GEOProcessing, ALLSENSORS, ICDS Joint International Expert Panel:

Urban and Spatial Computing: Challenges in Society Sensing

April 25, 2016, Venice, Italy

The Eighth International Conference on
Advanced Geographic Information Systems, Applications, and Services (GEOProcessing 2016)
The First Internat. Conf. on Adv. in Sensors, Actuators, Metering and Sensing (ALLSENSORS 2016)
The Tenth International Conference on Digital Society and eGovernments (ICDS 2016)
– DigitalWorld 2016 –

GEOProcessing, ALLSENSORS, ICDS / DigitalWorld
April 24–28, 2016 - Venice, Italy

GEOProcessing, ALLSENSORS, ICDS Panel: Challenges in Society Sensing

Panelists

- *Claus-Peter Rückemann* (Moderator), Westfälische Wilhelms-Universität Münster (WWU) / Leibniz Universität Hannover / North-German Supercomputing Alliance (HLRN), Germany
- *Yerach Doytsher (Moderator),* Mapping and Geo-Information Engineering, Israel Institute of Technology, Israel
- *Jean-Paul Kasprzyk,* University of Liege, Belgium
- *Paulo E. Cruvinel,* Embrapa Instrumentation Center, Brazil
- *Jean-Pierre Jessel,* IRIT-UPS, University of Toulouse, France

GEOProcessing, ALLSENSORS, ICDS 2016:

`http://www.iaria.org/conferences2016/GEOProcessing16.html`
`http://www.iaria.org/conferences2016/ALLSENSORS16.html`
`http://www.iaria.org/conferences2016/ICDS16.html`

GEOProcessing, ALLSENSORS, ICDS Panel: Review 2015

Review: 2015 Expert Panel Summary "Geo Measurements and Urban Challenges":

- There is the threat of **no privacy anymore** (beyond scenarios of "non-network" use)!
- **Components**: Integration of solutions, data organisation, geospatial data, GIS, analytics, fusion, near real-time data as well as long-term vital knowledge and transfer, various data sources, crowdsourced and coordinated approaches, geotagged data, geovisualisation and planning dialogs.
- **Most pressing**, nationally and internationally: **Privacy and data!**
- Required: **Legal framework(s)!**
- **Unanimous understanding** from Expert Panel: **Regulations required** for individual and integrated use of data.
- **International differences (legal and social) but global scenarios!**
- **Big Data** feasible via individually **"destilled" / "reduced"** information, which enables to be stored due much smaller volumes.
- **Practicable: Responsibilities where data is (actually) created and handled.**
- Data sources range from **crowdsourced, automated** (voluntary/without explicit consent) to **centralised/coordinated**.
- **Follow-up topic** suggestions for next international expert panels: **Metadata and legal regulations, international view**.

GEOProcessing, ALLSENSORS, ICDS Panel: Challenges in Society Sensing

Pre-Discussion-Wrapup:

- **Society Sensing:** Current status of urban and spatial computing?
- **Dark matter?:** Where do the challenges in society sensing come from and which facets does society sensing have?
- **Scenarios:** Central data, crowdsourced data, ...?
- **Data, metadata, and sources:** Which data/methods are really required for planning and management?
- **Issues:** Are there legal and social issues? Are legal regulations and their "complements" fit for the challenges?
- **National and international view:** Is there a common understanding of the challenges?
- **Disciplines and components:** What are the contributions: Geospatial methods and processing, social networks, sensors, ...?
- **Use cases:** Use cases and applications?
- **Networking:** Discussion! Open Questions? Suggestions for next Expert Panel?

GEOProcessing, ALLSENSORS, ICDS Panel: Post-Panel-Discussion Summary

Post-Panel-Discussion Summary (2016-04-25):

- On the one hand there is **"no privacy anymore"** (beyond scenarios of "non-network" use) and on the other hand tools and practices to protect privacy are on the rise!
- **Most pressing, still**, nationally and internationally: **Privacy and data are valuable goods!**
- **Required: Legal framework(s)/regulations, especially for individual and integrated use of data and services! Global scenarios!**
- **Big Data** feasible via individually **"destilled"/"reduced"** information.
- **Practicable: Responsibilities are where data is (actually) created and handled. Strengthen individuals' rights for alternatives to singular and data-collecting services.**
- Suggested: **Independent auditing (e.g., non-governmental, non-for-profit) of services and service providers on national and international base**.
- Suggested: Make "misuse" documented for the public regarding quantity and quality. **Create an independent documentation centre and services**.
- **Follow-up topic** suggestions for next international expert panels: **How have privacy, metadata, legal regulations developed in the last years in national and international view**.

GEOProcessing, ALLSENSORS, ICDS Panel: Table of Presentations, Attached

Panelist Presentations: (presentation order, following pages)

- **Coping with Frailties** (*Rückemann*)
- **Crowdsourcing and Wisdom of the Crowd: The Location Based Services Perspective** (*Doytsher*)
- **Behind data sensing: Business intelligence for an effective analysis** (*Kasprzyk*)
- **Interaction between urban and rural for food production & supply** (*Cruvinel*)
- **3D and imaging technologies to face Society/City Sensing challenges** (*Jessel*)

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Coping with Frailties

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Dr. rer. nat. Claus-Peter Rückemann[1,2,3]

[1] Westfälische Wilhelms-Universität Münster (WWU), Münster, Germany
[2] Leibniz Universität Hannover, Hannover, Germany
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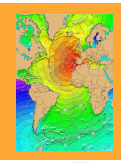

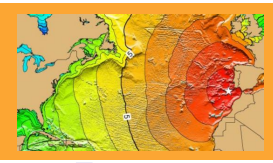

Review 2015 GEOProcessing and ICDS Panel:

Review: 2015 Expert Panel Summary "Geo Measurements and Urban Challenges":

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Status: Challenges from Natural Sciences Measurements and Computing?

Space-and-time: Universal long-term knowledge and vitality?

Natural Sciences – Fundamental research – Long-term integration?
Applied Sciences – Practical applications – Long-term integration?

Scientific methods and data ...

- Geo-electric measurements
- Geo-magnetic measurements
- Gravimetric measurements
- Resistivity measurements
- Seismic measurements
- Geo-Radar, EMR, Tomography
- Borehole techniques
- RADAR, LIDAR, ...
- nD time-lapse 3D, 3.5D, 4D
- ...

Widely applied methods and data ...

- Scientific measurements
- Technical measurements
- Satellites / measurements
- Distance measurements
- Spatial Information
- Positioning data
- Various RT data
- ...

Components

Scientific measurements and purposes

- Documentation
- Conservation
- Construction
- Reconstruction
- Simulation
- Warning systems
- Plans (preservation, evacuation, ...)
- Safety and policies (access, qualities, ...)
- Long-term perspectives
- Protection (history, archaeology)
- Development (cities' infrastructures)
- ...

Scientific measurements and means

- Knowledge resources (creation, documentation, ...)
- Computing, Storage, Integration, ...

... on the other hand: Challenges from non-scientific use?

