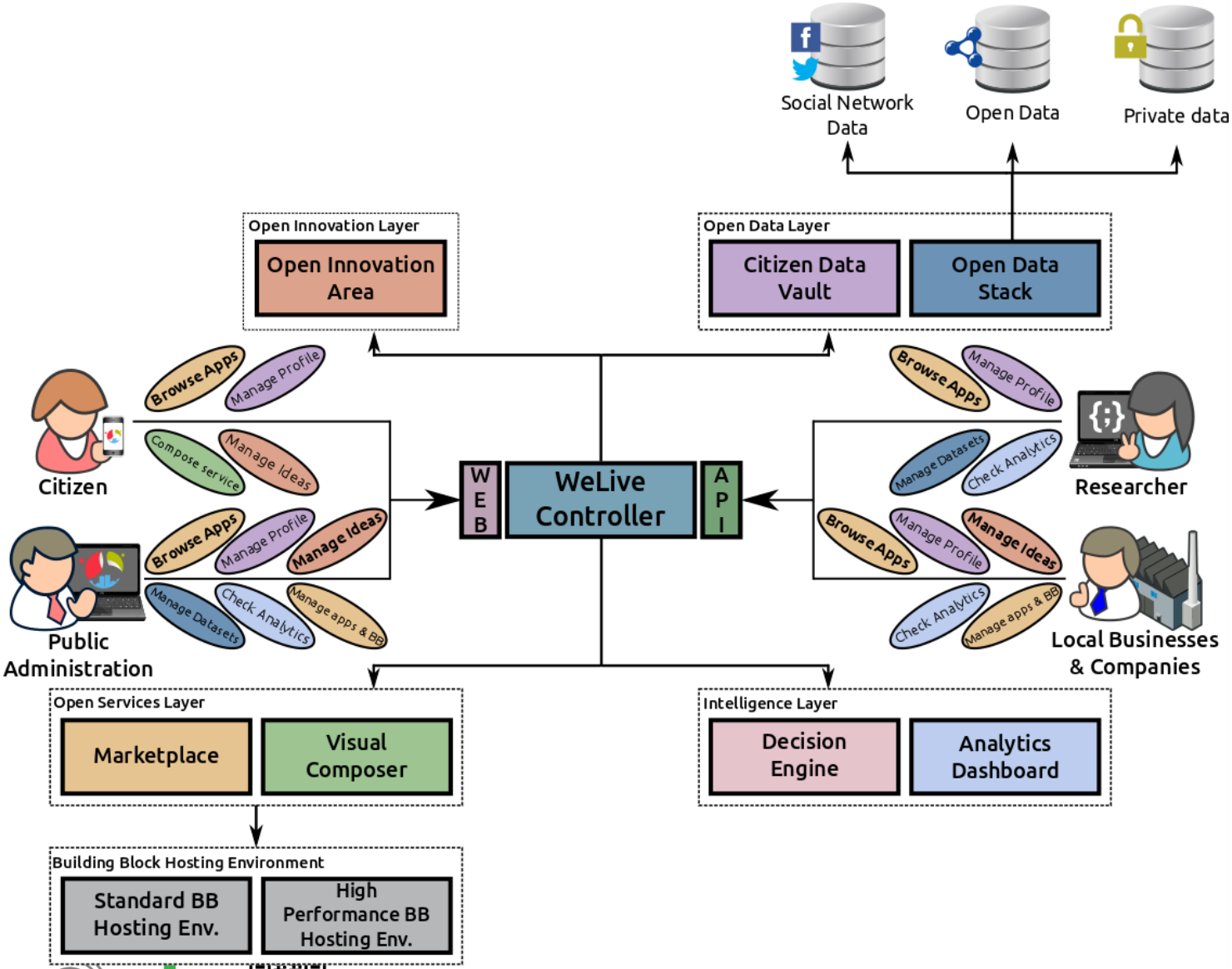
How? (II): WeLive Service co-creation approach



