

Making Cities Smarter: Integrating Official Statistics, Geo- Information, Big Data for Better Policies



Professor Paul Cheung

Professor, National University of Singapore

Consultant, Myanmar National Statistical Development Strategy

Former Director, United Nations Statistics Division

16 May 2016

Data and the City

- Cities are becoming aware that data, and the infrastructure to analyze them, will eventually become as important to the citizens' welfare as the power grid and the transport system.
- Information is typically kept at databases; making these work together is crucially important but difficult.

Boston City Score

LEGEND

- < 1 (FOLLOW UP)
- = 1 (MAINTAINING)
- > 1 (EXCEEDING)

CITY SCORE

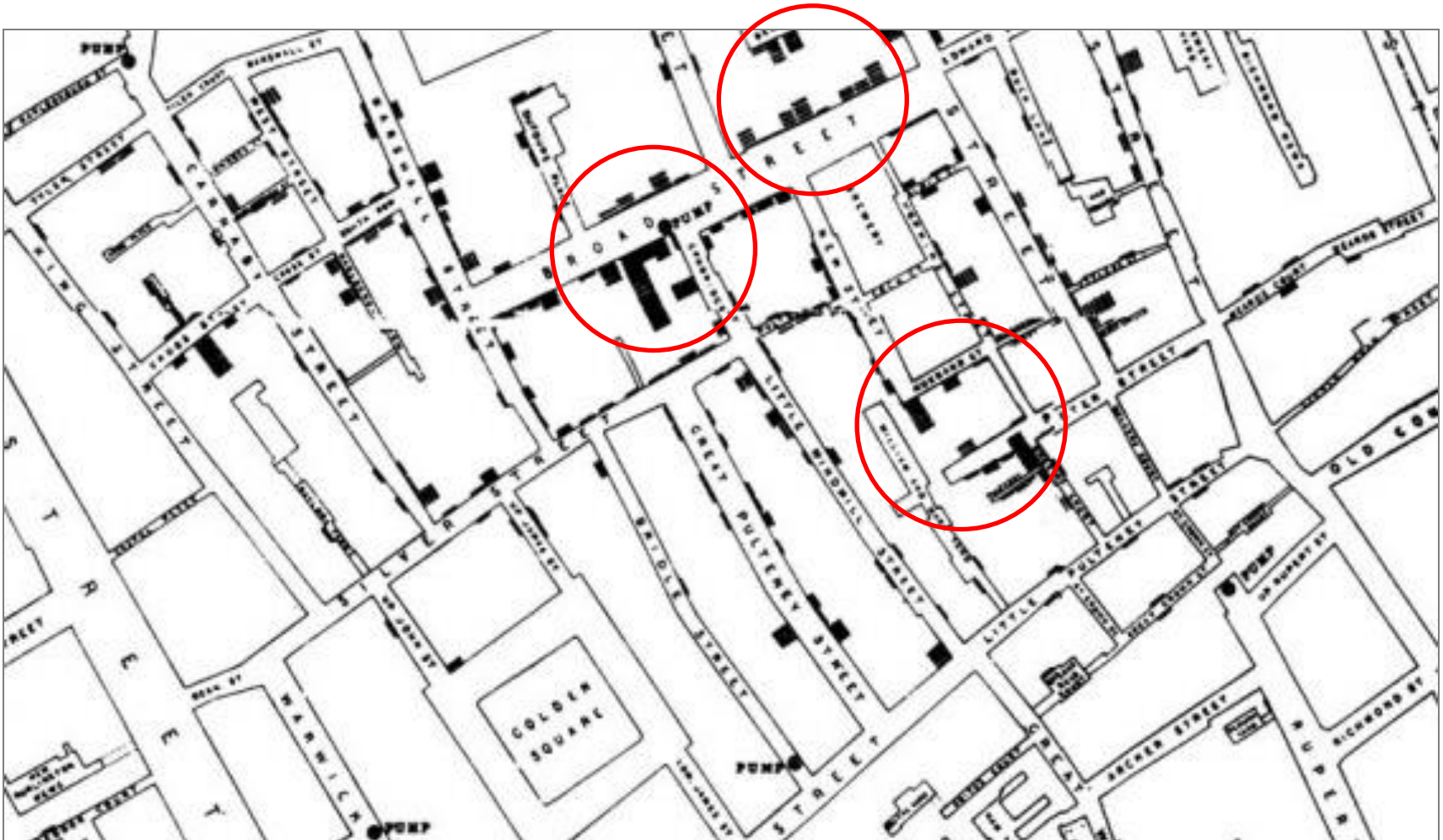
LAST UPDATED
5/13/2016



MAYOR MARTIN J. WALSH

	DAY	WEEK	MONTH	QUARTER
PART I CRIMES	1.94	1.53	1.40	1.36
SHOOTINGS (TREND)	1.87	2.18	2.55	3.19
LIBRARY USERS	1.42	1.49	1.43	1.58