- Gathering, storing, (re-)using, integrating data
- Feeling comfortable with the flair of "everything is possible" and "nothing to hide" ...

Challenges

Developments:

- Social environment developed from local to national to international (compared with ancient Greek understanding).
- Rights moved from direct to indirect (compared with ancient Greek understanding).
- Decisions moved from self-determination to heteronomous (directed).
- The following of trends moved from optional to pre-mandatory.
- Practices have not been renamed but may have been revised.
- Perception is changed.
- Balance points of responsibilities and rights have been moved.

Vision – Solutions

Solutions.

- **Independent auditing, best practice, solutions from non-for-profit and non-governmental-organisations, individual right not to participate in any way. Responsibility for privacy where the data actually is ('owned' not where it has been transferred to).**
- **Regulations for gathering, use, and integration of data. Protect the individual against threats from (groups of) individuals. Strengthen the individual person (legal / rights, funding, understanding, ...).**
- **Naming the problems, contributors, and interest groups. Standard education does not help. Openness and transparency do not help. Create an independent documentation centre for misuse.**
- **Strengthen scientific research (data organisation, integrated measurements, systematics and methodologies with content, long-term means, multi-disciplinary knowledge resources, data vitality). Create global counter balance against sole commercial use / non-direct "democratic" processes.**
- **Improve data organisation (structure, standards ...) and integration and create long-term knowledge resources.**

Conclusions

Save the data, eat more datapeckers!

- **First: Technology is neither the major challenge nor solution.** Technical measures can only help implementation on a legal base.
- **Society: Communication fails for major problems.**
- **Global "gold-rush mentality" is a challenge for the society.**
- **Strengthen the individual / lobbyless person and international and national understanding of individual rights.** Permitting sensing should be voluntary, without any drawbacks for denial.
- **Create effective means, regulations, best practice mandatory for funding, documentation, and auditing.** Prohibit integration of different sensed and related data. Disable the extradition of sensed and related data from data holders. Data belongs to the individual person. A person who pays for a respective service owns all the data associated with the use of the service.
- **Science: Long-term data, structures, and methods / means.**
- **Multi- and trans-disciplinary work, knowledge documentation, content / context.**

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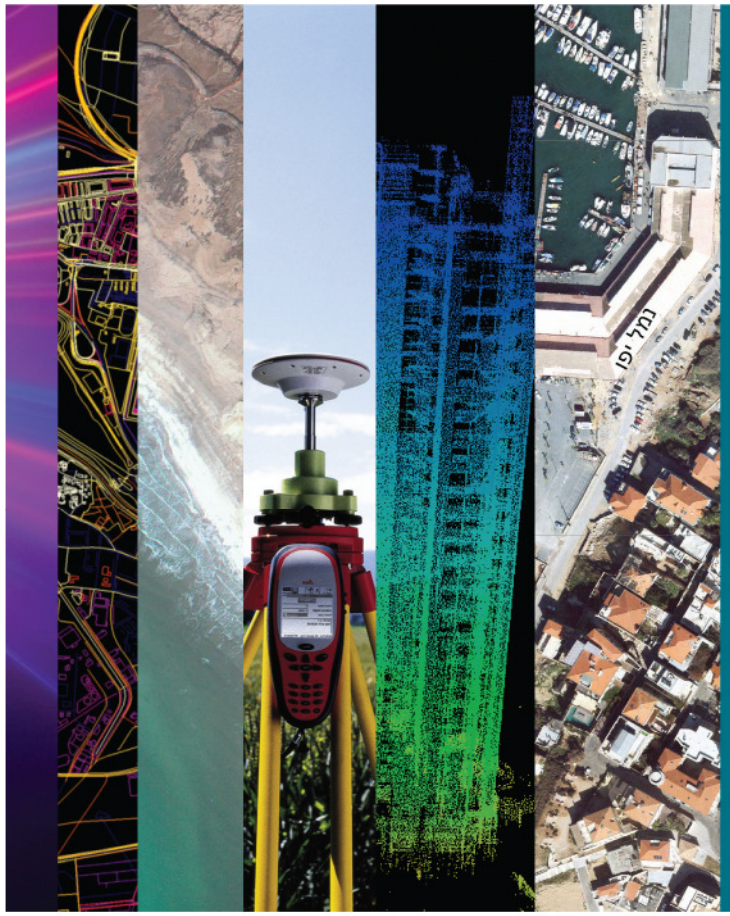


Crowdsourcing and Wisdom of the Crowd: the Location Based Services Perspective

Prof. Dr. Yerach Doytsher

Technion
Israel Institute of Technology

MAPPING & GEO INFORMATION ENGINEERING

Urban Sensing Technology

- New citizen-activated sensors in the urban environment
  - Cellular phones
  - Radio Frequency Identification (RFID) tagged items
  - Urban observation sensors ("video recording")
- Active and/or passive collecting and managing a wide range of urban information
- Possibility to track movements of all citizens across a megacity
  - RFID like barcodes broadcasting their information
  - Everywhere surveillance through the use of mobile phones
  - Toll passes for vehicle tracking
  - Travel passes for individuals

Urban Sensing Technology (cont.)

- It is becoming passive sensors that silently collect, exchange and process information continuously
- Cheap sensors are able to detect environmental variables such as:
  - Air pollution
  - Noise pollution
- Great efforts are carried out to:
  - Improve traffic jams by using mobile sensors
  - Integrate location based services (LBS) and social networking to providing real time social interactions
- We are just at the middle of this urban sensing era

A sample of personalized estimates of environmental exposure

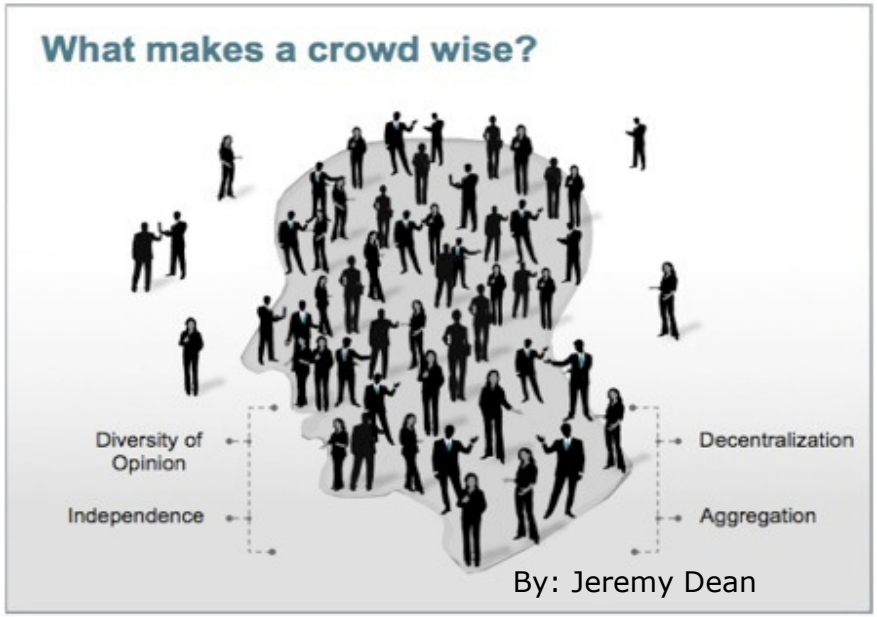
World Wide Web and the Users

- A development of online publishing tools, and particularly of the World Wide Web (WWW) simplified:
  1. interaction between users.
  2. 'navigation' through enormous amounts of data and information.
- Users all over the world are involved with data processing (thanks to Web 2.0).
- This revolution has brought the development of two important working methodologies: "**Wisdom of the Crowd"** and "**Crowdsourcing"**.

