



# Open Smart City – Open Social Innovation Infrastructure

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## 25 years of PSNC

- Poznań Supercomputing and Networking Center (PSNC)**, established by the decision of the Rectors' College of the City of Poznań and affiliated to the Institute of Bioorganic Chemistry of the Polish Academy of Sciences in Poznań on 23 October 1993, is an internationally well known ICT R&D institution and an important node of the European Research Area in the field of the IT infrastructure for scientific research.

**DIGITAL  
SCIENCE**

**DIGITAL  
ECONOMY**

- PSNC has carried out or is carrying out **230** projects under European and international research and structural programmes, **44** of which are in Horizon 2020. For our activity in these programmes we received **the Crystal Brussels Prize** in 2004, 2010, 2016 and 2018.





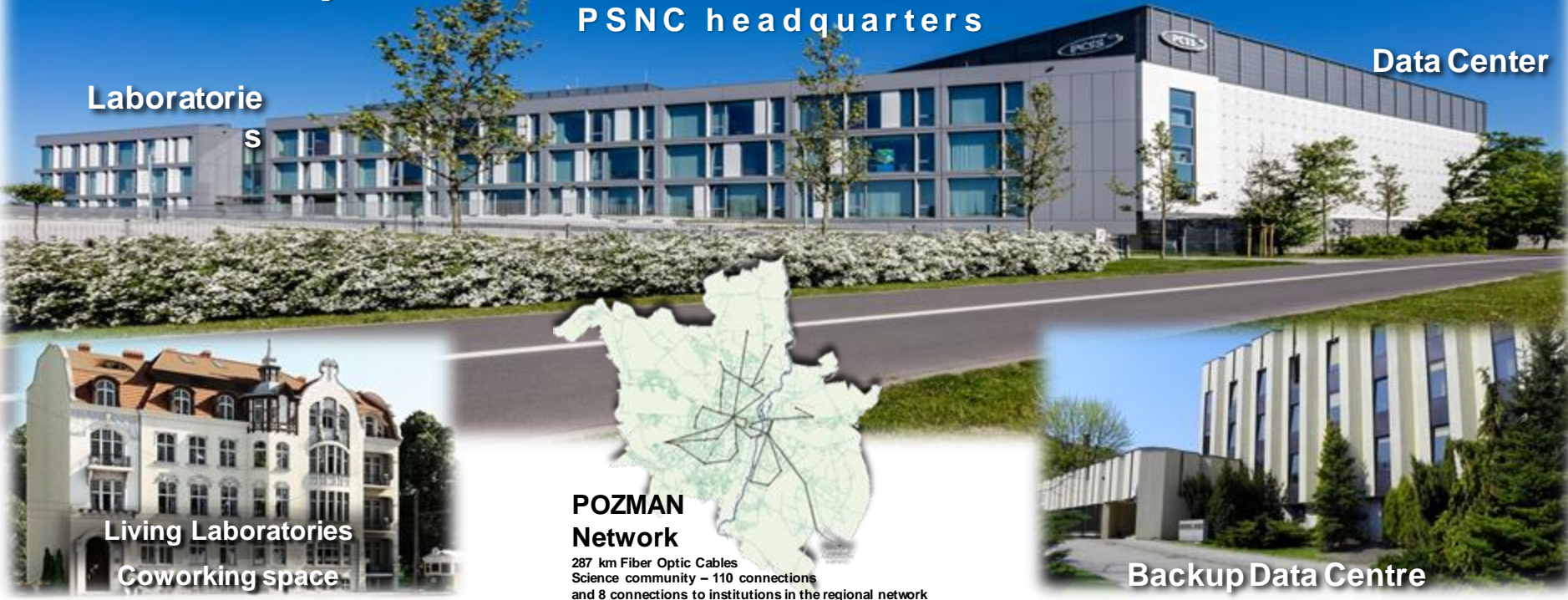
## PSNC locations

# Polish Optical Internet Research Center

PSNC headquarters

Data Center

Laboratories