POTHOLE ON-TIME %	1.25	0.97	0.96	0.95
SIGNAL REPAIR ON-TIME %	1.25	1.16	1.03	1.01
TREE MAINTENANCE ON-TIME %	1.25	1.17	1.22	1.18
MISSED TRASH ON-TIME %	1.22	1.23	1.22	1.23
ON-TIME PERMIT REVIEWS	1.17	1.24	1.12	1.13
PARKS MAINTENANCE ON-TIME %	1.00	1.04	0.88	0.88
EMS INCIDENTS	0.98	1.02	1.06	1.06
GRAFFITI ON-TIME %	0.98	1.15	1.10	1.15
311 CALL CENTER PERFORMANCE	0.98	0.98	0.98	0.97
EMS RESPONSE TIME	0.93	1.05	1.04	1.03
BFD INCIDENTS	0.87	1.04	1.11	1.22
BFD RESPONSE TIME	0.83	0.93	0.94	0.95
CONSTITUENT SATISFACTION SURVEYS	0.67	1.01	0.89	0.89
STREETLIGHT ON-TIME %	0.63	0.87	0.81	0.89
BPS ATTENDANCE			0.97	0.97
HOMICIDES (TREND)			10.86	5.60
SIGN INSTALLATION ON-TIME %		1.00	0.99	1.10
STABBINGS (TREND)		2.72	1.99	1.84
	1.13	1.25	1.64	1.44

Dr Snow's Broad Street Analysis (1854)



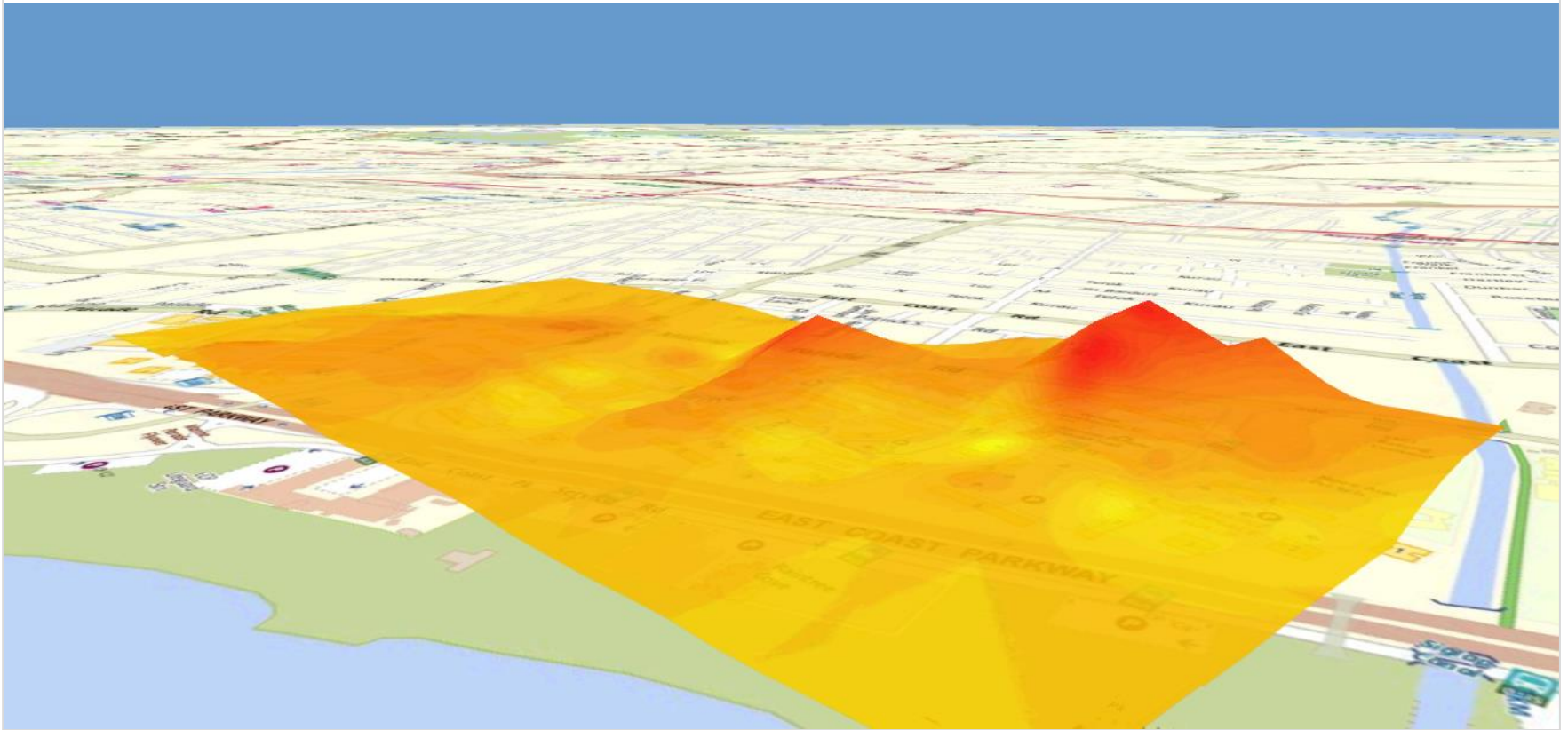
Source: <http://blogs.plos.org/publichealth/2013/03/11/john-snow-the-first-epidemiologist/>