World Wide Web and the Users

Wisdom of the Crowd

- Described by Surowiecki (2004):"*Large groups of people are smarter than an elite few*".
- The crowd can be any group of people that "*can act collectively to make decisions and solve problems*".
- 'Wise' crowd has to exist of 4 main attributes :
  - Diversity,
  - Decentralization,
  - Independence,
  - Aggregation.



Crowdsourcing

- Different definitions of the term:

1) "*Taking a job traditionally performed by a designated agent and outsourcing it to an undefined, generally large group of people*" (Howe, 2006).

2) "*The practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers*" (Merriam-Webster online dictionary, 2014).

Introduction

Wisdom of the crowd <----> Crowdsourcing

- The two range across fields as diverse as: culture, psychology, biology, behavioral economics, artificial intelligence, social sciences, military, history, politics and computing.

- Affecting urban environment and their inhabitants (quality and efficiency of smart cities)

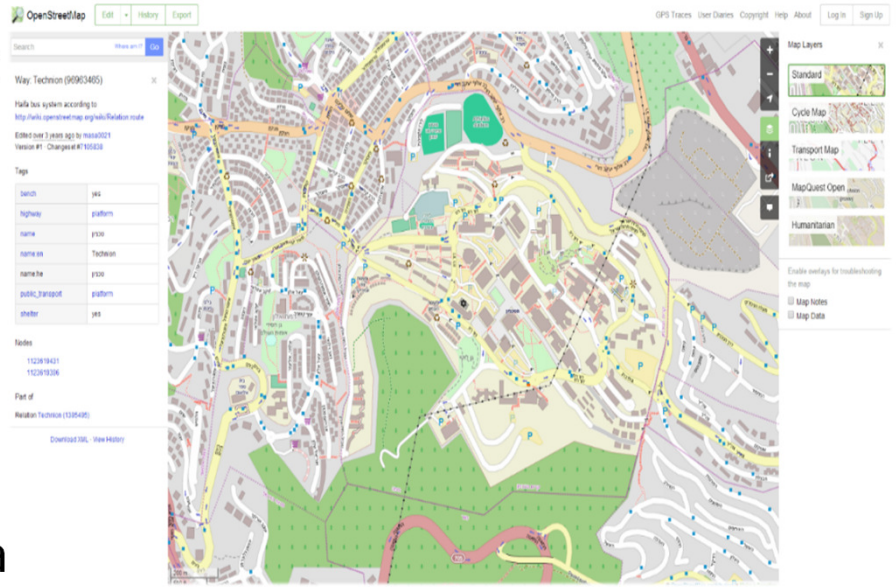
Methodology

- The comparison and differentiation between the two terms was analyzed (at the Technion) in respect to three very popular (tens/hundreds of millions worldwide) location based services having geospatial characterization:

1) OpenStreetMap (OSM)
2) Waze (© 2009-2014 Waze Mobile)
3) Moovit (© 2014 MOOVIT)

OpenStreetMap

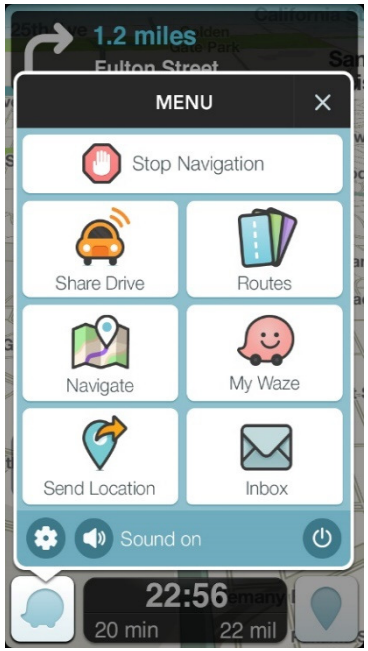
- A collaborative online project
- An open-source editable vector map of the world
- Users can:



1) view and edit the underlying data
2) upload GPX files (GPS traces) from hand-held GPS units
3) correct errors in local areas according to satellite imagery and out-of-copyright maps
4) download desirable data freely and use it to their own purposes

Waze

- A community real-time GPS-based traffic and geographical navigation service
- Was bought by google (1.3 B$)



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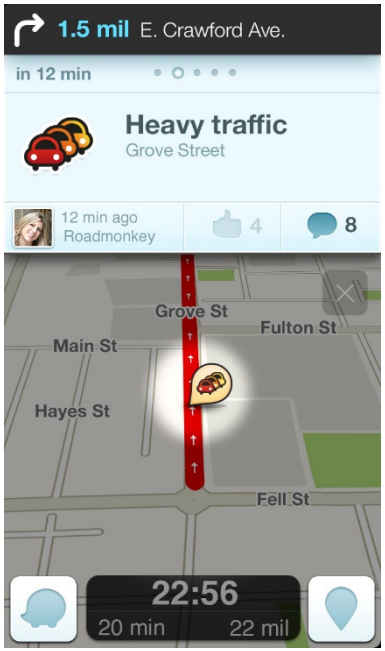
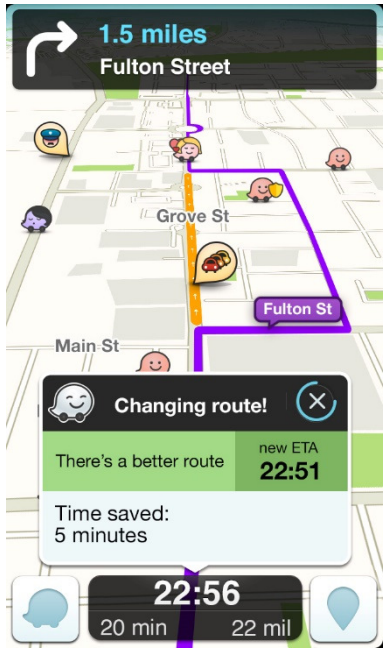




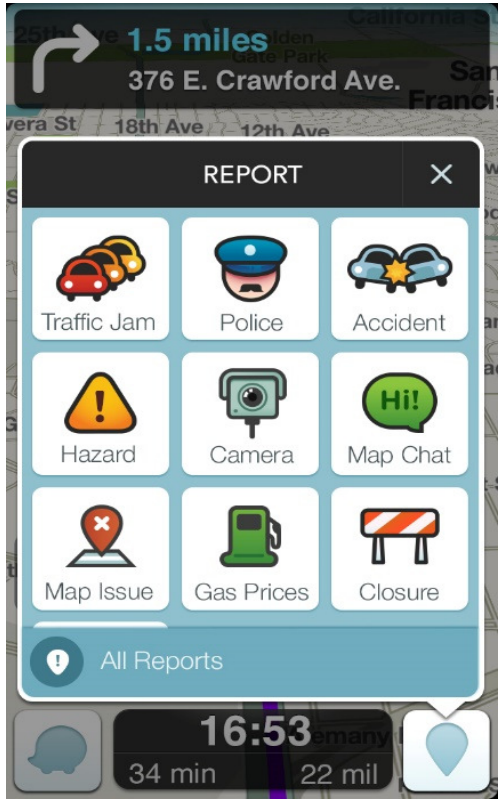
Waze

- Drivers can:

1) share real-time traffic and road information (with just opening the Waze app)

2) actively report traffic jams, accidents, road dangers, etc.

