November 29, 2017
Eindhoven

CROWD INSIGHTS

EIT Digital Innovation Day

Weaving the Web of People and Things for Intelligent Cities

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kpn

FLUXEDO

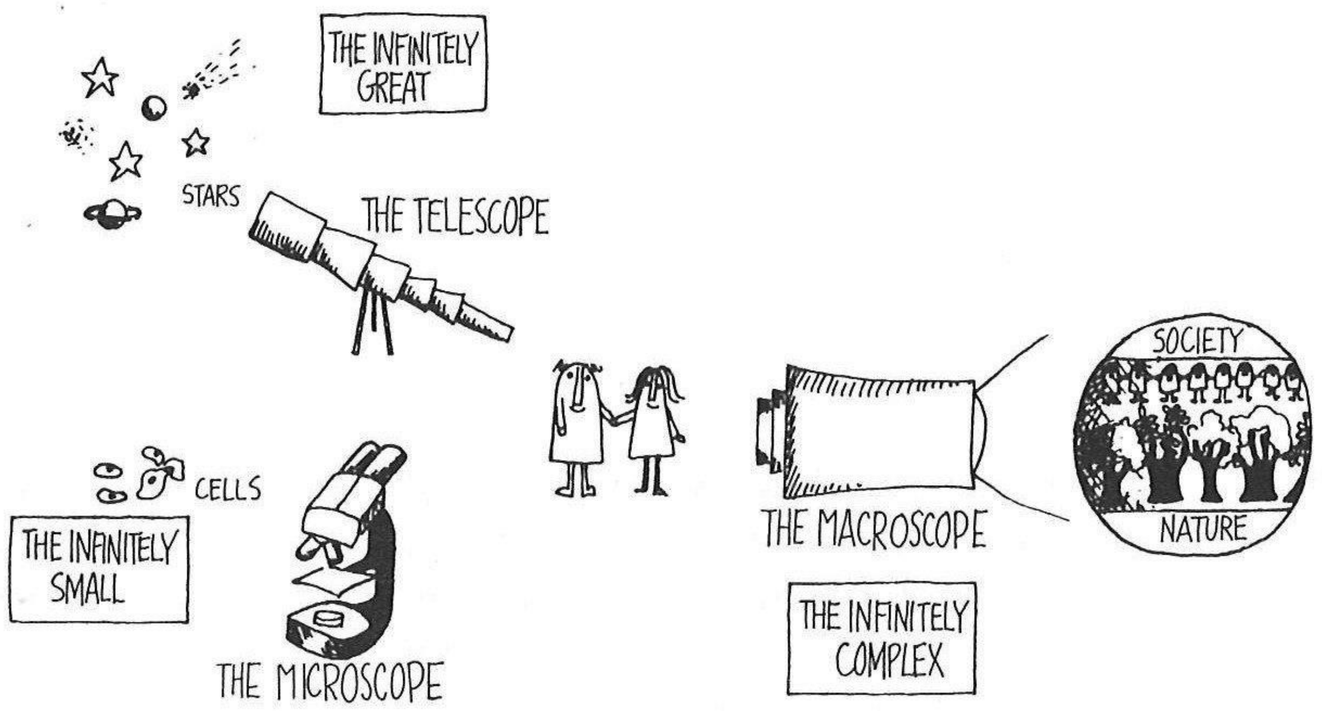
Politecnico Milano 1863

TIM

Fondazione Bruno Kessler

The cost of Knowledge search

- Knowledge gaps can be expensive to fill in
- Especially knowledge about the real world
- Especially for complex systems like cities



"The Macroscope" by Joël de Rosnay. 1979, Harper & Row, (New York)

Geo-social data

Sources of geo-social data

- Census
- GPS
- Geo-portals
- Spatial data infrastructures
- Cell phones
- IoT sensing devices
- Location-based social networks (e.g. Foursquare)
- Geo-enabled social media (e.g. Twitter, Instagram etc.)
- Geo-enabled human computation

Geo-social data

The past

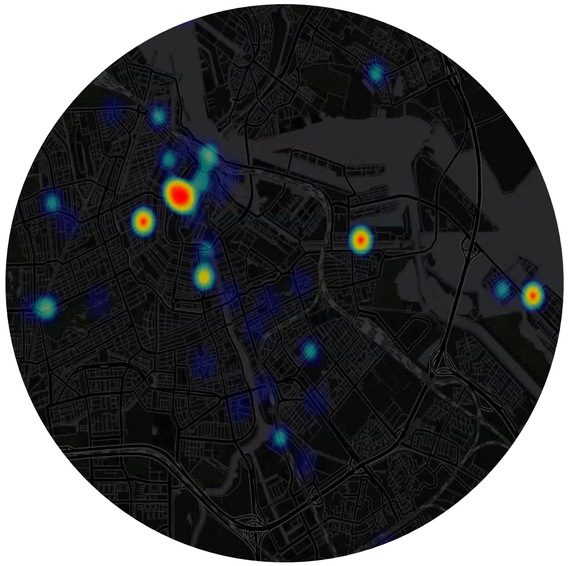
- Data scarcity
- Limited official resources (e.g. censuses, surveys)
- Large volumes, yet infrequently updated
- Limited storage and processing

- [+] Structured datasets

Geo-social data

…and the present

- Data richness
- Variety of sources
- Near real-time updates
- Abundant storage and processing



- [–] Spontaneous unstructured datasets
- [+] Crowdsourced (structured) datasets

Need for an update to the methodological toolbox

Geo-social Data

	Social Urban Data	Sensor & Mobile Phone Data	Social Web Data
	Census Records, Demographics, Spatial Statistics, Economic Data, Real-Estate Data etc.	Physical Sensor Data, Mobile Phone Logs (CDRs), Transport Data, Energy Data etc.	Geo-localized Social Media Data from web platforms (e.g. Twitter, Instagram, Sina Weiboo 4SQ etc.)
+	High data quality High levels of accuracy, completeness, and validity Generally truthful Semantic-by-design	High levels of accuracy High spatio-temporal resolution High technology penetration Generally truthful Scalable & dynamic	High speed & refresh rate Created by people Enriched with annotations about places and human activities Scalable
−	Low refresh rate Costly & laborious collection methods Non-scalable Limited or no temporal variability (static, semi-static)	Mostly proprietary Very expensive to acquire (CDRs) Very expensive to deploy at the city-scale No semantics	Mismatch between the platform's scope and the application domain "Noisy" Biased (tech, social) Generally untrustworthy

New methods & tools

An updated toolbox needs to **capitalise on…**

- High spatial & temporal resolution
- Ease of access (e.g. through APIs)
- Multiple information layers (e.g. spatial, temporal, social etc.)