Cat Tracking in Smart Cities



Community Analytics for Community Services

Heat Map for Planning of Elderly Services



New Elements of Policy Architecture

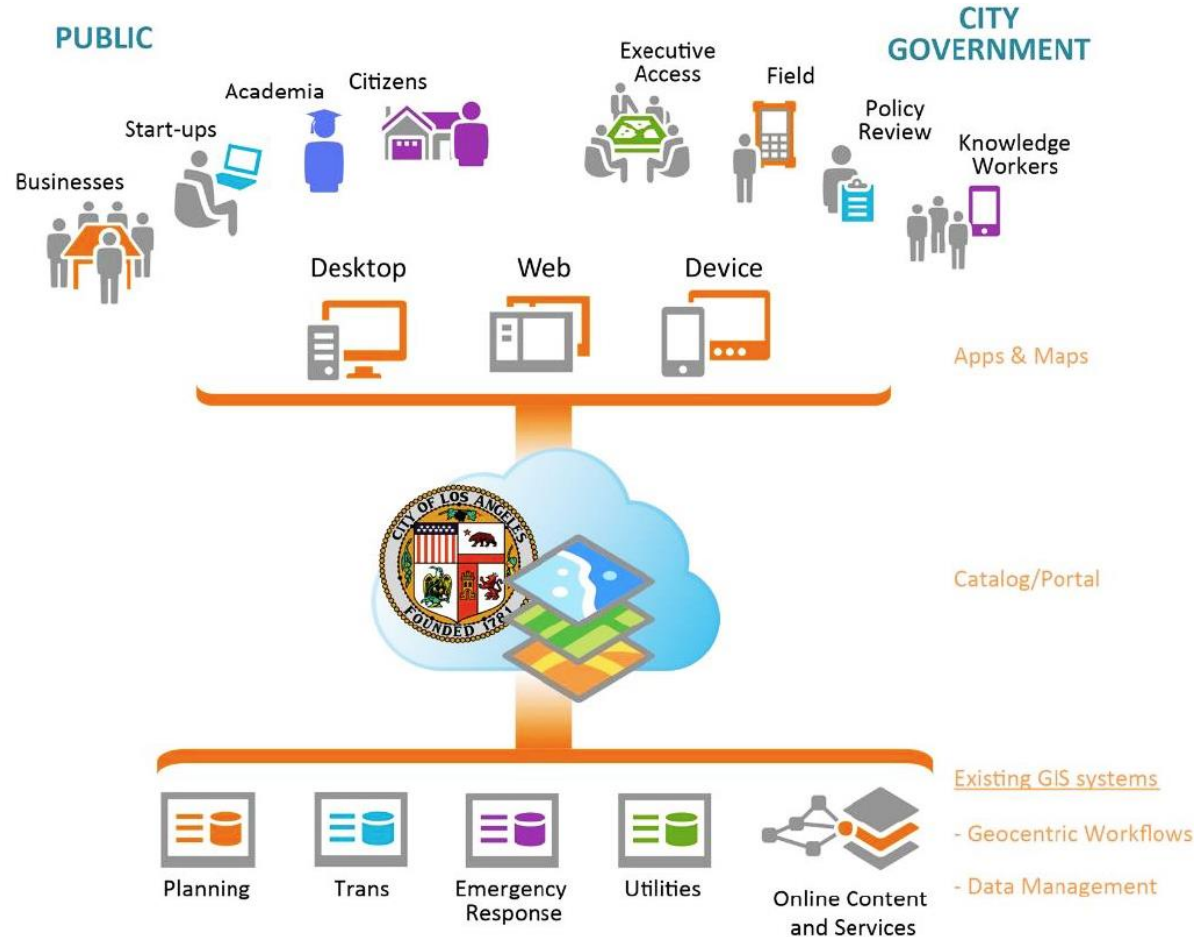
Process Integration

- Integration of back-end processes across domains
- Whole-of-Government Approach
- Deploy advanced planning tools: gaming, large-scale simulation

New Information Paradigm

- Sharing and integration of Information
- Forward service planning at source
- In-depth understanding of etiological factors and patterns

Innovation Ecosystem for Los Angeles



EC Smart Cities Initiative

European Innovation Partnership **Smart Cities & Communities**
Invitation for Commitments

Open Data

Business Models

Policy & Regulation

Energy Efficiency & Low Carbon Solutions

Finance & Procurement

Urban Mobility

Integrated Energy Networks

1 Smart Cities and Community a European Innovation Partnership

How to make our cities smarter?

The Partnership integrates the **ICT**, **energy** and **transport** sectors. It aims to apply innovative solutions to tackle issues such as **congestion**; **air pollution**; **high energy costs** and to achieve **better mobility**; **cleaner urban environment**; **energy efficiency**.