3) from the online map editor users can add new roads, update existing roads, add landmarks, house numbers, etc.

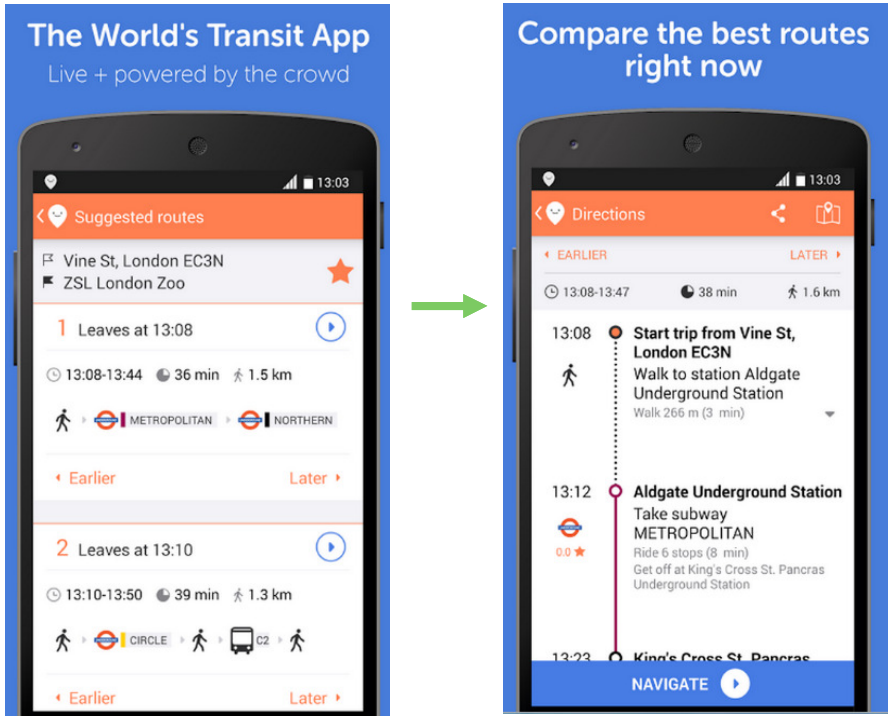


- The collected data are aggregated and provided to the user/ community as alerts, traffic flow updates – and more

Moovit

- A real-time cooperative, community-driven service for public transportation and transit navigation based on GPS
- Users can:

1) get a live map with nearby transit stops, lines stopping, arrival times etc.
2) actively add new information to the system
3) plan a trip by choosing the most efficient/convenient option
4) receive dynamic estimated time of arrival to the desirable destination



Differentiating Parameters

Six main indices to differentiate between "**Wisdom of the Crowd**" and "**Crowdsourcing**" are:

- **Diversity**
- **Decentralization**
- **Independency**
- **Aggregation**
- **Knowledge**
- **Activity**

Conclusions

- In a research at the Technion aimed at deferring between the terms **Crowdsourcing** and **Wisdom of the Crowd** (in respect to three specified location based services) – based on these six indices – it was concluded that:
  - **OpenStreetMap** is a typical crowdsourcing project.
  - **Waze** and **Moovit** are more wisdom of the crowd projects, mostly because an aggregation process is crucial.
- Due to rapid technological developments:
  - Both terms are in principle flexible and dynamic
  - The services themselves do not follow the terms 'rules'

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Thank you (*)

Prof. Dr. Yerach Doytsher

(*)Special thanks to Dr. Sagi Dalyot and Ms. Talia Dror
for their contribution to this presentation

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Behind data sensing: business intelligence for an effective analysis

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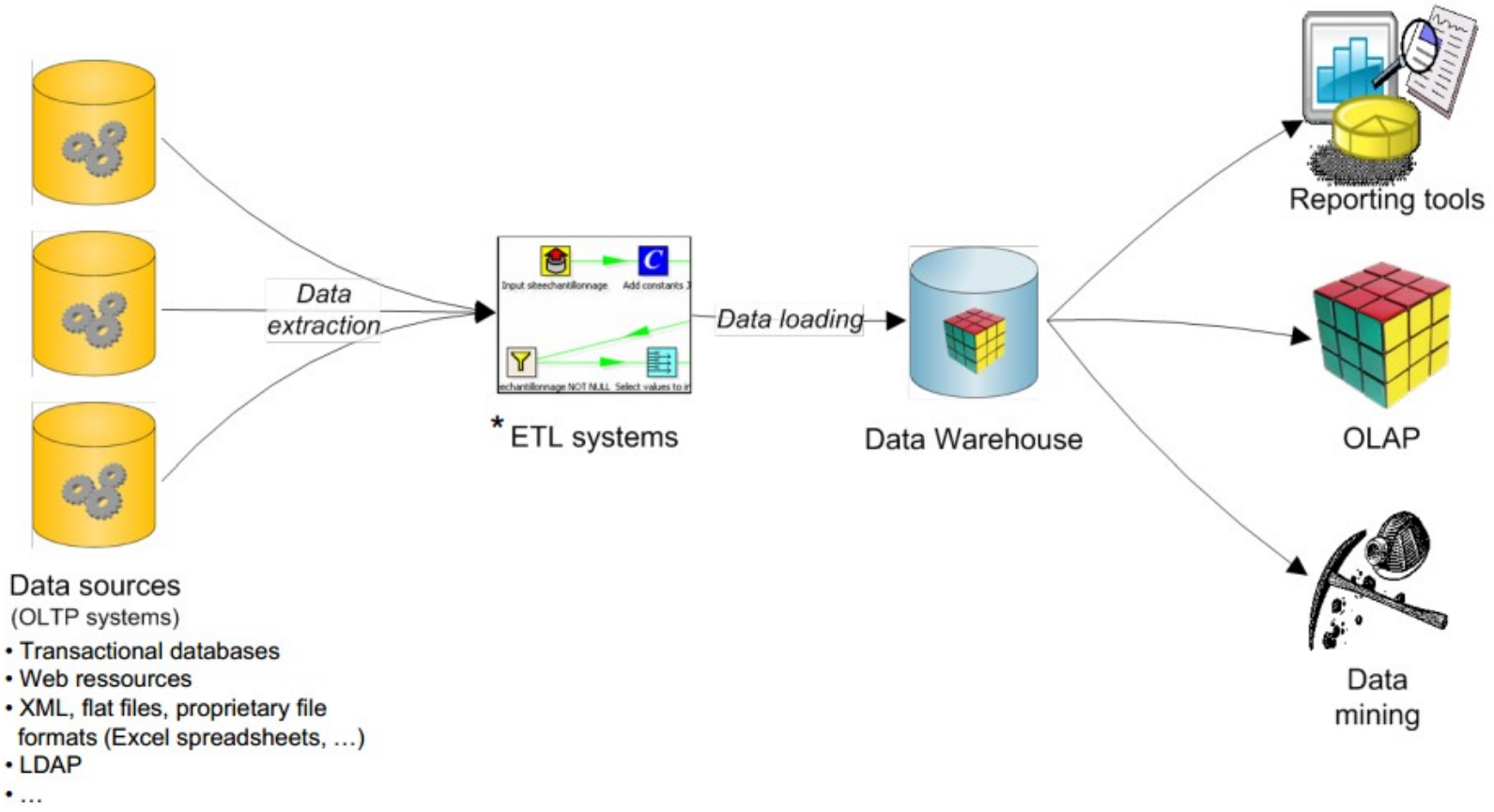
Big data

