

Exploiting spatiotemporal data for smart city applications

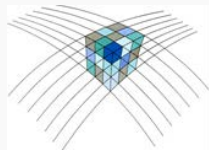
Manuel Garcia

J. Morales

MJ. Kraak

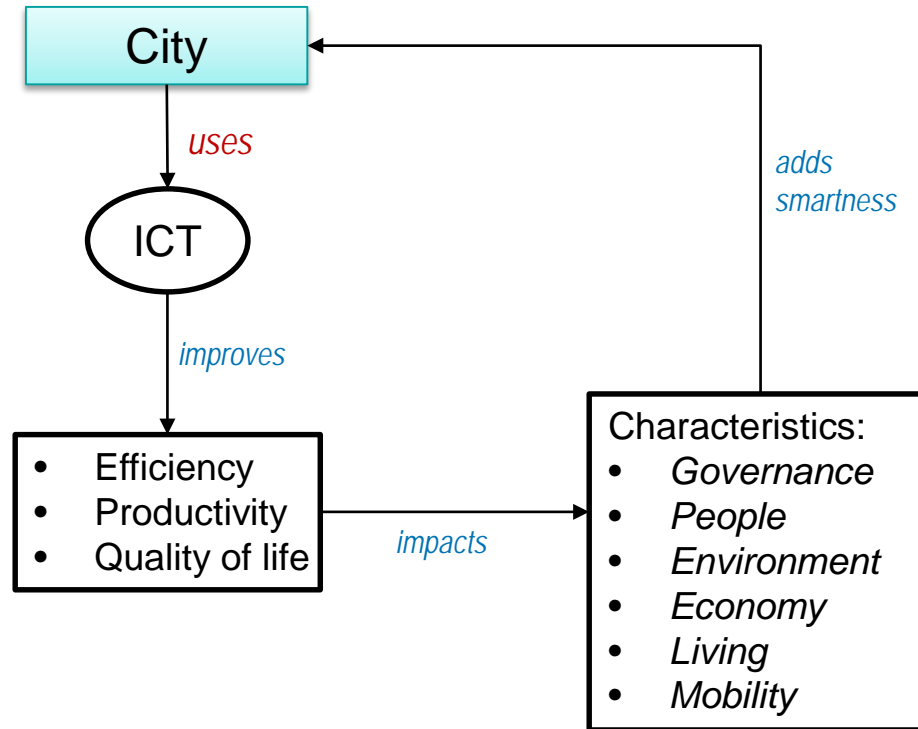
Geo-Information Processing

Faculty ITC, University of Twente



Smart City

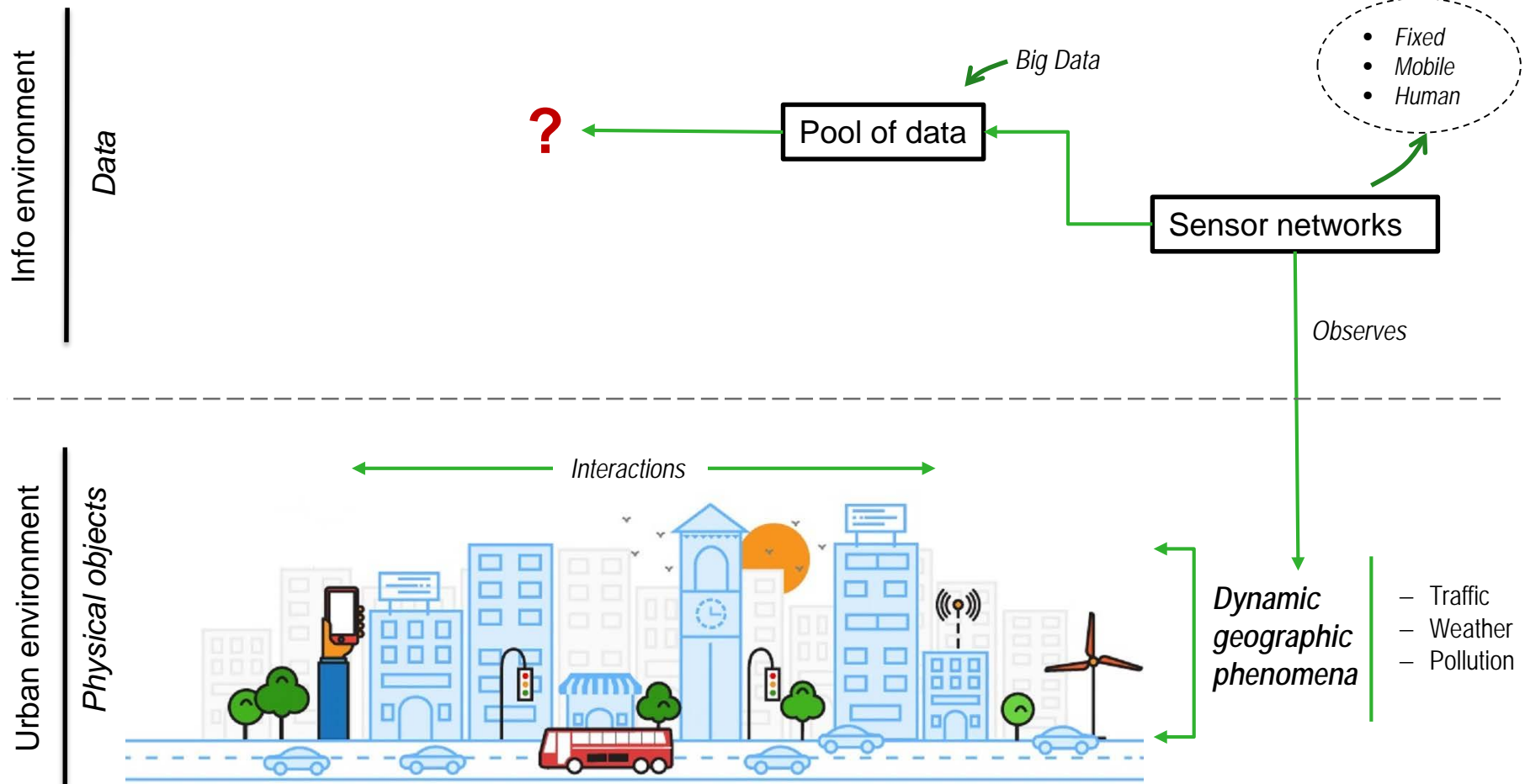
A SMART CITY



Griffinger et al. (2007)
Caragliu et al. (2011)
Platform (2011)

GEOINFORMATION PERSPECTIVE

DYNAMIC GEOGRAPHIC PHENOMENA





HOW TO EXPLOIT DATA FROM SENSOR NETWORKS?

HOW DO WE ADD UTILITY TO SPATIOTEMPORAL DATA TO ACHIEVE SMARTNESS
IN CITIES?


LOOKING FOR ANSWERS

SMART CITY APPLICATIONS



GEOGRAPHIC EVENTS

INFORMATION UNITS FOR SMART CITY APPLICATIONS




Geographic
event

- occurrence
- change of state
- observable dynamic geographic phenomena
- specific space-time window