New methods & tools

… and **tackle …**

- Biases (representational, contextual, functional etc.)
- Complexity, diversity & multidimensionality
- Very large volumes

How?

Human Computation

Machine Learning

Distributed Computing

SMART CITY actors are willing to understand, predict & control CROWD DYNAMICS

SMART is having the right questions…

WHEN do people come in the city? How long they stay?

When do they leave? **WHERE** they move around?

WHY? and **HOW MANY** are their?

Are their citizens / visitors, of **WHICH TYPE?**

…and know how to ANSWER

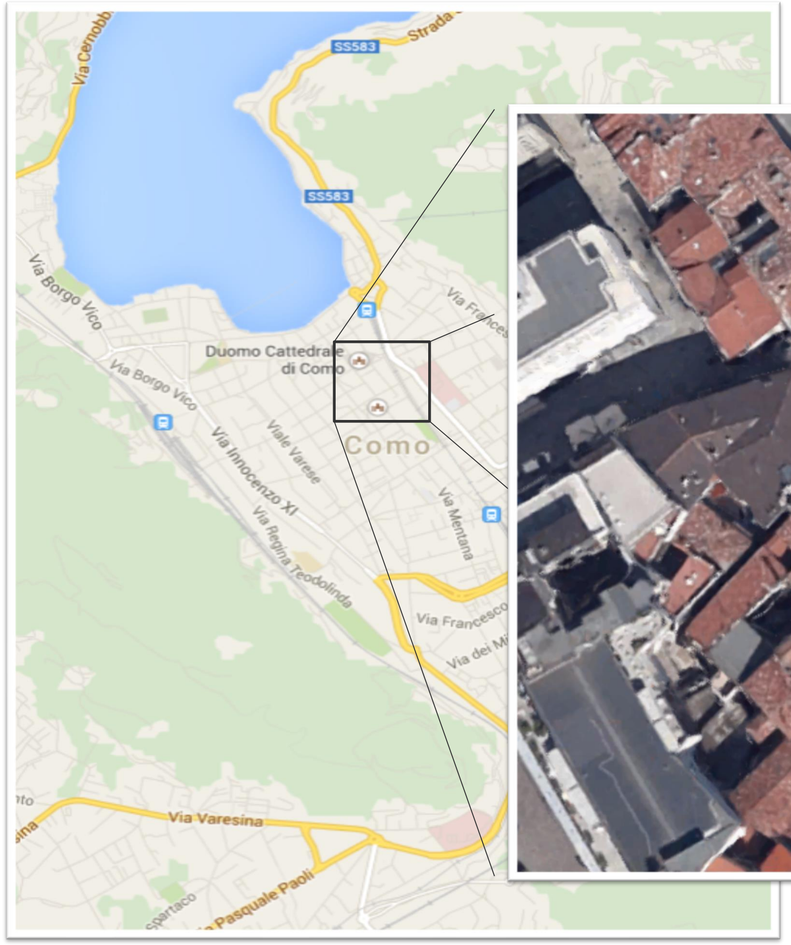
CrowdInsights actively **MONITORS**
URBAN ENVIRONMENTS

Detects the **COMPOSITION, DYNAMICS** and potential
INTENTIONS / INTERESTS of CROWDS.

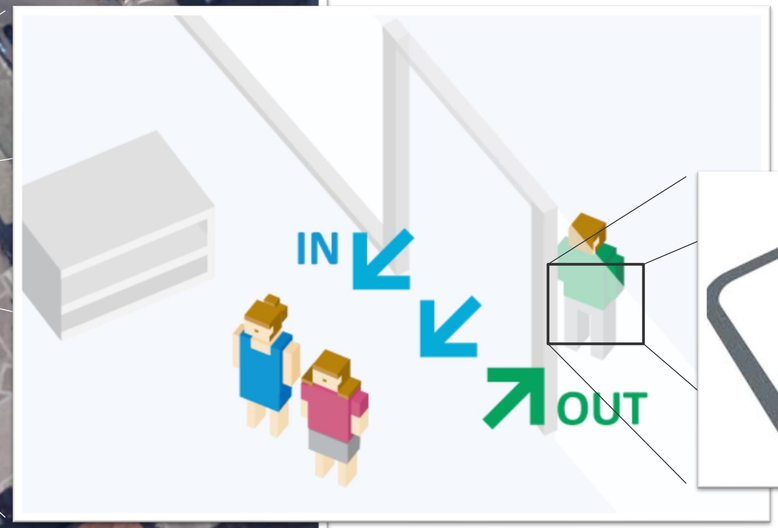
It provides data **ANALYTICS** and actionable **INSIGHTS**
on city dynamics on a **MULTI-SCALE PERSPECTIVE**
(from city scale to single streets squares scale, down to citizens scale).