Scenario-driven Artefact Definition per City

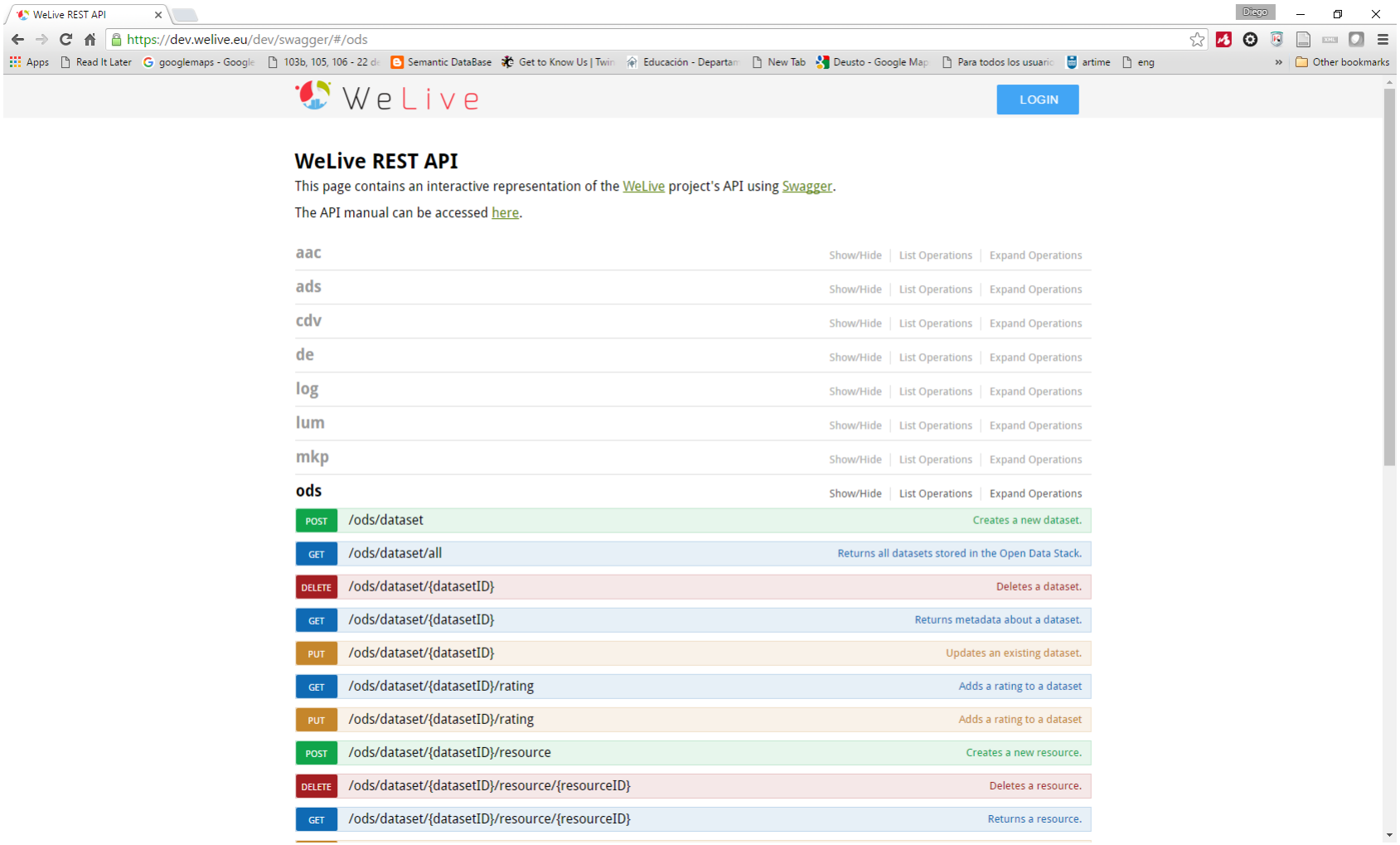


WeLive Vision/Architecture



WeLive Web UI Controller

WeLive RESTful API