- 
- *Car accident*
 - *Traffic jam*
 - *A rain fall*

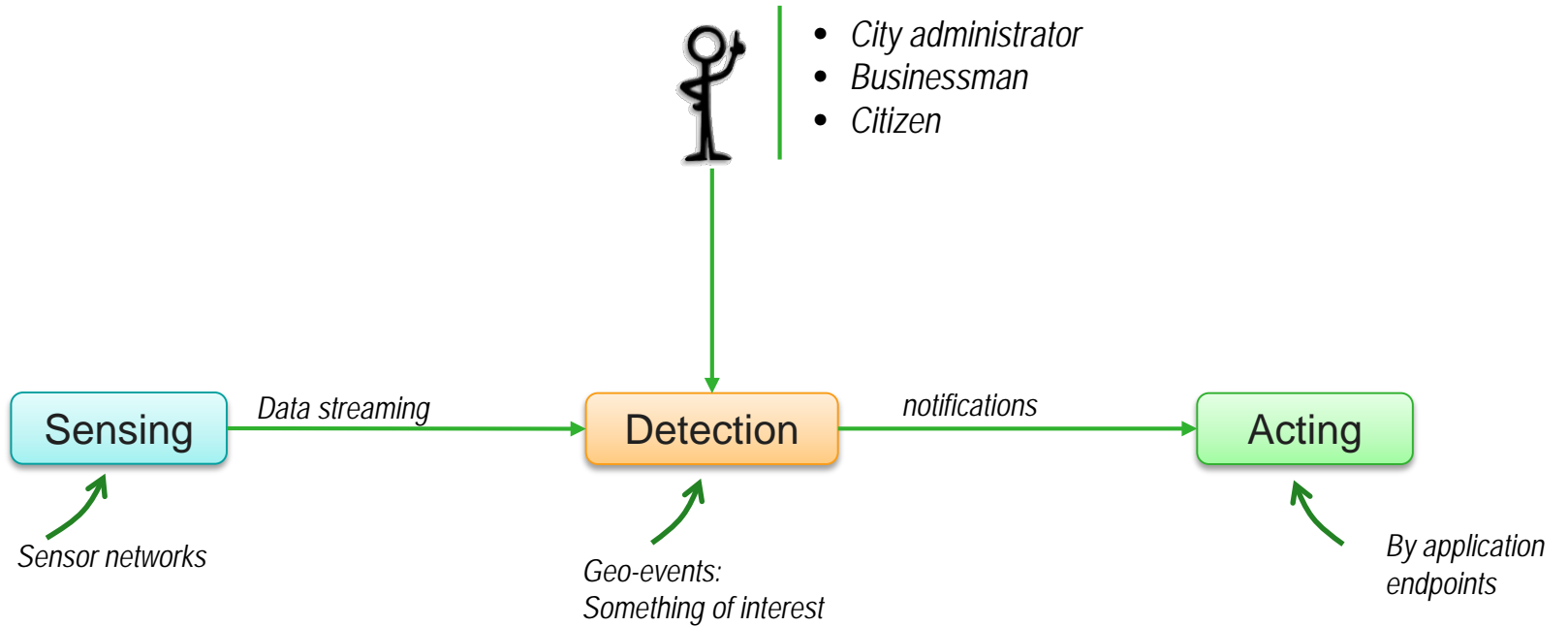
Event
Processing

Set of operations to collect, transform,
detect and discard events.

- 
- *Real time response*
 - *Big data capabilities*
 - *Responsive applications*

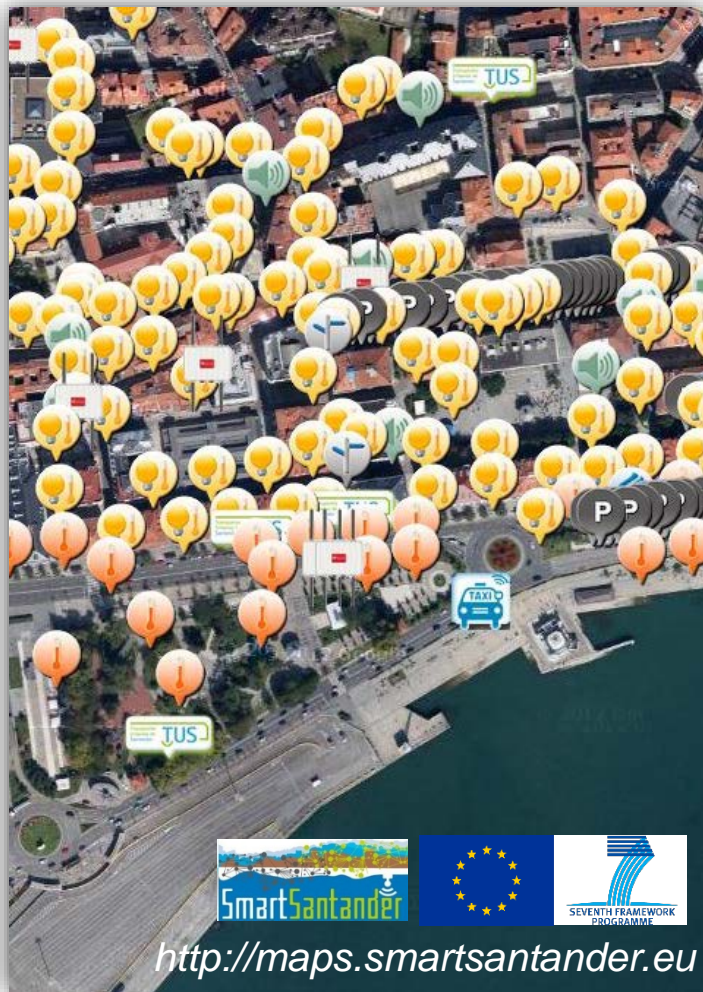
SMART CITY APPLICATIONS WORKFLOW

OVERVIEW



SYSTEM ARCHITECTURE

IMPLEMENTATION (CASE STUDY)