Combines multi-scales technologies

City (Big Data)

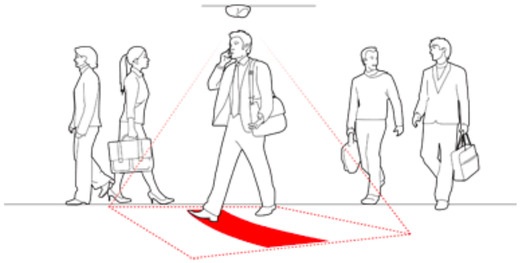


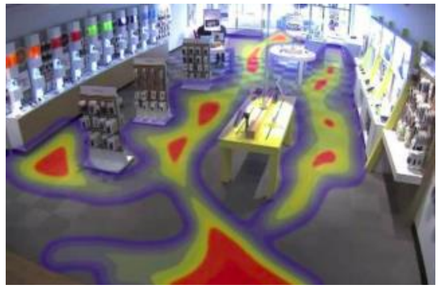
Square/Street (IoT)

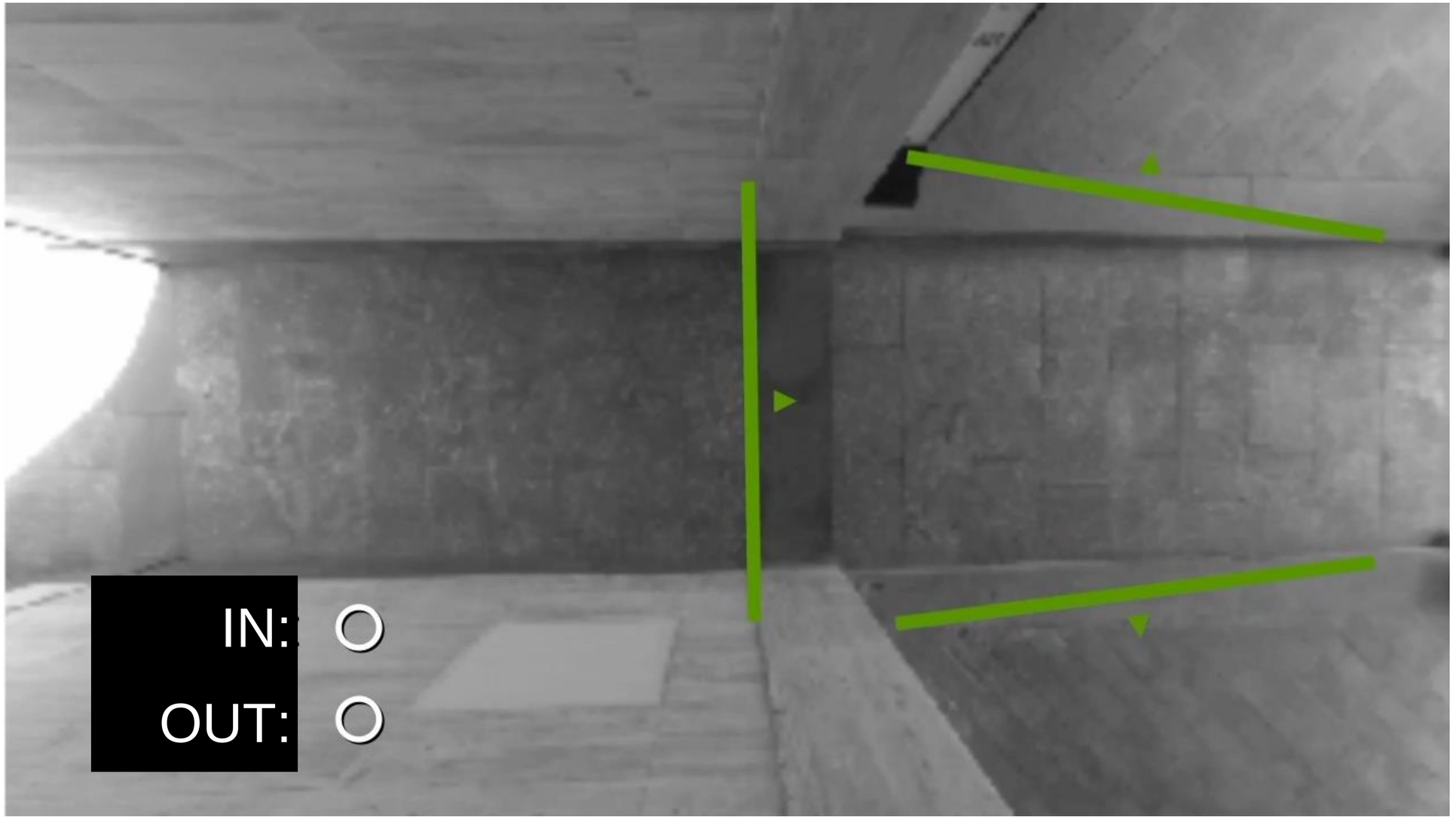


Citizens & POI (Apps & Social Media)