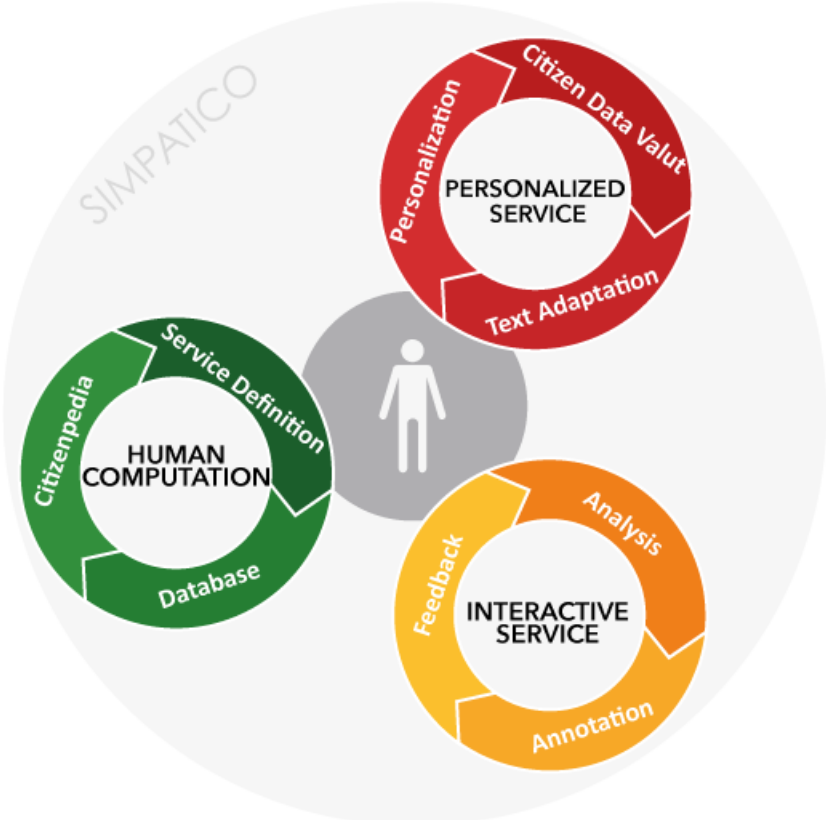
WeLive Apps: Bilbozkatu

All WeLive apps available at:
https://play.google.com/store/search?q=welive_project