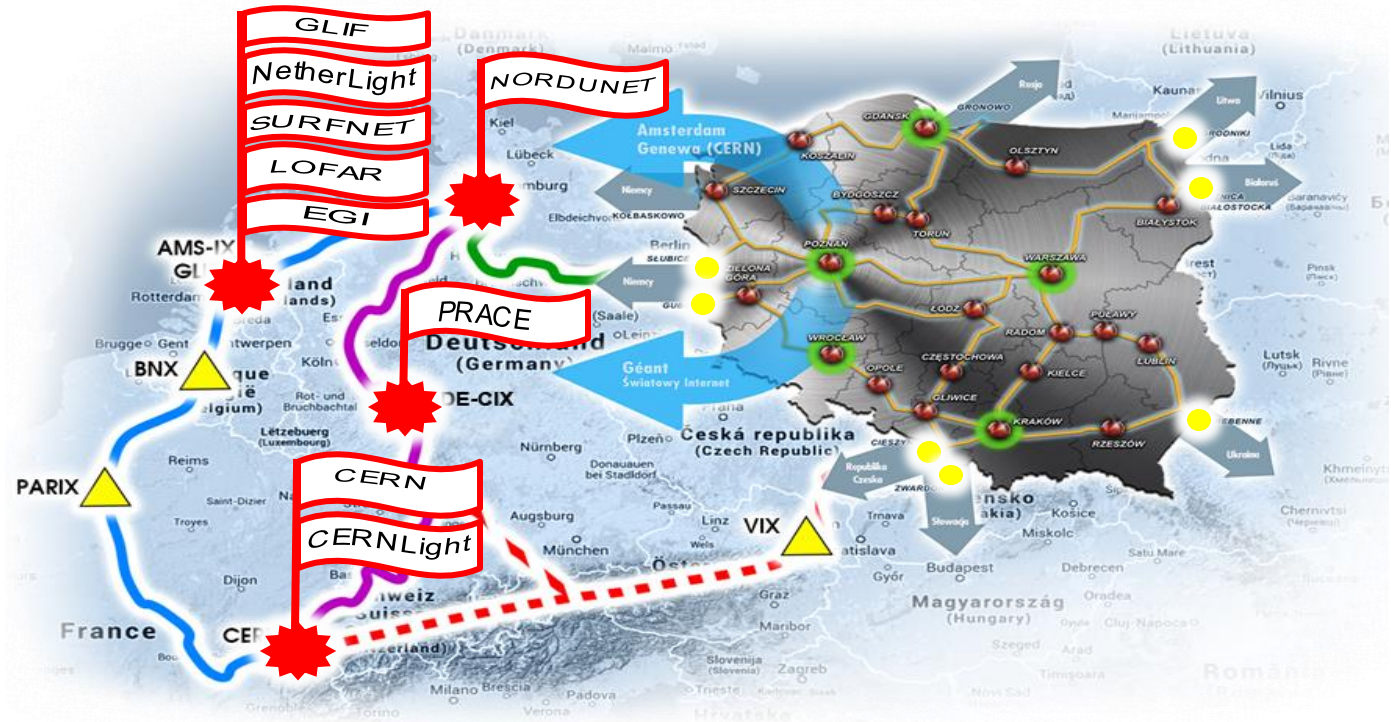


### POZMAN Network

287 km Fiber Optic Cables  
Science community – 110 connections  
and 8 connections to institutions in the regional network

Backup Data Centre

# Direct fiber optic connection between PIONIER and the European and global research area





# High Performance Computing at PSNC in Poznan



## Computing:

- HPC Infrastructure (currently **1.7 PFLOPS**, **170. position on TOP500 world list**)
- 2 independent Data Centres
- Computer clusters
- GPGPU Clusters
- Prototypes of the future technologies

## Storing of data:

- Hierarchical data infrastructure (**47 PB**)
- European infrastructure component



## Environment:

- 1600 m<sup>2</sup> in main Data Center
- 300 m<sup>2</sup> in Backup Data Center
- Air-cooled and liquid-cooled systems
- Video monitoring, fire protection
- 24/7 Supervision

## PSNC is a part of:

- European HPC infrastructure (PRACE)
- European and national Grid infrastructure (EGI, PL-GRID)
- European (EUDAT) and national data infrastructure (Platon, KMD)