Business Intelligence

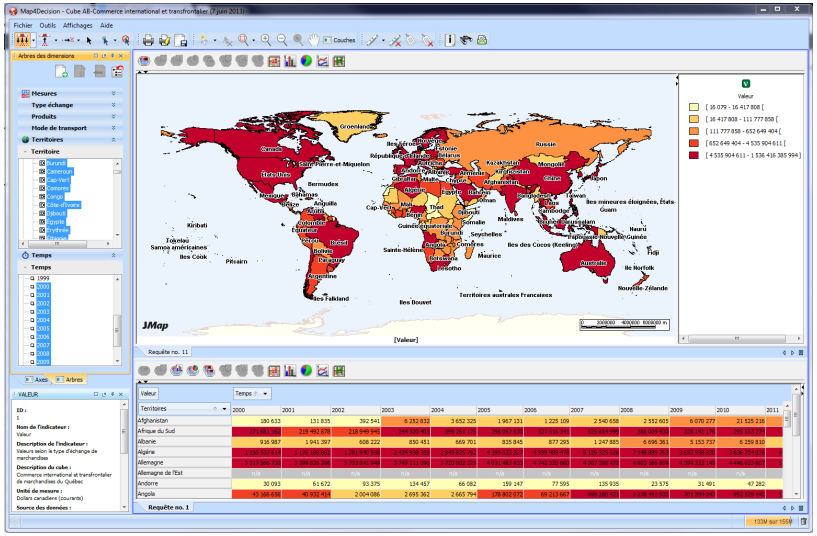


Architecture of a BI system (Badard et al, 2009)

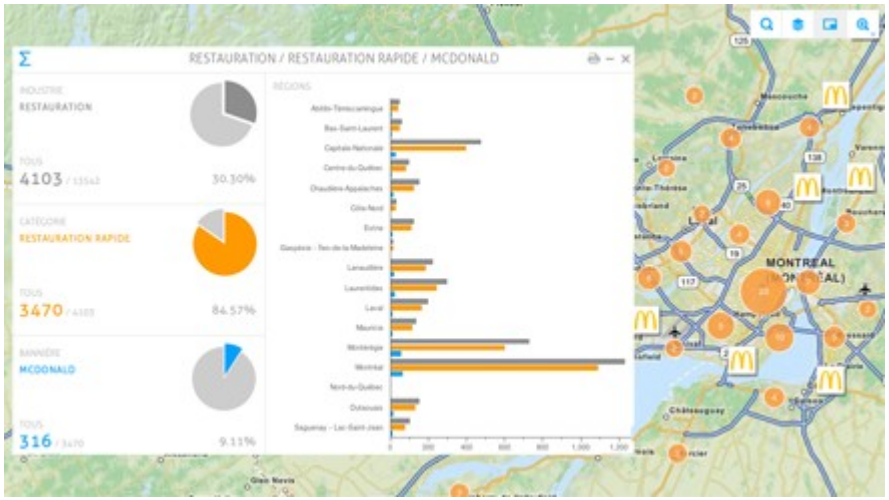
OLTP versus OLAP

- GIS : OnLine Transactional Processing (OLTP)
  - Daily management of spatial data
    - Easy update, integrity and no redundancy of the data
  - Based on transactional databases
    - Entity association approach
    - Easy access to data
- SOLAP : Spatial OnLine Analytical Processing (Bédard, 1997)
  - Decision support (Business intelligence)
    - Archiving ⇒ temporal dimension
  - Based on data warehouses
    - Multidimensional approach
    - Easy exploration of the data at different aggregation levels
    - Integration of large amount of heterogeneous data

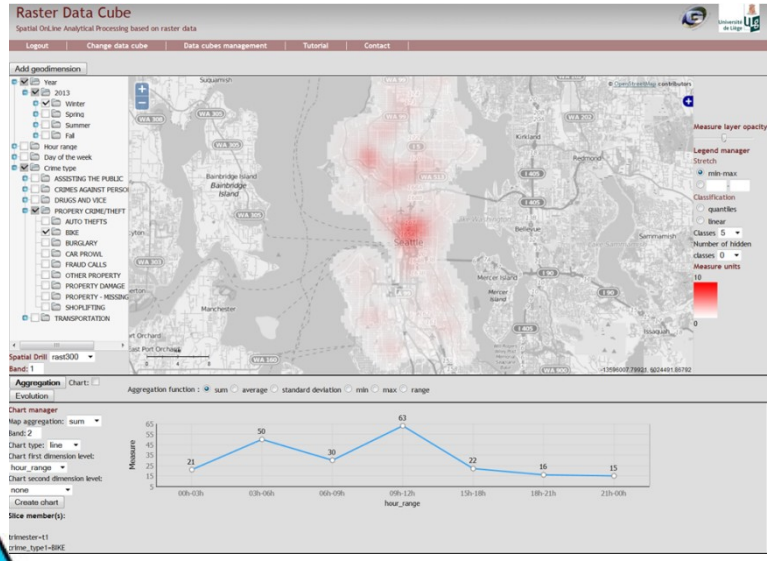
SOLAP tools



Map4Decision (Intelli³)



GeoMondrian
(Spatialytics)



RasterCube (Kasprzyk)

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Urban and Spatial Computing: Challenges in Society Sensing

(interaction between urban and rural for food production & supply)

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Embrapa

Ministério da Agricultura, Pecuária e Abastecimento

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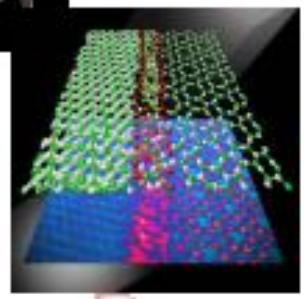
How useful is Spatial Computing & Sensing for food production and supply?