congestion



air pollution



high energy costs



better mobility

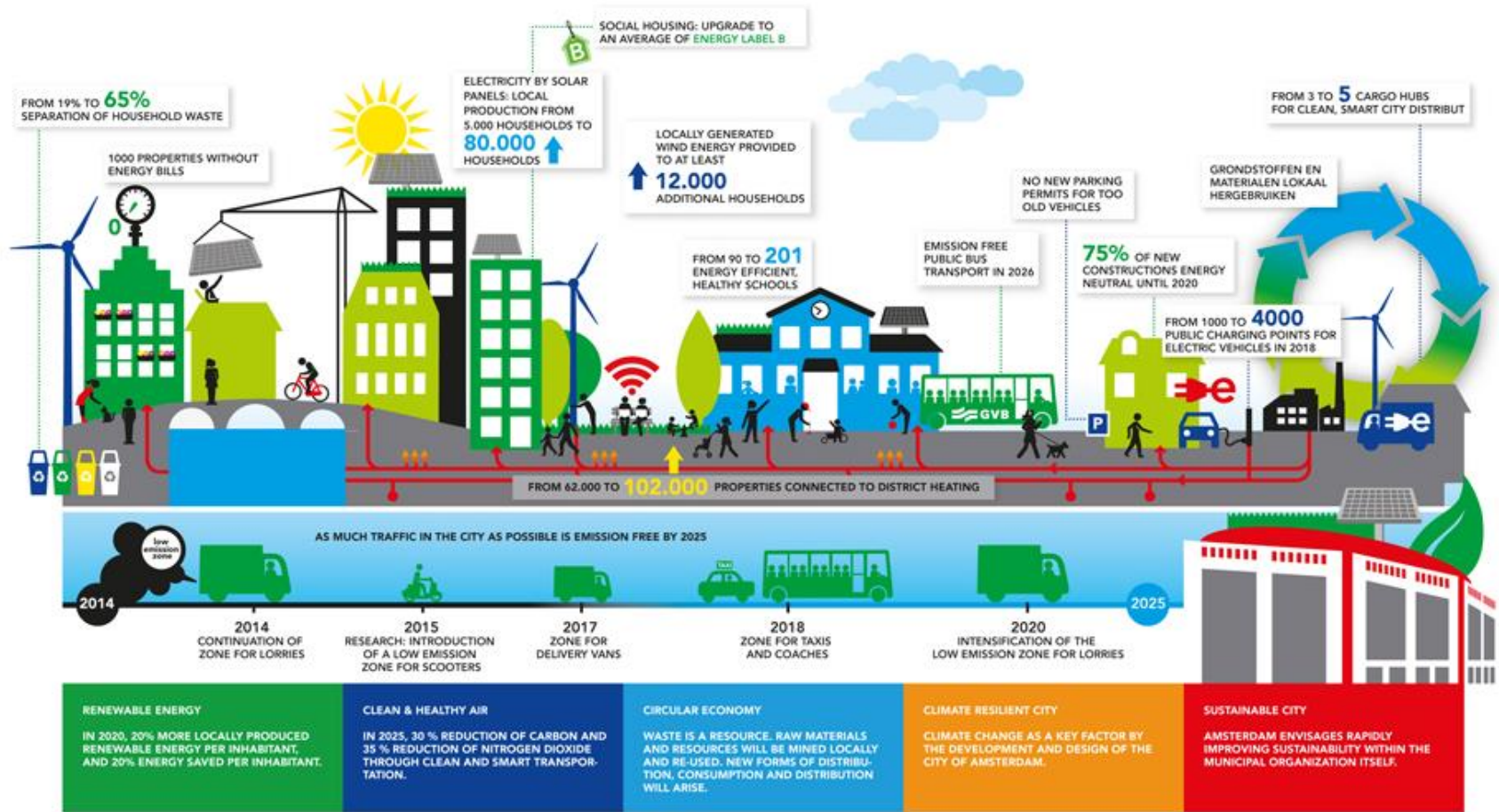


cleaner urban environment

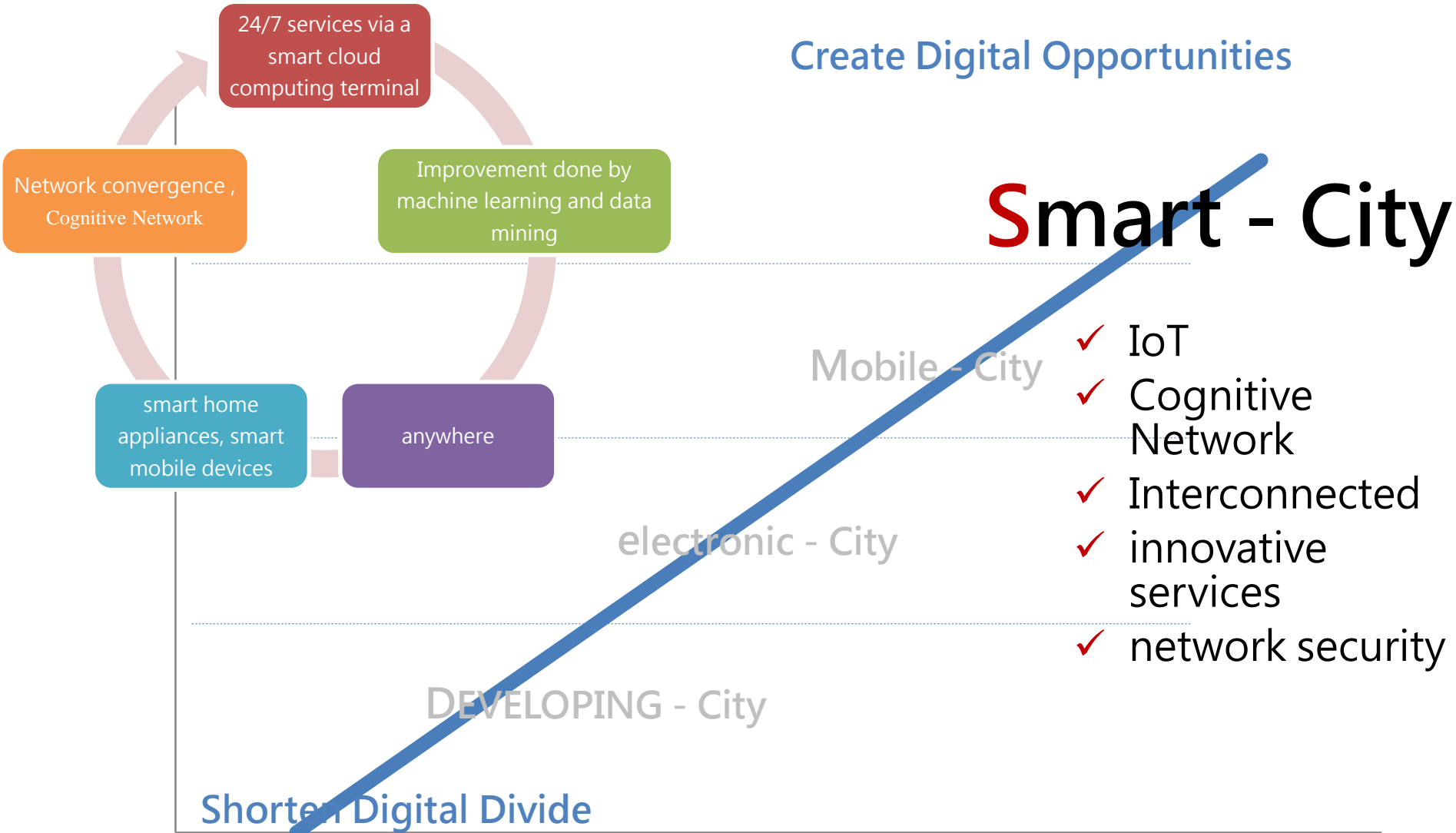


energy efficiency

Amsterdam Smart City



Smart Cities Development: Taiwan



Smart Singapore

Smart Singapore

Singapore is expanding its use of technology to entrench its position as a leading global city and improve Singaporeans' quality of life. Here are some upcoming initiatives:

Punggol pilot: The first "smart" housing project will be launched in Punggol next year, and will include energy-efficient measures like motion sensor lights in carparks.

Phone home: Controlling household appliances from a smart phone may be possible once HDB determines the digital infrastructure needed for an automated home. Trials start next year.



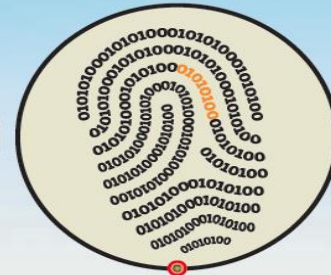
Senior sensors: Sensors in the homes of the elderly will monitor their movements and send alerts to caregivers if irregular behaviour is detected.



Virtual therapy: A "tele-rehab" system being tested at community hospitals will allow patients to perform therapy exercises at home, while sensors attached to their limbs transmit data back to the hospitals.



One ring to pay them all: An embedded chip could turn a ring, a watch or your identity card into a payment device, eliminating the need for cash or credit cards.