## Technological partnership: PSNC- Poznań City Hall

- Cooperation since 1996
- The basis for the implementation of the Municipal Multimedia Guide (MIM) as a "pilot system for the new generation of services in Poznań" is the Agreement between the City of Poznań - IBCH PAS of 9 September 1996.
- 2017 - new opening: Public-Public Partnership

W szczególności strony zobowiązują się do:

1. stworzenia perspektywicznego planu budowania i wdrażania usług telematycznych w Poznaniu i współpracy w jego stopniowej realizacji,
2. współdziałania w zakresie rozwoju i utrzymania Miejskiego Informatora Multimedialnego jako pilotowego systemu dla nowej generacji usług w Poznaniu.
3. wspólnego występowania o granty (KBN - celowe, zamawiane; Unii Europejskiej, związane z powstaniem i rozwojem systemów i usług telematycznych w Poznaniu).

- w okresie budowania pilotowych systemów telematycznych i w trakcie realizacji grantów Urząd miasta będzie traktowany w tym zakresie obsługi w sposób identyczny jak instytucje naukowo-badawcze,
- do realizacji systemów i usług wykorzystane zostaną zasoby komputerowe Poznańskiego Centrum Superkomputerowo - Sieciowego,
- wdrożone systemy i usługi będą wspólnie utrzymywane,



## Towards Open Innovation

- **Digital Science** that is the Big Challenges
- **Digital Economy** that is Innovation in Business
- **Social impact** that is the Digital Society
- **Smart Cities** - Living Labs
- **Citizen Science** - we live in the era of Open Innovation

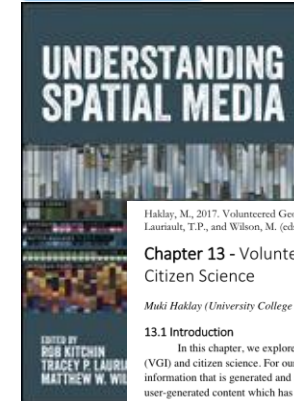
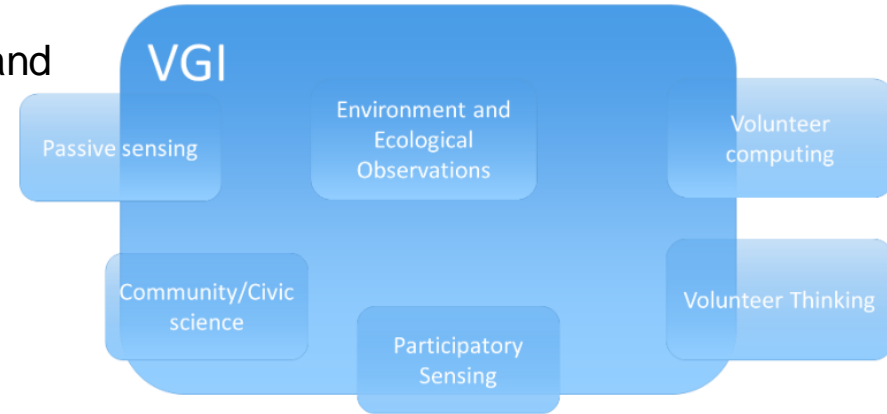


**Openness to Innovation is not limited to closed physical space**



# Citizen Science

- Virtual observatories of residents - collection and interpretation of data
  - Climate
  - Quality of life
  - Geographical information (VGI)
- Crowdsourcing, crowdfunding – scientific cooperation
  - Online projects
  - Joint experiments with the participation of residents
  - Volunteers
- Digital resources and raising historical awareness
- Dimensions:
  - Local, regional, national, global -> VIRTUAL



Haklay, M., 2017. Volunteered Geographic Information and Citizen Science, in Kitchin, R., Lauria, T.P., and Wilson, M. (eds.), *Understanding Spatial Media*. London: Sage, pp. 127-135

## Chapter 13 - Volunteered Geographic Information and Citizen Science

Muki Haklay (University College London)

### 13.1 Introduction

In this chapter, we explore the related areas of Volunteered Geographic Information (VGI) and citizen science. For our purpose here, we will define VGI as digital geographical information that is generated and shared by individuals. VGI can be viewed as the part of user-generated content which has become a major element of Web media over the past two decades. Within VGI, geographical information is an integral part of the digital media object – for example coordinates as an integral part of the Exchangeable image file format (Exif) element of a picture taken with a digital camera (Goodchild, 2007). Citizen science, on the other hand, is defined by the Oxford English Dictionary as ‘scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions’ (2014). Citizen science can also be considered as a type of user-generated content, whereas this content refers to scientific facts, observations or analysis.