Competitiveness & Sustainability

Small farmers & productive capacity

Food Security & Food Safety

Environmental Diversity

Science & Knowledge frontier

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- Responding to increasing concerns over agriculture´s footprint on the natural resource base, as well as its aspects related with green economy to attend urban demands.

- The agricultural research system has taken important leaps, in a short period of time, towards development of innovations for increasingly safer and sustainable agricultural systems.

Research in Agricultural Sensors, Metering, Computing, and Automation

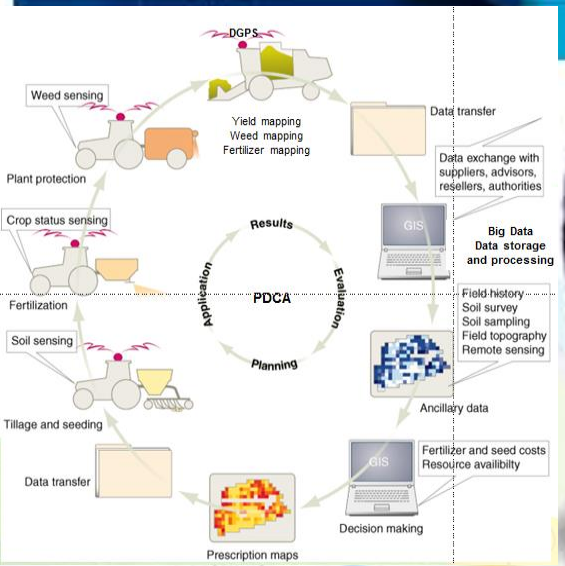
Precision Agriculture

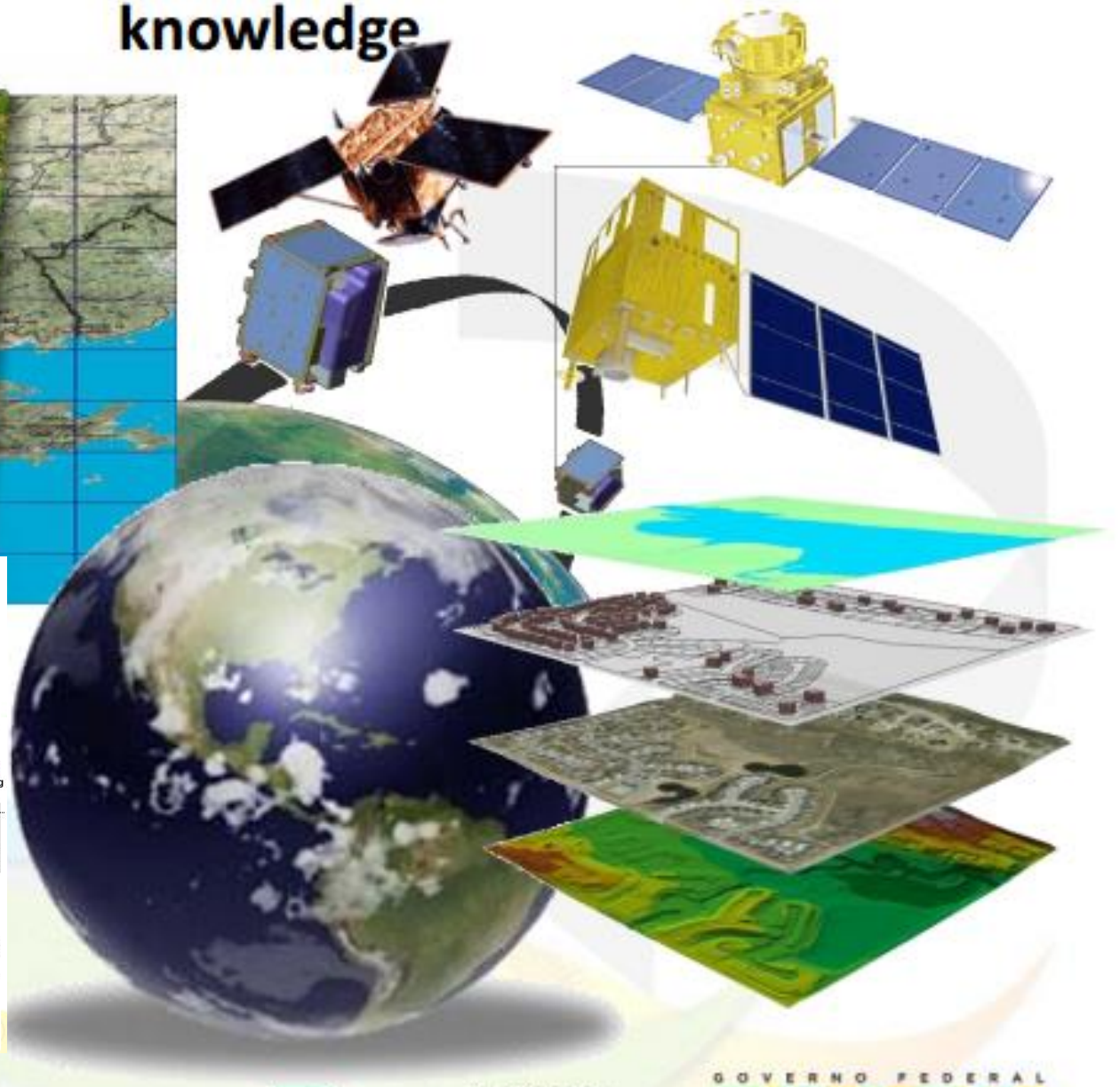
soil + plant + environment

=

spatial and temporal variability of productivity