CrowdInsights: IoT / 1

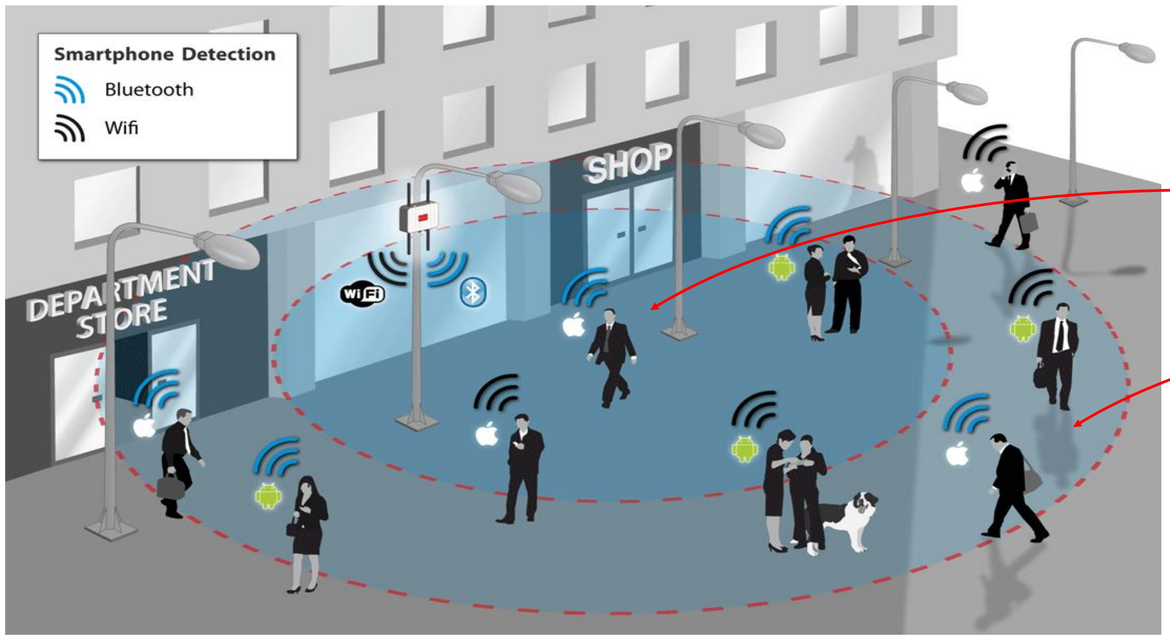


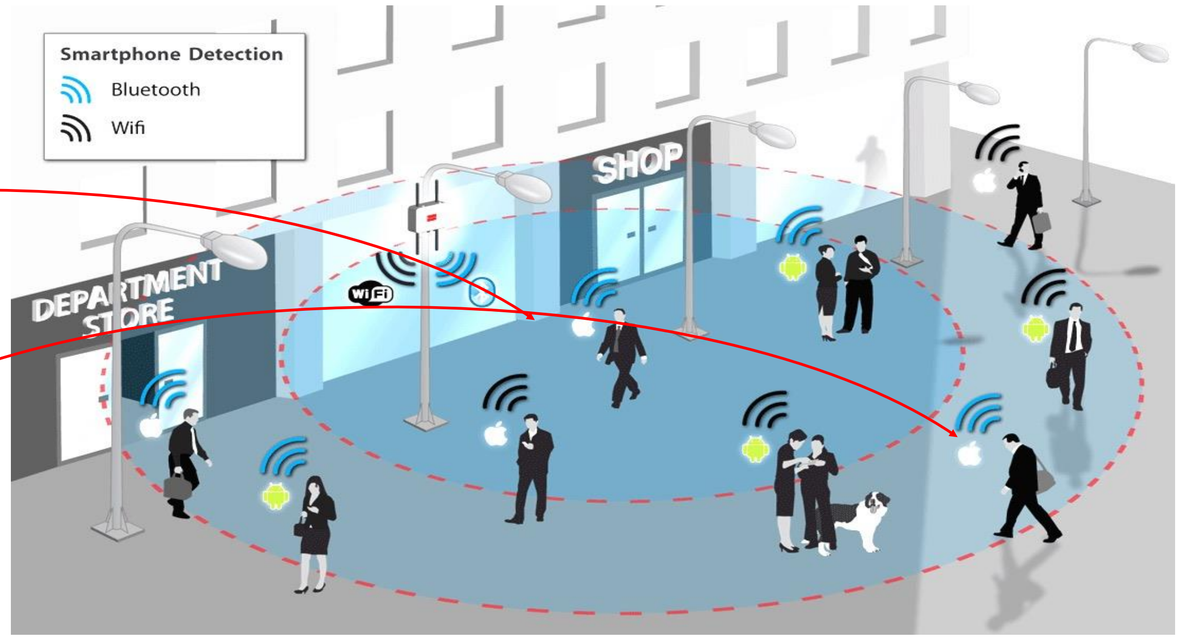




Attribution: Fluxedo S.r.l.