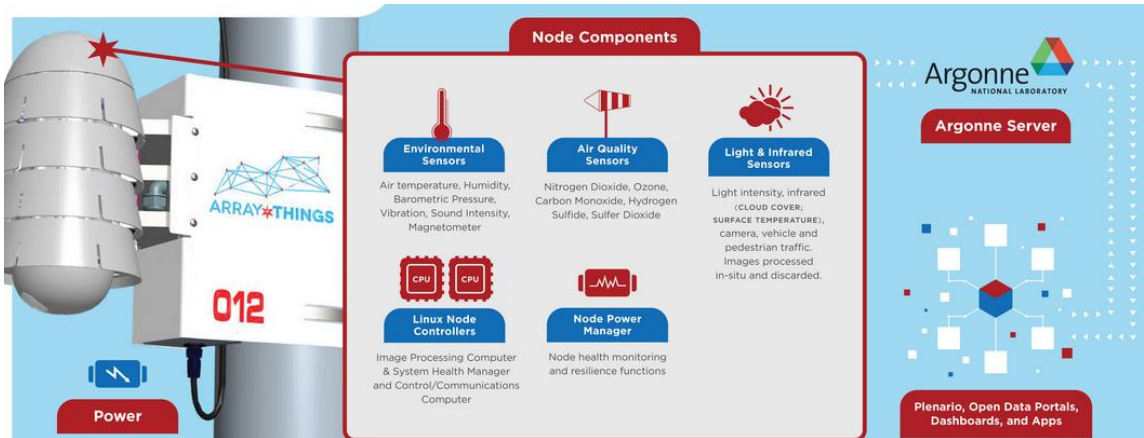


# Example: Array of Things Infrastructure- Chicago

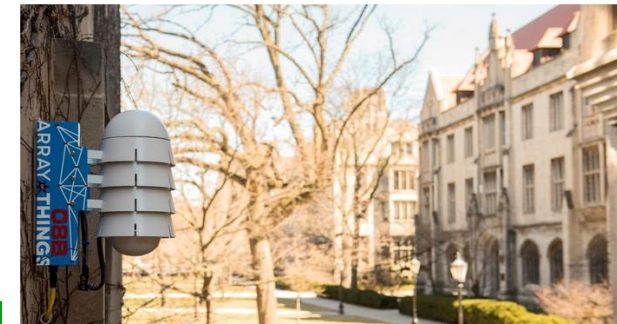
## Users:

- Domain scientists - air quality, transport, climate, environment
- Data scientists - dependency study and linked data
- Computer scientists - Machine learning new programming models based on API, operating systems
- Sensor developers – deployment environment

and



Five years, 100 nodes, and more to come



## Example: Open Data Infrastructure - Ghent

### Data provided in real time:

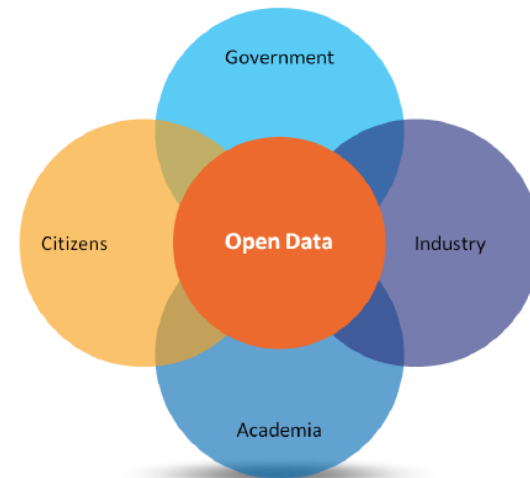
- Number of cars on the ring road
- Availability of urban bikes
- Number of available parking spaces