Sensors, Measurements, Computing & Geomatics knowledge





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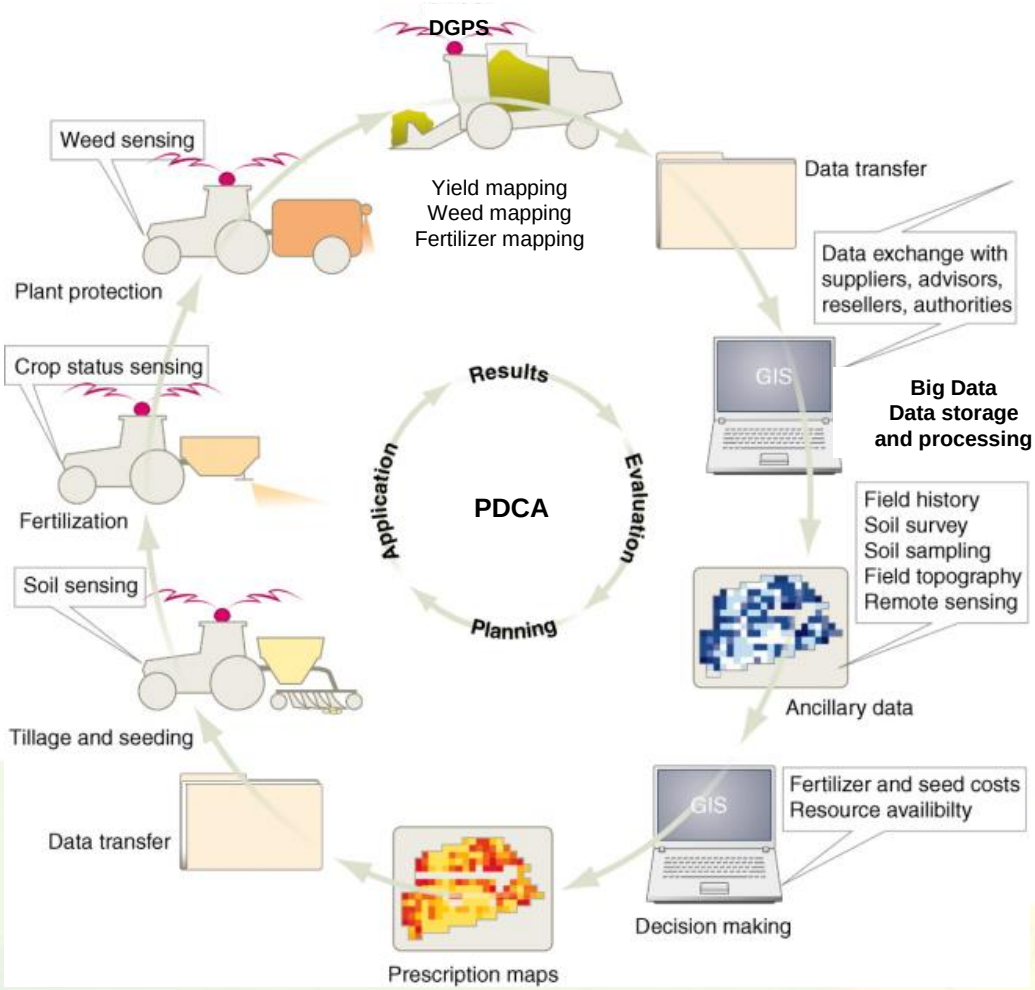
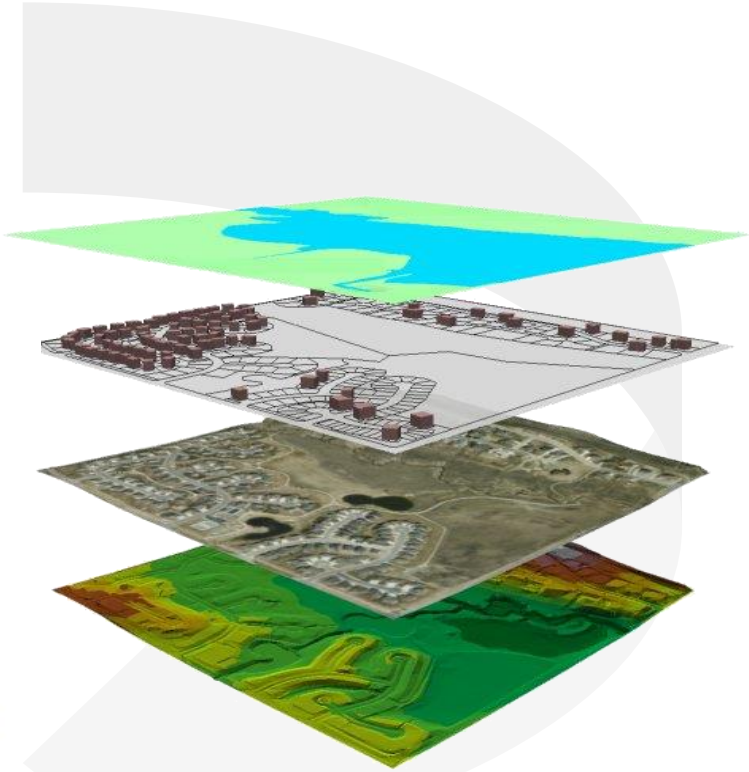
Sensors, Measurements, Computing & Geomatics knowledge



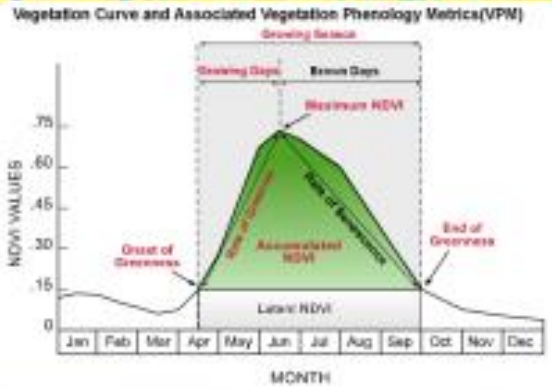


Plant, Soil & Environmental knowledge

Risk Monitoring

Modeling

Plant, soil & environmental variables monitoring



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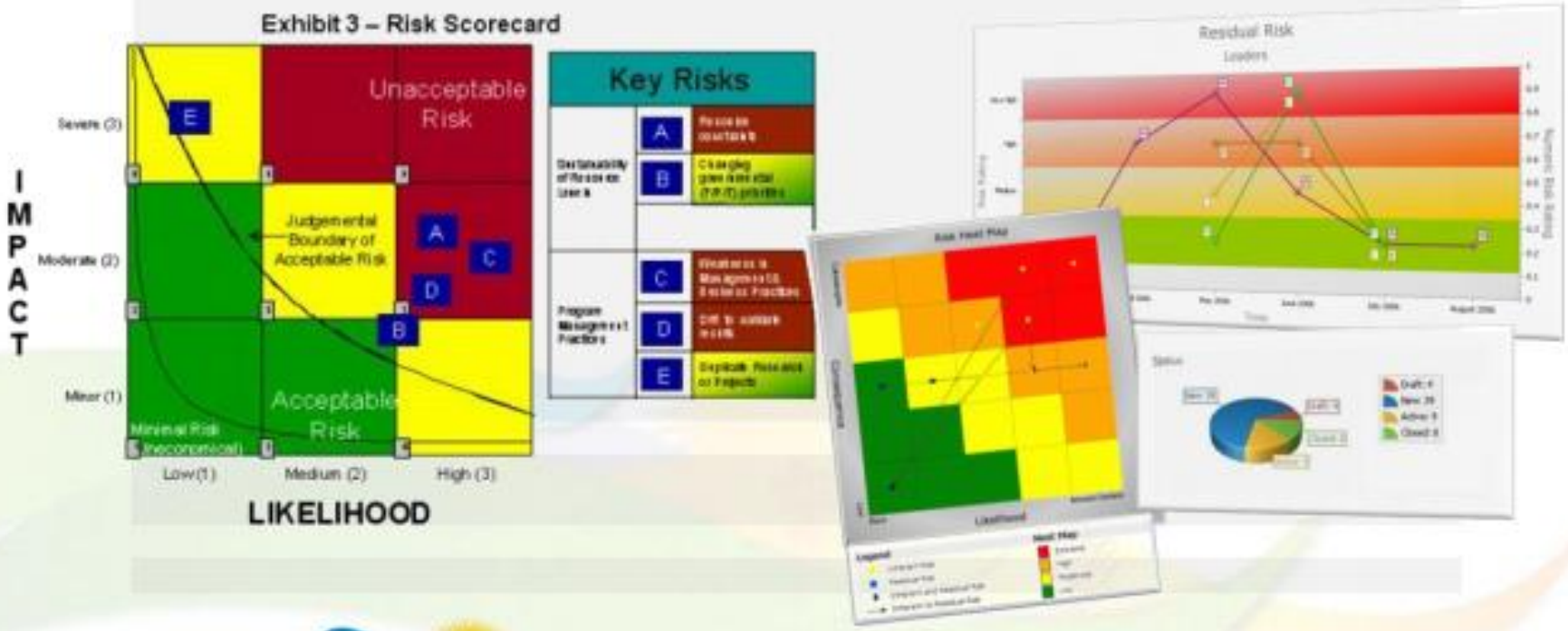
Statistical knowledge

Agricultural risk monitoring

Variables integration



The desired future of the organizations should occur based on the development of systemic practices that enable to administer the self-transformation, which constitutes the main challenge.