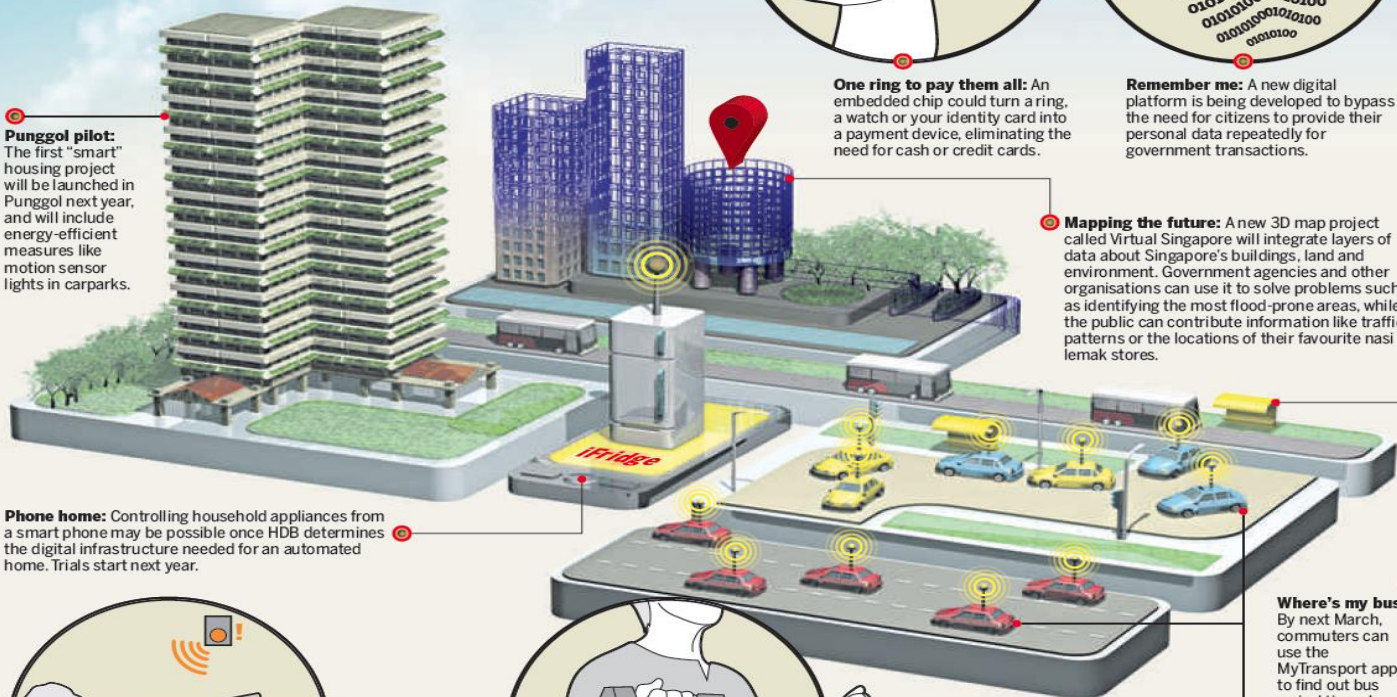


Remember me: A new digital platform is being developed to bypass the need for citizens to provide their personal data repeatedly for government transactions.

Mapping the future: A new 3D map project called Virtual Singapore will integrate layers of data about Singapore's buildings, land and environment. Government agencies and other organisations can use it to solve problems such as identifying the most flood-prone areas, while the public can contribute information like traffic patterns or the locations of their favourite nasi lemak stores.

Where's my bus: By next March, commuters can use the MyTransport app to find out bus arrival times by the minute and how crowded each bus is.

"Public" transport: Self-driving cars will be tested on public roads for the first time come January next year, in One-North at Buona Vista.



Place Policy Needs Location Information

- “Place policies target the prosperity, equity, sustainability, and livability of places – how well or how poorly they function and how they change over time”