**579 data sets(2017)**

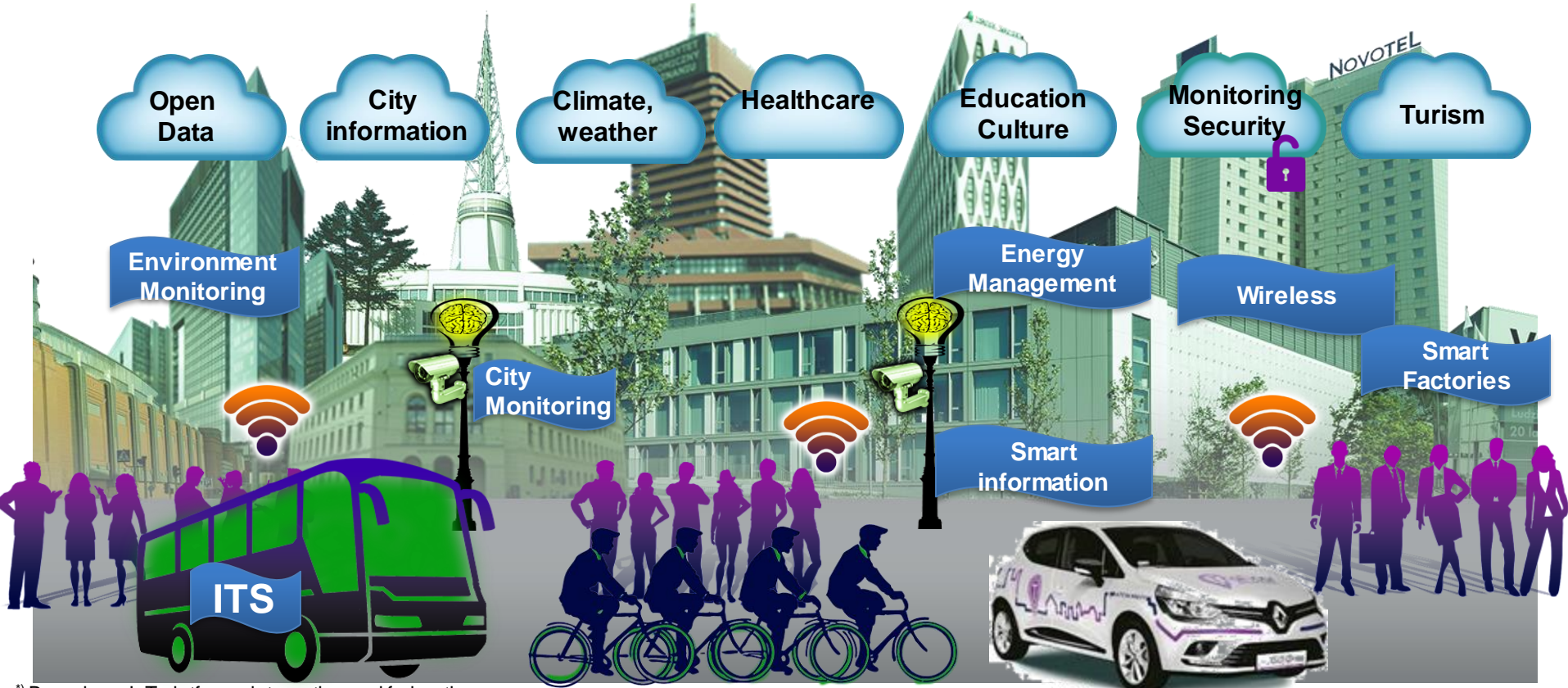
**Decentralised management (e.g. crowdsourcing)**

Ghent already offers real-time data, for instance the number of vehicles on the ring road, the availability of bikes at bike sharing stations and free parking spaces, and it plans to expand the number of real-time datasets. Ghent is also investing in Linked Open Data, with data being available in RDF format and linking their data to Open Data available at regional or national level.