Thank you for your attention!

Université de Toulouse

CNRS - INPT - UPS - UT1 - UT2J

3D and imaging technologies to face Smart City challenges.

Jean-Pierre JESSEL

IRIT-UPS

University of Toulouse

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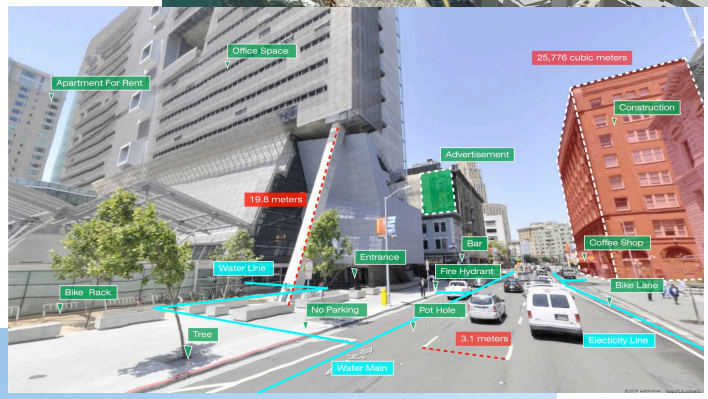
VORTEX

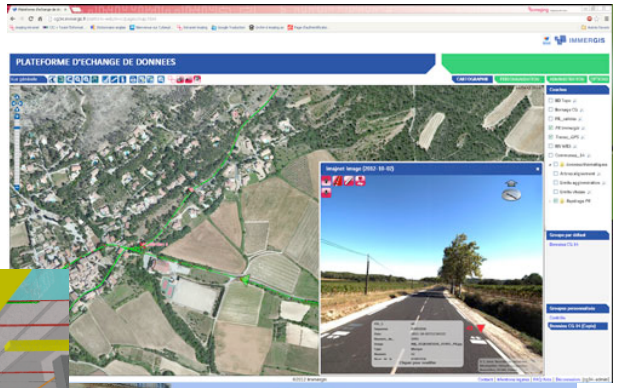
Smart City challenges

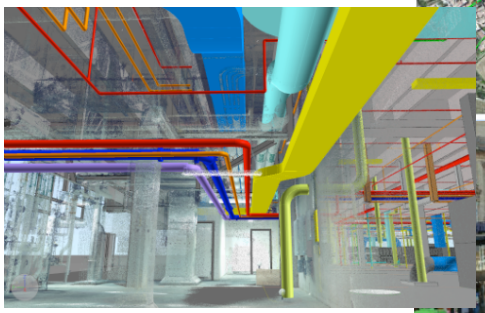
- People
  - Inhabitant expectations
  - Population growth, aging
  - Civic engagement vs skepticism
- Sustainable development
    - Do more with less
  - Transportation
  - Water, Energy
  - …
- Implementation issues
  - Technological barriers
  - Sensing everywhere
  - Improve data value

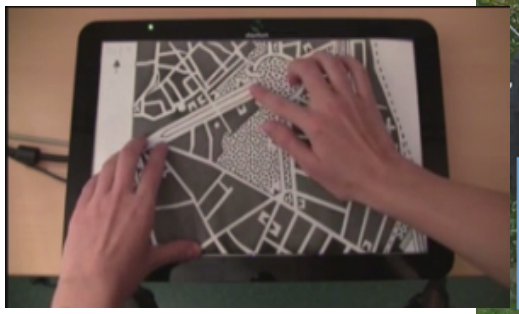


Contribution of 3D and associated technologies

- Management
  - DB automatic update
  - Smart grids (infoviz)
- Simulation
  - Construction impact
  - Traffic, development
  - Resources allocation/distribution
- People assistance
  - Elderly or disabled
  - Tourist

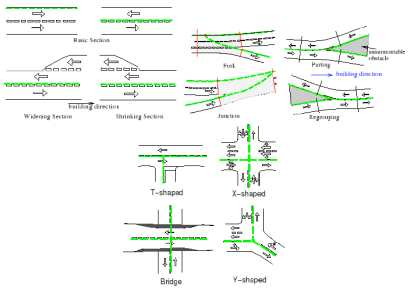


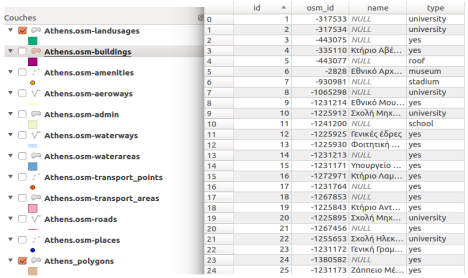




Creating a 3D urban environment

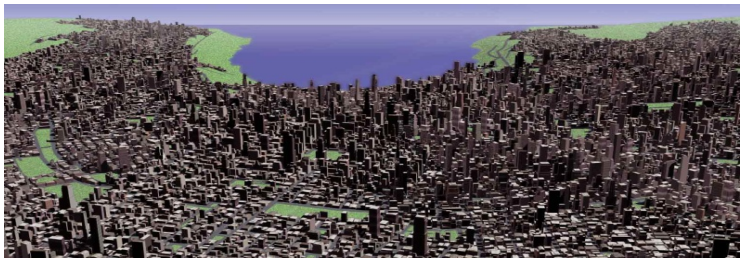
- 3D reconstruction (computer vision)
  - Laser / photogrammetry, lidar
  - Ground, plane or satellite
- Architecture, engineering
  - CAD-CAM 3D modeler
  - GIS
  - BIM
- Declarative modeling
  - Features, Properties, Rules, Constrains
  - L-systems, multi agent systems, cellular automaton, genetic algorithms…





Modeling smart and complex virtual urban environments

- Advanced modeling to develop a semi automatic system to create 3D urban environments using heterogeneous data:
  - For modeling process automation
  - 3D reconstruction
  - Maps and layers, 3D reconstruction data:
    - raw data for geometry and basic knowledge



  - 3D models declarative generation: constraints, properties, rules
- Extracting semantics from data (GIS, 3D…)
  - To get more knowledge
  - To create smart world
  - Need to add rich/smart 3D objects to virtual cities

Time to discussion