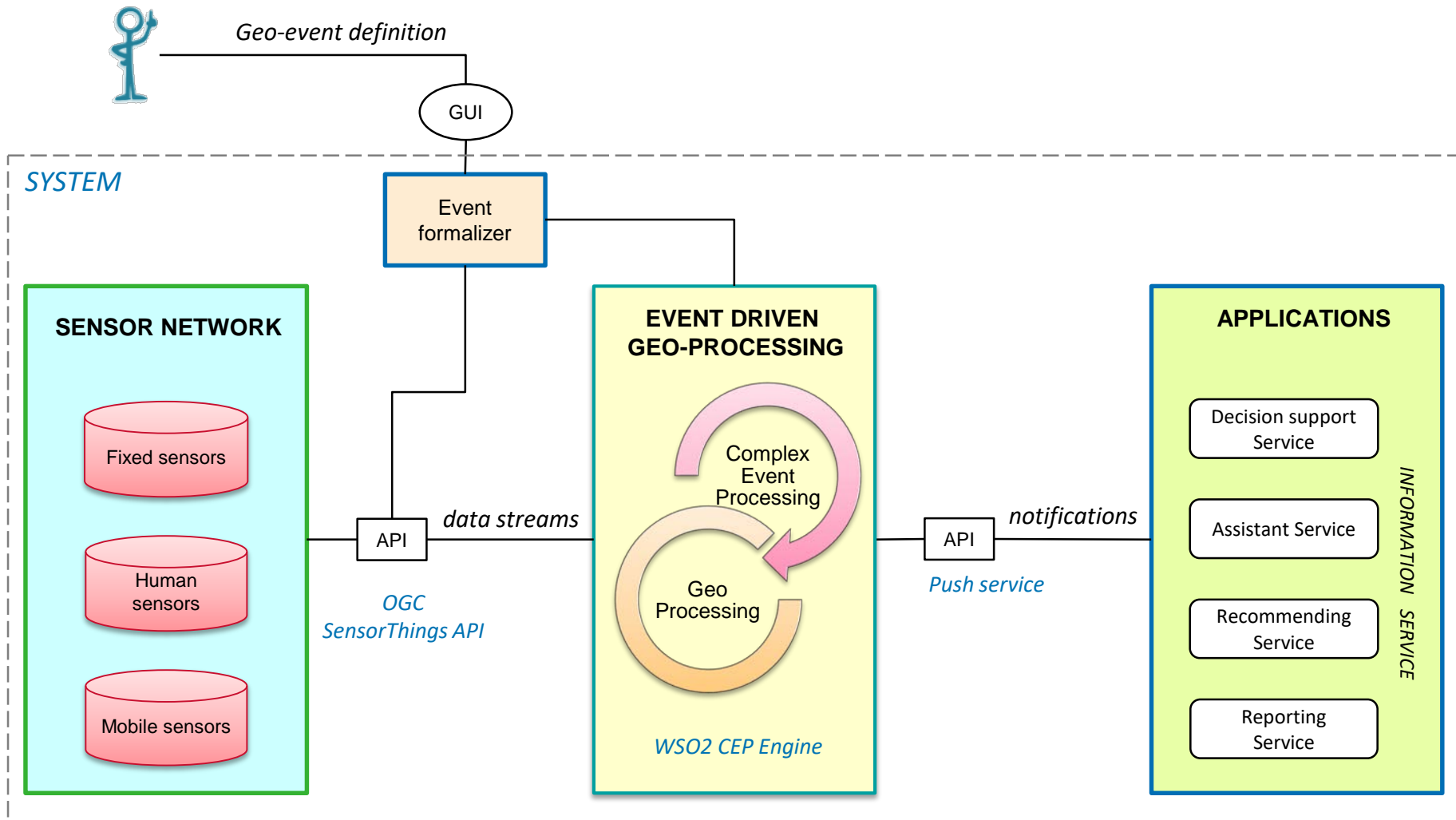


SENSOR	NUMBER	DATA (measurements)
Fixed sensors	~2000	Location
		Time-stamps
		Light intensity
		Noise
		Carbon monoxide
		Temperature
		Relative humidity
		Solar radiation
		Atmospheric pressure
		Soil moisture
		Soil temperature
		Wind direction
		Wind speed
		Rainfall
Mobile sensors	~150	Location
		Time-stamps
		Nitrogen dioxide
		Ozone
		PM10
		Temperature
		Carbon monoxide
		Relative humidity
		Speed and course of the vehicle
		...
Parking	350	Location Status (occupied/free)
Traffic monitoring	40	Location Number of vehicles occupancy of the lanes average speed of vehicles average queue length Inward and outward traffic flow

• 139,370 environment observations/day
 • 8,365 irrigation observations/day
 • 82,726 mobile environmental observations/day
 • ...

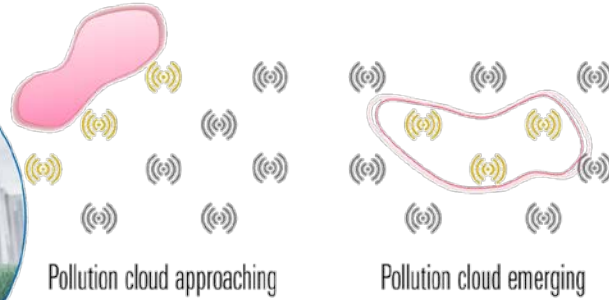


SYSTEM ARCHITECTURE

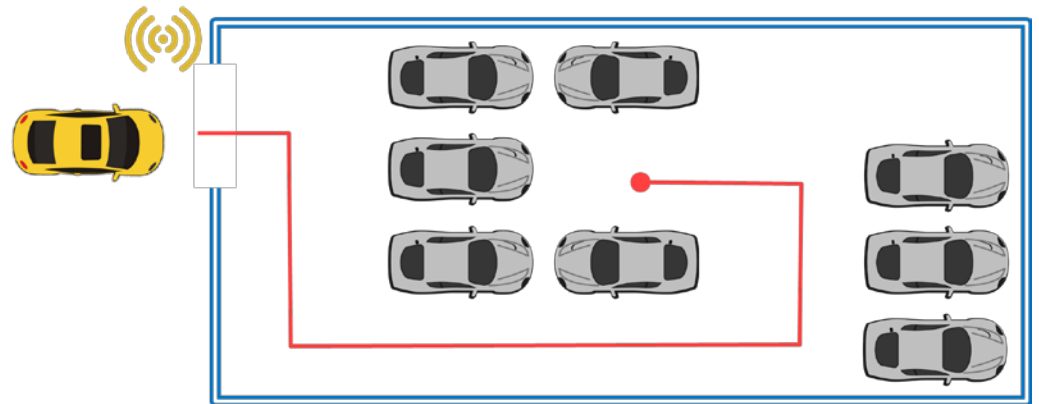


SMART CITY APPLICATIONS

CLOSING WORDS



Pollution alert service



Car Arrival

Routing to closest available parking space



GEOSMART CITIES

FINDINGS AND CONCLUSIONS

- Propose the adoption of event processing in the analysis of spatiotemporal data for smart city applications.
- Application development faces conceptual (efficiency, productivity and quality of live.) and technological (management, real-time processing and big data analytics) challenges.
- The application workflow addresses the technological challenges.
- Application cases and concepts are examples of how conceptual challenges can be overcome.
- SensorThings API offers limited functionality to manage mobile sensor data.
- WSO2 CEP engine offers only basic geoprocessing operations.
- Current work: implementation and testing of a system prototype.
Challenge: provide a language for the formalization of event.
- Future work: applications proof of concept.

Exploiting spatiotemporal data for smart city applications

Garcia, M., & Morales, J. (2015). GeoSmart Cities: Event-driven geoprocessing as enabler of smart cities. In *Proceedings of the First IEEE International Smart Cities Conference*. Guadalajara, Mexico.

email: m.g.garciaalvarez@utwente.nl

Visit: gip.itc.nl/resources/magarcia