European Data Portal, Analytical Report6: Open Data in Cities 2, June 2017



## Vision of *Smart City* \*)

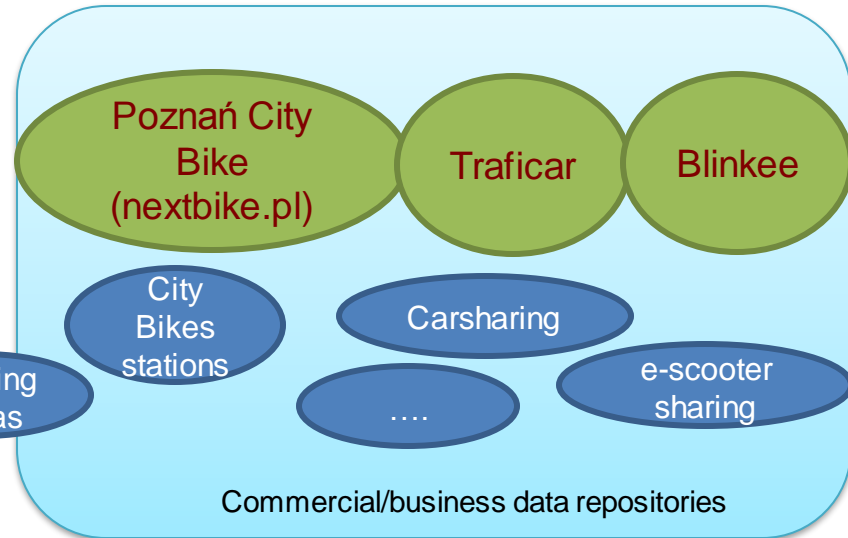
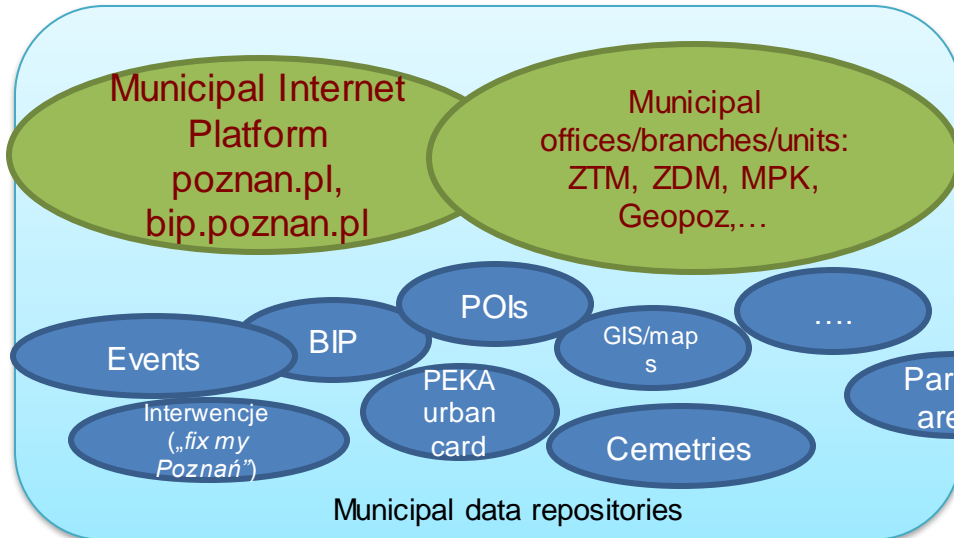


\*) Based on.: IoT platforms integration and federation  
in Vermesan, Ovidiu; Friess, Peter (Eds.) Digitising the Industry Internet of Things Connecting the Physical, Digital and Virtual Worlds (2016) pp.70





## POZNAŃ OPEN DATA



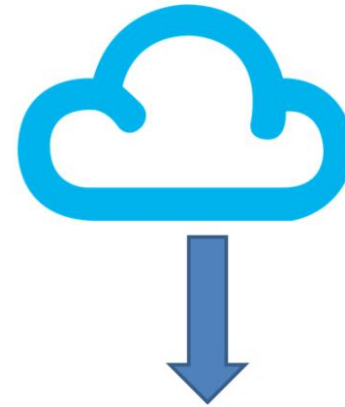
# Infrastructure of Poznań Municipal Data Platform

## Smart mobility case

Municipal transportation IoT



Municipal Data Platform



- Open data
- Digital city map
- Applications
- Big data analysis
- Video/image processing (ML, DML)
- ...