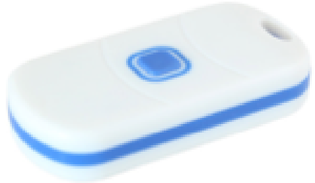
CrowdInsights: IoT / 2

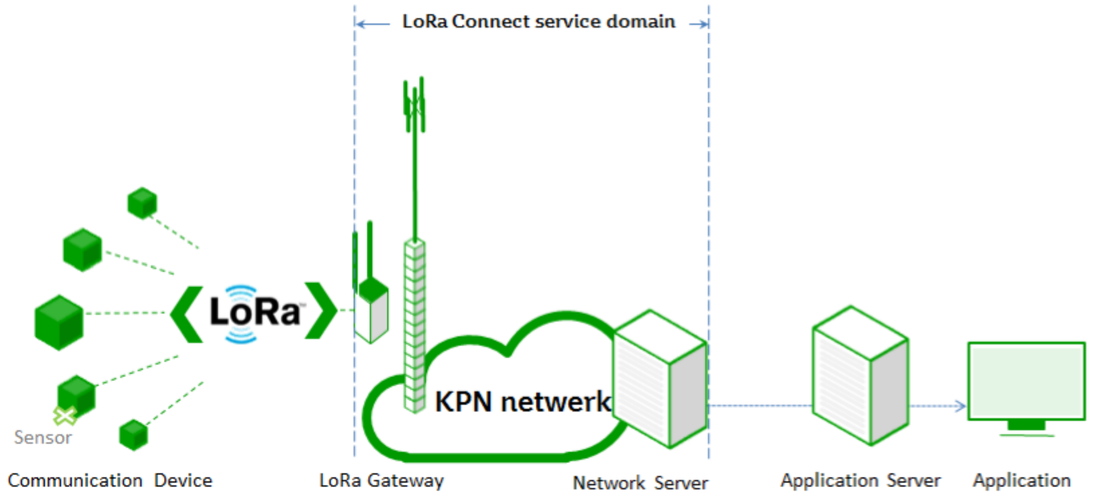




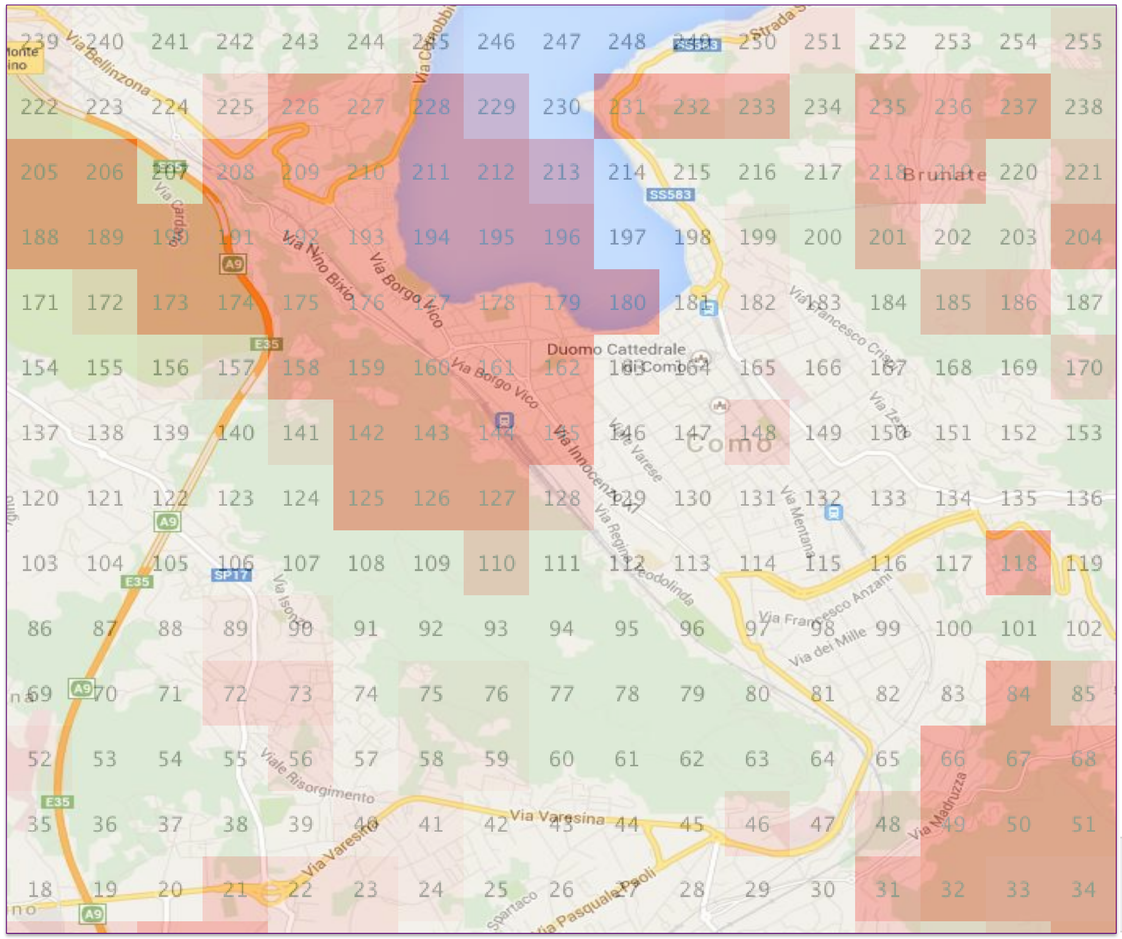
CrowdInsights : IoT / 3

- Low Power Long Range (LoRa) network for IoT
- Based on LPWAN protocol, supplements existing 2G, 3G and 4G networks
- Interfaced with KPN Nationwide LoRa network for Internet of Things (IoT) applications

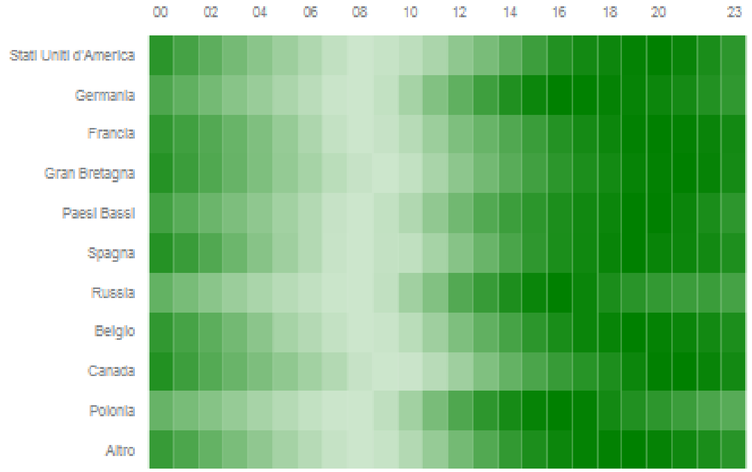




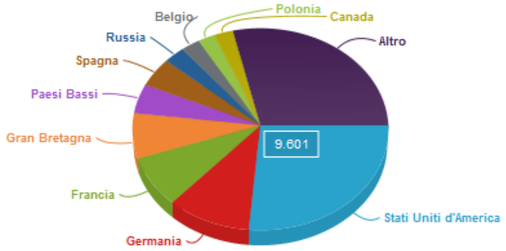
Big Data: City / Area Level



Heatmap Oraria



Top Nazioni



Media giornaliera

	FERIALI	PREFESTIVI	FESTIVI
	35.445	38.160	37.398
Stati Uniti d'America	9.399	9.961	10.000
Germania	3.509	3.810	3.977
Francia	2.897	3.175	3.051
Gran Bretagna	2.568	2.649	2.557
Paesi Bassi	1.800	1.720	1.710
Spagna	1.569	2.063	1.910
Russia	999	943	941
Belgio	892	939	861
Polonia	842	874	851
Canada	780	895	969
Altro	10.190	11.131	10.571

Fasce orarie

Totale Presenze Stimate

124.516

MAX 149.806

MIN 99.189

Estimation of **Presences, Proveniences and Demographics** from telco data aggregation