Simpatico

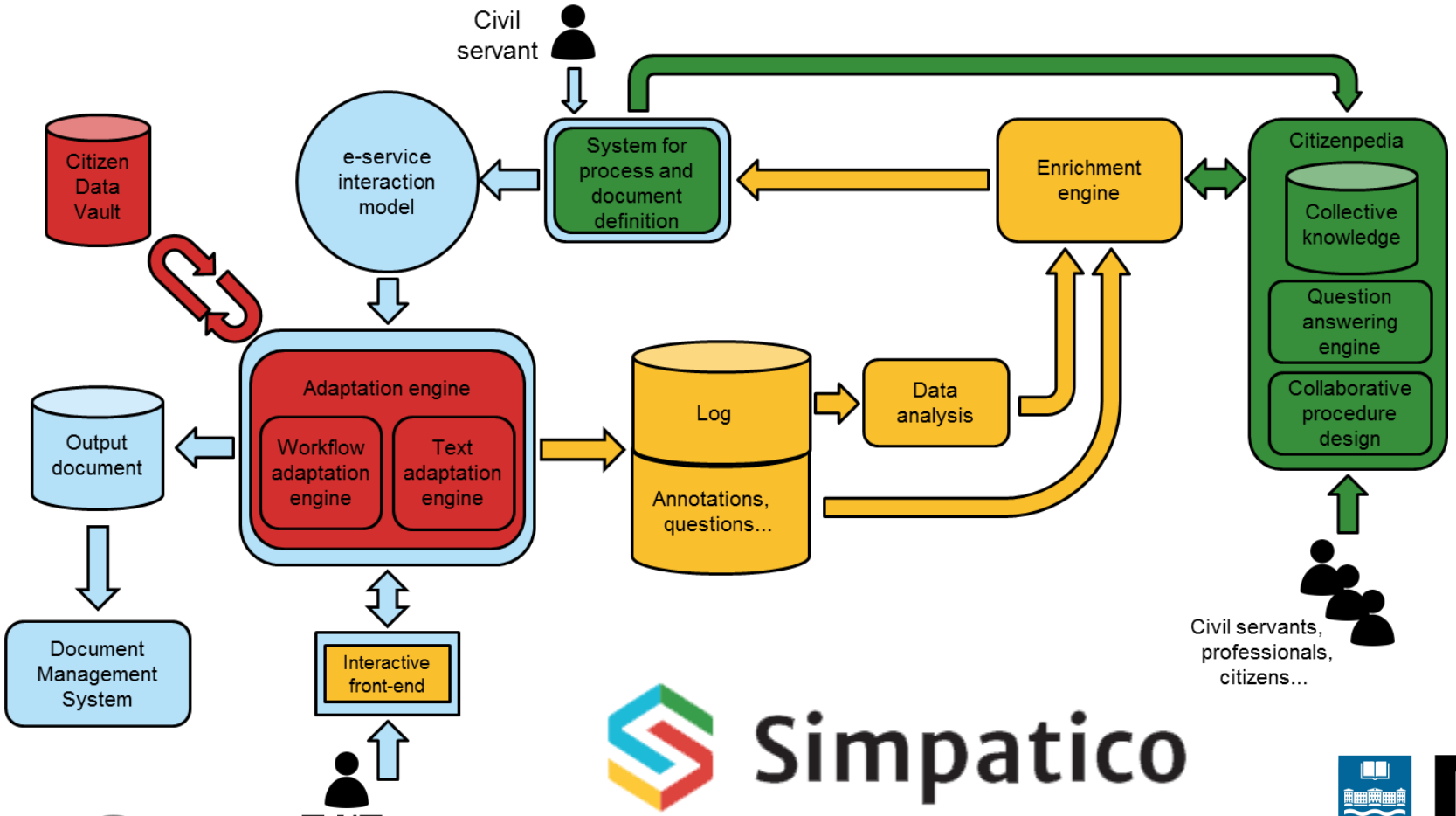
- Addresses the need to offer a more efficient and **more effective experience to companies and citizens in their daily interaction with Public Administration (PA)**
  - Providing a **personalized delivery of e- services** based on advanced **cognitive system technologies and by promoting an active engagement of people** for the continuous improvement of the interaction with these services.

H2020 project
2016-2018, EURO6,
Sheffield, Trento &
Xunta Galicia involved



http://www.simpatico-project.eu/

PA traditional e-services vs. SIMPATICO approach



Simpatico

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Conclusion

- We need **cooperative cities and territories** which are **inclusive, participative, aware and responsive** to the needs of all societal sectors
  - **ICT intertwined with co-creation through multi-stakeholder involvement are key to achieve smarter environments**
    - To do more with what we have, without having to invest big amounts, but taking advantage of information that is already available, transforming knowledge, democratizing its access and usage, protecting and regulating its usage, and easing decision making among different actors

Learning Goals

1. Know about the key methodologies and technological enablers of Smarter Environments
2. Realize why the right technology is not enough to enable acceptable Smarter Environments
3. Understand how to democratize technology usage so that it serves to empower users in an inclusive manner to foster better more acceptable Smart Environments
4. Gain an understanding on how stakeholder engagement and partipation approaches are being successfully combined with technology
5. Learn what technologies and user involvement methods are available and how to bring them together to pursue CyberParks goals

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Workshop Co-Creating of Inclusive and Mediated Public Spaces

13-16 February, Lisbon, Portugal

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References

- Innovating the Smart Cities, Syam Madanapalli | IEEE Smart Tech Workshop 2015, http://www.slideshare.net/smadanapalli/innovating-the-smart-cities
- Kitchin, R., Lauriault, T. and McArdle, G. (2015) Knowing and governing cities through urban indicators, city benchmarking and real-time dashboards. Regional Studies, Regional Science 2: 1-28, http://rsa.tandfonline.com/doi/full/10.1080/21681376.2014.983149
- Towards Smart City: Making Government Data Work with Big Data Analysis, Charles Mok, 24 September 2015, http://www.slideshare.net/mok/towards-smart-city-making-government-data-work-with-big-data-analysis-53176591
- Mining in the Middle of the City: The needs of Big Data for Smart Cities, Dr. Antonio Jara, http://www.slideshare.net/IIG_HES/mining-in-the-middle-of-the-city-the-needs-of-big-data-for-smart-cities