# Municipal transportation IoT

- Municipal data
  - Cyclist monitoring sensors
  - P&R (park and ride parking areas) usage
  - Static and dynamic (realtime localisation based) timetables of local transportation
  - ITS/PEKA urban card
  - Incidents in the city area (accidents, traffic jams, etc)
  - Video content from city surveillance system
- Business data
  - City bikesharing system (Nextbike)
  - City Electric scooter-sharing (Blinkee)
  - City carsharing data (Traficar)
- Citizens reporting issues
  - Interwencje Poznań – category *incidents in the city area*
- Understanding of citizens transportation needs
  - What citizens search for on municipal websites:
    - Municipal transportation websites stats (ZTM, MPK, ZDM, poznan.pl)
    - BIP – transportation chapter
    - Public transport timetables
    - Environment data (pollution, water level)
  - Consultations, PBO (Poznań participatory budget) projects

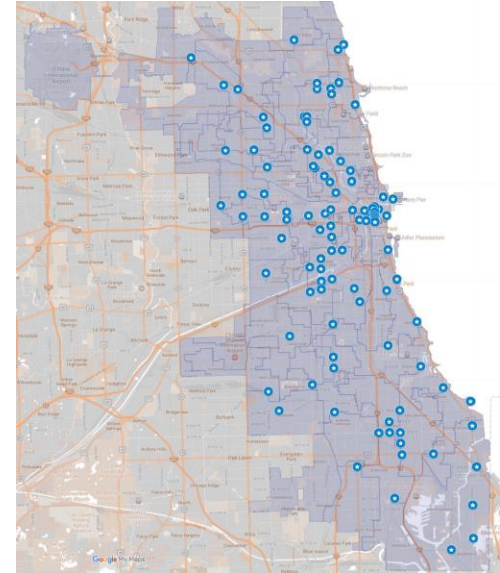


## Municipal Data Platform

- Aquisition & aggregation of data from distributed data repositories (APIs, files, databases, etc), coming from public and business repositories
- Visualisation on city digital map
- New services: e.g. Interwencje Poznań enhancing two-way communication with citizens
- Data, image and video processing (ML, DML)
- Data harmonisation
  - Synergy between city units responsible for transportation infrastructure and services, and businesses
  - Creation of collaboration space and empowering new ideas/concepts - toward innovation culture
- Better governance (evidence based policies)
  - Big data analysis making use of the platform data – from raw data to knowledge&understanding of dynamics and trends on mobility in the city area
  - Data shared and accessible for city offices/branches/units without any limits
- Open data sharing model for citizens and businesses: transparency, stimulation of innovation (City API/SDK)