IoT: Street / Square Level

3D video-cam IOTs – or – LoRa Sensors

People counting & trajectories using commercial, privacy-preserving **IoT sensors** (distinguishing people/directions)

Social Media: Citizens Level

SOCIAL LISTENER POWERED BY Fluxedo - WEB VERSION: FLUXEDO.COM/COMO247

DATI SOCIAL

350906

TOTALE POST ANALIZZATI

147111

TWEET ANALIZZATI

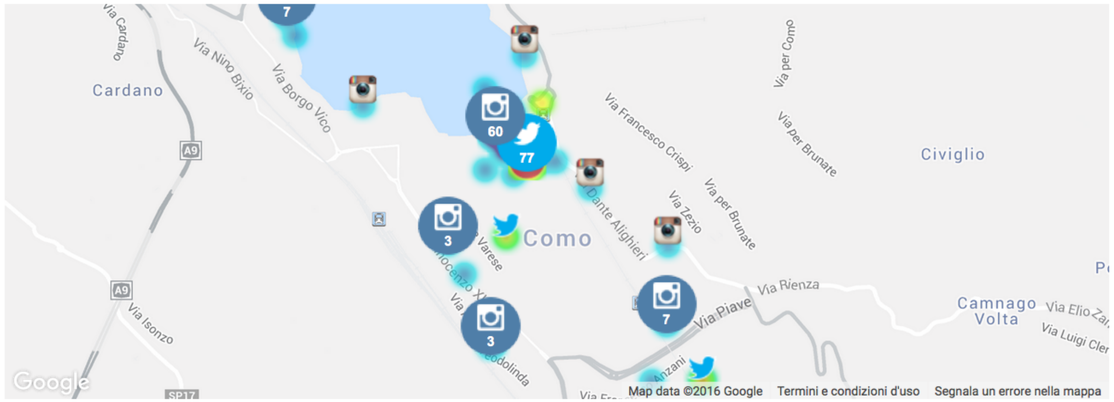
203795

FOTO INSTAGRAM ANALIZZATE

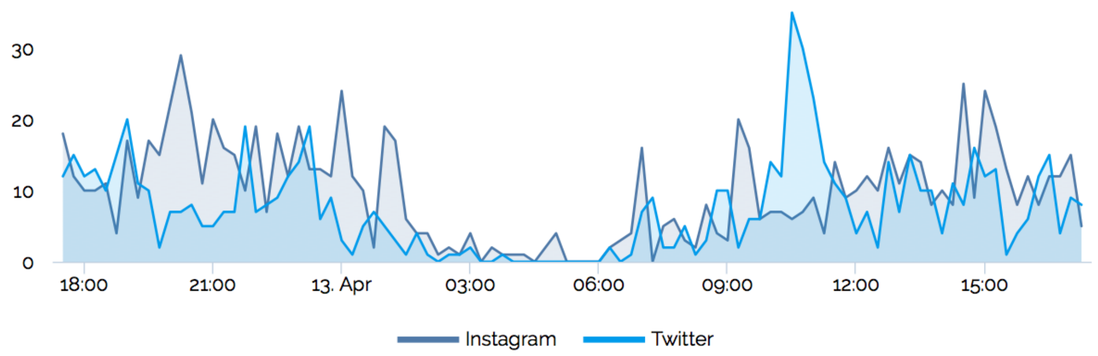
TOP USERS

@ZORAIDANUGUID	ISIGSHOPCOMO	@QTIMENEWS	@MARILENALUALDI	CENTRO_STUDI_CASNATI
13	8	5	4	4

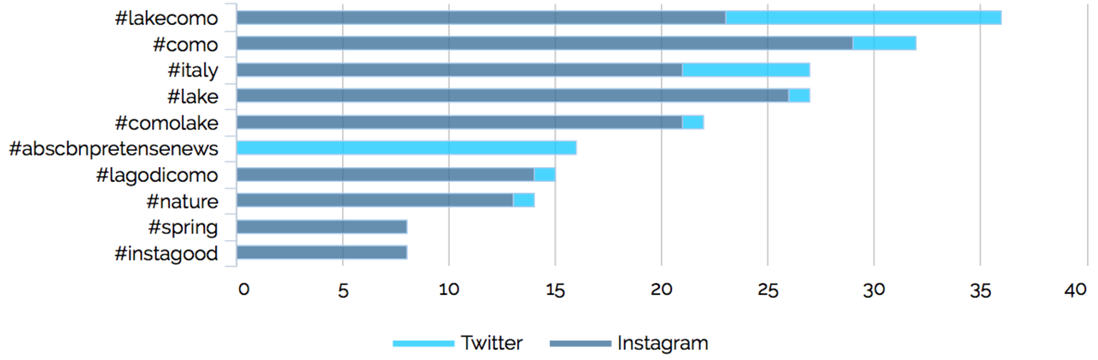
COMO HEATMAP



AREA CHART



TOP HASHTAGS



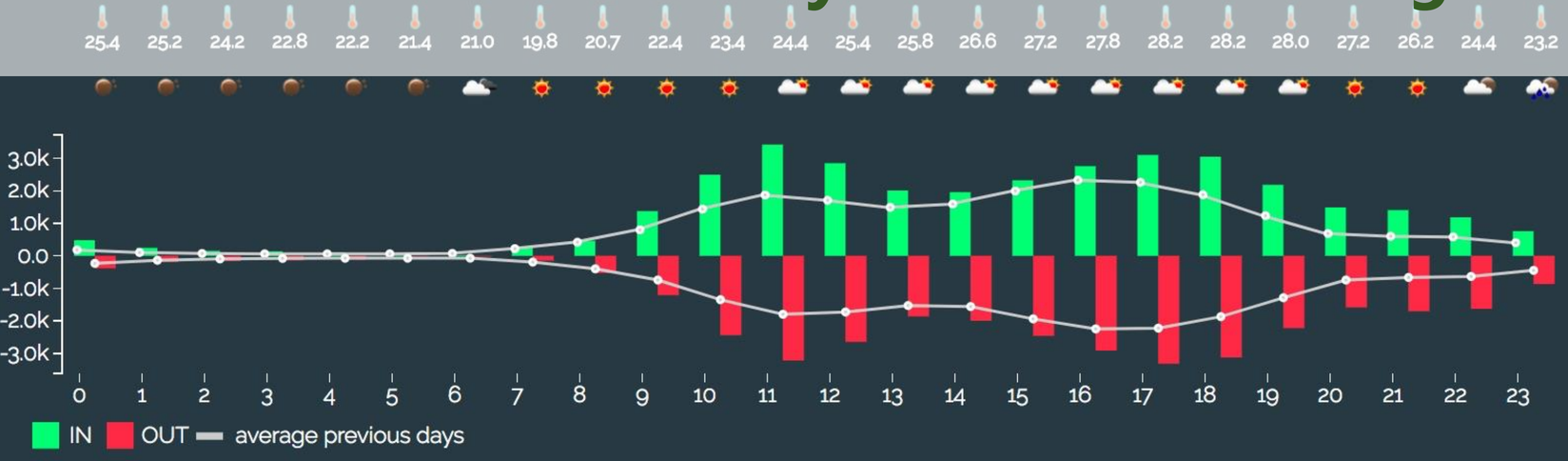
People interest, intentions, preferences, demographics and influencers… from Social Media analytics

Como

Today 950 people
shared 1120 posts
(187 tweet & 933 instagram)
that 35502 people liked

Today 34231 people
entered in the
Duomo Square of Como

- Urban Planning
- Tourism and stable city events monitoring



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Milan – Piccolo Teatro

- Monitoring of topics & locations on Social Media
- IoT monitoring of public space in the city (cloister)

Bassano del Grappa

- City Marketing for Tourism & Culture
- Urban planning to support Commerce in city

Amsterdam – King’s Day

- **Large Events monitoring**
- **Monitor & Control Safety (WiFi + Cam)**

Amsterdam – Europride

- **Large Events monitoring & Social Media analysis**
- **Monitor & Control Safety (LoRa)**

AMSTERDAM INSTITUTE FOR
ADVANCED METROPOLITAN SOLUTIONS

ENGINEERING THE FUTURE CITY.

AMS Institute [eɪ - ɛm – ɛs] is a scientific institute located in Amsterdam. In this institute science, education, government, business partners and societal organizations are working tightly together to create advanced solutions for the complex challenges a metropolitan region like Amsterdam is facing. Now and in the future.