References

- Schema.org - Extending Benefits, Richard Wallis, http://www.slideshare.net/rjw/schemaorg-extending-benefits?qid=9ecd1fa6-cfac-460d-9bbb-065879c46aee&v=&b=&from_search=3
- SDA-SmartCity – Overview and Challenges, Alessandra Mileo. Senior Research Fellow, Insight Centre for Data Analytics, NUI Galway, http://ict-citypulse.eu/page/tutorial/smartcity-tutorial-eswc2015_files/ESWC-SD-INTRO-small.pdf
- Internet of Things: Concepts and Technologies, Payam Barnaghi, http://www.slideshare.net/PayamBarnaghi/internet-of-things-concepts-and-technologies

References

- Internet of Things towards Ubiquitous and Mobile Computing
  - http://research.microsoft.com/en-us/UM/redmond/events/asiafacsum2010/presentations/Guihai-Chen_Oct19.pdf
- 5 key questions to ask about the Internet of Things
  - http://www.slideshare.net/DeloitteUS/5-questions-the-iot-internet-of-things
- Internet Connected Objects for Reconfigurable Eco-systems
  - https://docbox.etsi.org/workshop/2012/201210_M2MWORKSHOP/zz_POSTERS/iCore.pdf
- Internet of Things and Big Data – Bosch, August 2015
  - https://www.bosch-si.com/media/bosch_software_innovations/media_landingpages/connectedworld_1/bcw_2016/bcw_1/download_page_1/download_page/bcw16_mongodb_collateral_followup_sponsor.pdf
- The internet of things and big data: Unlocking the power
  - http://www.zdnet.com/article/the-internet-of-things-and-big-data-unlocking-the-power/

References

- Deconstructing the Internet of Things
  - https://jenson.org/deconstructing-the-iot/
- Mobile in IoT Context ? Mobile Applications in "Industry 4.0“
  - http://www.slideshare.net/MobileTrendsConference/karol-kalisz-vitaliy-rudnytskiy-mobile-in-iot-context-mobile-applications-in-industry-40
- Inside the Internet of Things (IoT) – A primer on the technologies building the IoT – Deloitte
  - http://dupress.com/articles/iot-primer-iot-technologies-applications/
- Internet of Things (IoT) - We Are at the Tip of An Iceberg – Dr. Mazlan Abbas
  - http://www.slideshare.net/mazlan1/internet-of-things-iot-we-are-at-the-tip-of-an-iceberg
- Infographic: What are Beacons and What Do They Do?
  - https://kontakt.io/blog/infographic-beacons/
- iBeacon
  - https://en.wikipedia.org/wiki/IBeacon

References

- ITU News – What is a smart sustainable city?,
  - https://itunews.itu.int/en/5215-What-is-a-smart-sustainable-city.note.aspx
- Frost & Sullivan's Predictions for the Global Energy and Environment Market,
  - http://www.slideshare.net/FrostandSullivan/frost-sullivans-predictions-for-the-global-energy-and-environment-market
- Fog Computing with VORTEX
  - http://www.slideshare.net/Angelo.Corsaro/20141210-fog
- What Exactly Is The "Internet of Things"? – A graphic primer behind the term & technologies
  - http://postscapes.com/what-exactly-is-the-internet-of-things-infographic

References

- The Big 'Big Data' Question: Hadoop or Spark?
  - http://www.datasciencecentral.com/profiles/blogs/the-big-big-data-question-hadoop-or-spark
- Hadoop vs. Spark: The New Age of Big Data
  - http://www.datamation.com/data-center/hadoop-vs.-spark-the-new-age-of-big-data.html
- Comparing 11 IoT Development Platforms
  - https://dzone.com/articles/iot-software-platform-comparison
- Moving from Descriptive to Cognitive Analytics on your Big Data Projects, Gene Villeneuve, IBM, http://www.slideshare.net/ibmsverige/gene-villeneuve-moving-from-descriptive-to-cognitive-analytics
- Virtualisation and Validation of Smart City Data. Dr Sefki Kolozali. Dr Payam Barnaghi