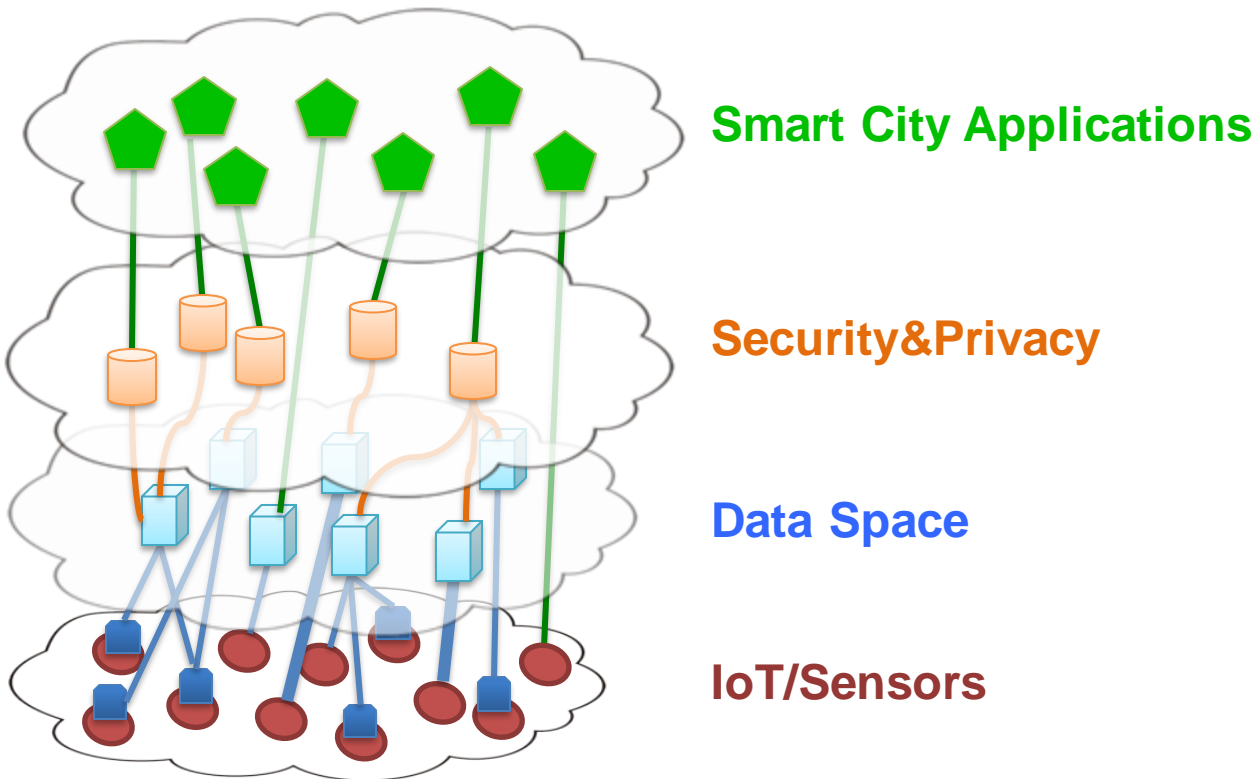
## Towards new data-processing models

- **High volumes of data** require intensive processing on a large scale and in real time
- Available **cloud services** are not able to meet the requirements for expected scalability and data processing models
- **High-performance computing (HPC)** environments are focused on central processing of locally stored data.
- The cost of **data transfer to HPC** systems is high and it is a time-consuming process
- New end-to-end **data processing models** are needed to ensure:
  - Aggregation and pre-processing on edge devices (Edge Processing)
  - Access to high-performance computing systems for analysis, simulation and knowledge discovery (using Machine Learning methods)
  - A unified processing workflow enabling automatic inclusion of new data sources and application development



**Poznań already has the necessary components  
for a pilot implementation of Open Smart City in such a model**

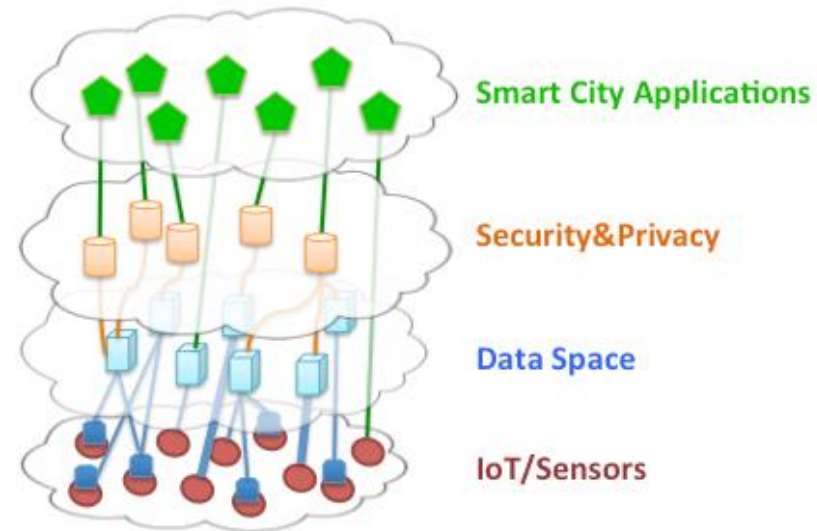
## Open Smart City Architecture Layers





# Challenges

- **For Business**
  - Openness to cooperation in building data and software ecosystem
  - Selection of data sets taking into account different levels of accessibility
- **For Governments**
  - Transformation from Development Strategy, through Smart City Strategy to Open Data Strategy (data publication and stimulating data use)
- **For Science**
  - Transformation from open data models, through automated data linking and discovery, to models of unified Big Data processing platform
- **For Citizens**
  - Activity in the living lab space
  - Developing new applications and providing data
- **For Everyone**
  - Ensuring methods of security, reliability and privacy





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