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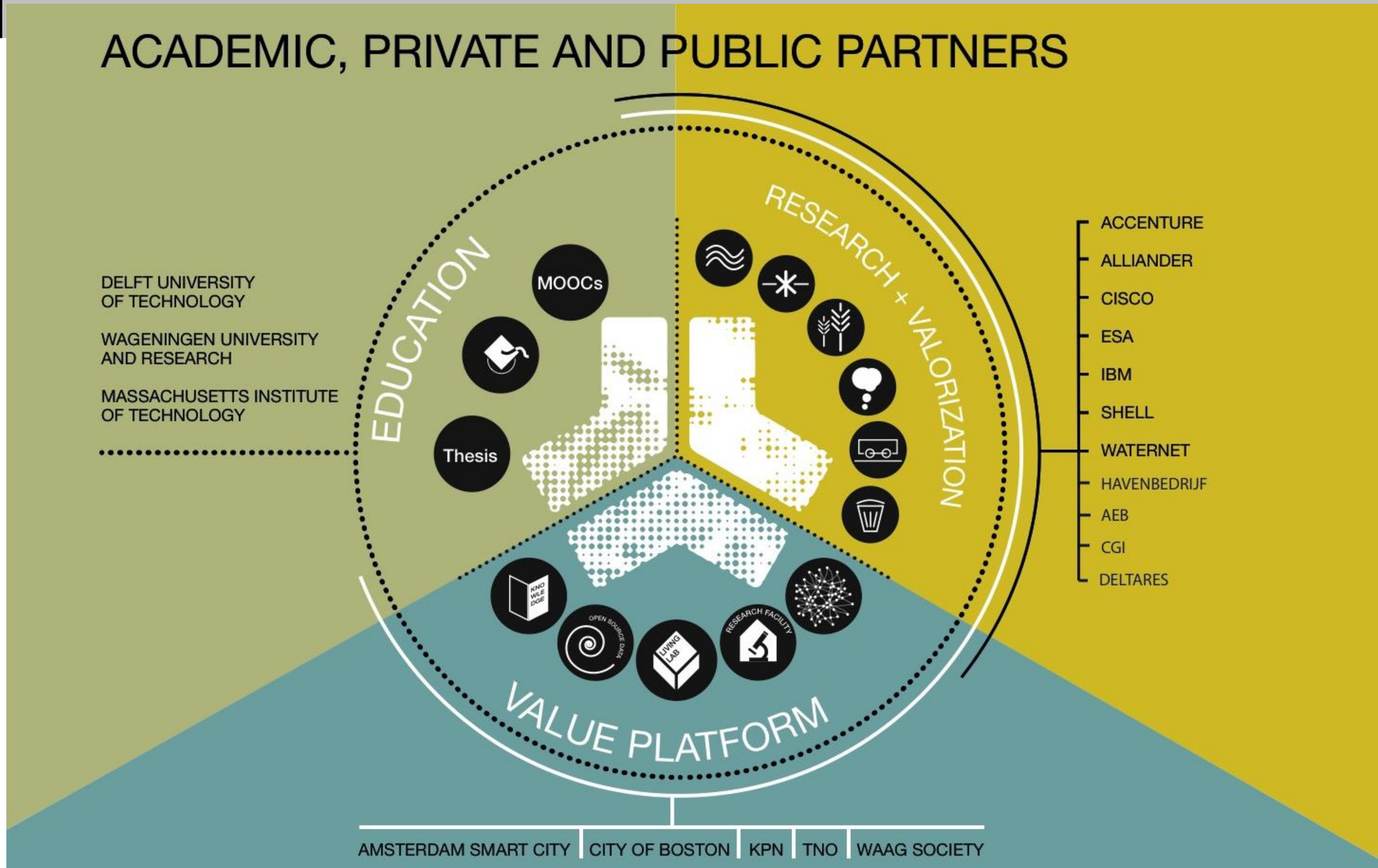
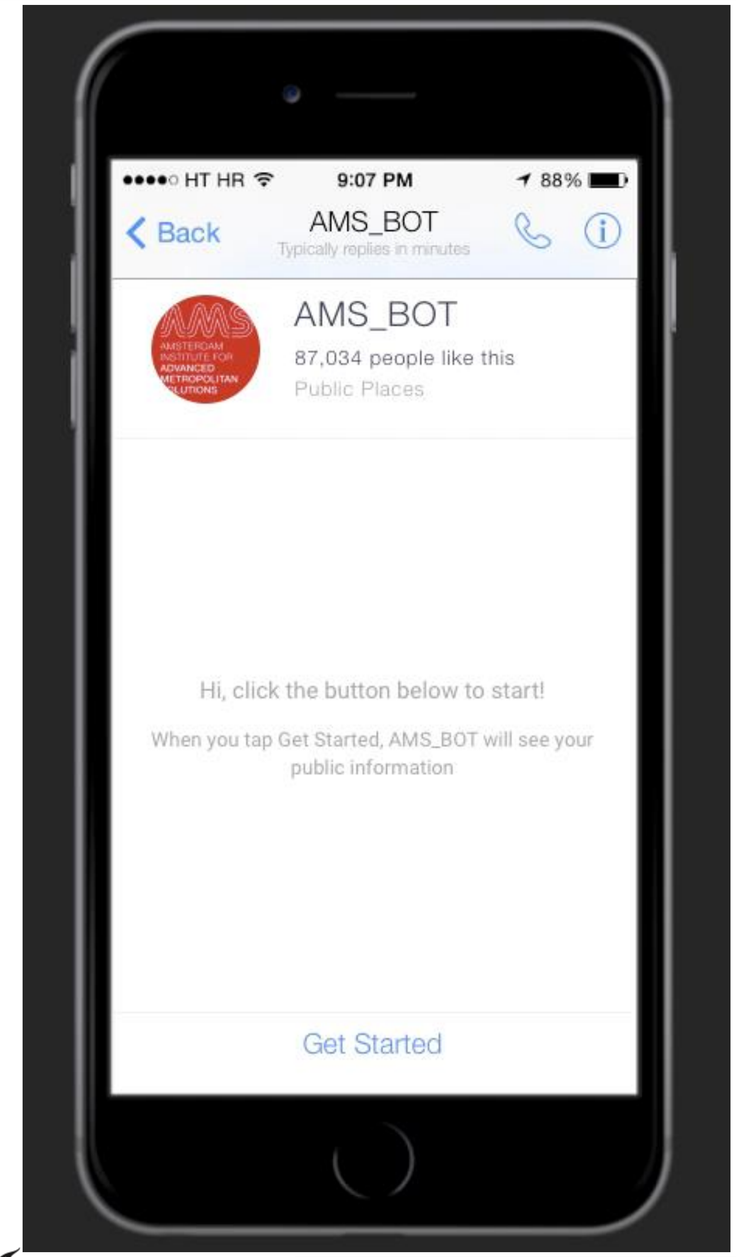


Chatbot with Human in the Loop

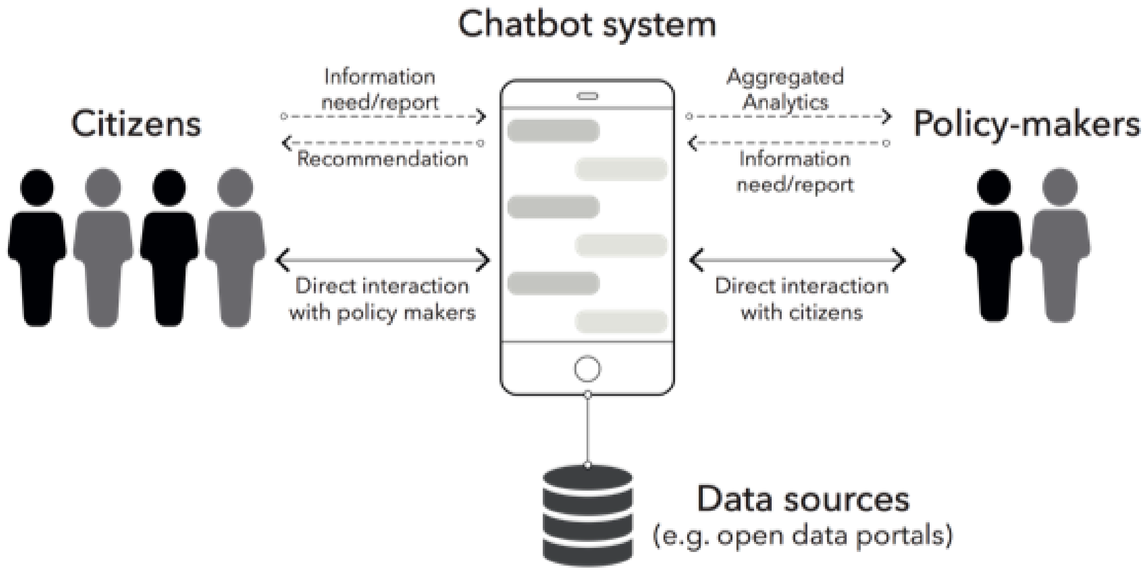


Why chatbots?

- No friction
- Universal interaction interface
- Support for different typed of needs
  - Conversational
  - Informational
  - Transactional

Why humans in the loop?

- Training
- Coping with uncertainty and lack of data
- Understanding
- Activate & Engage



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