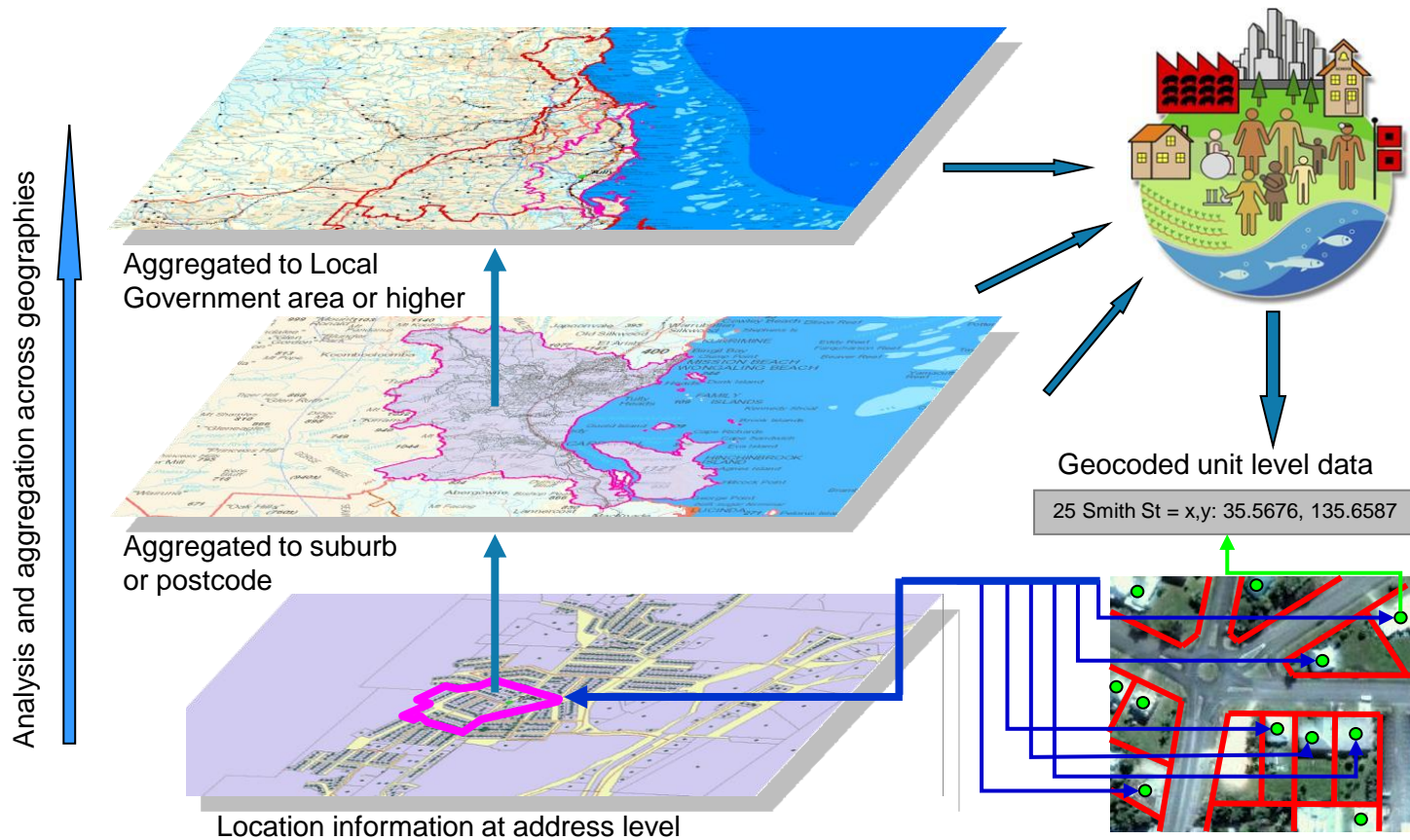
Office of Management and Budget 2009

- Place policy needs location information to measure successful outcomes.
- OMB proposes standardized performance measures and data collection

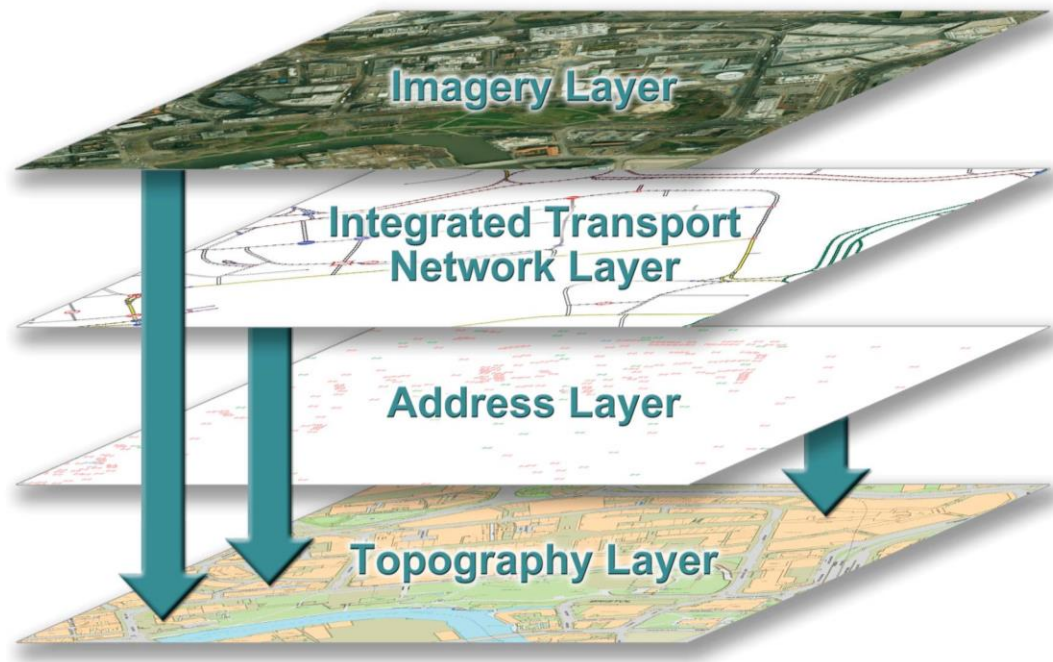
A New Era: Location as New Integrating Framework

- Rapid technological advancement overcoming security concerns, with innovative breakthroughs;
- Changing business model for the use, access and provisions of Geospatial (and related) Information;
- New business model gives rise to competition:
 - E.g. Google competes with government mapping agency;
- Data integration based on spatial framework gaining rapid pace (Location Information)

Location Information Framework



Mapping Layers; Connecting Information



Source: Ordnance Survey International

Coordinating NSDI and NSDS

- NSDI and NSDS at present two independent processes;
- NSDI sets norms for sharing spatial information;
 - Specifying the technology, policies, criteria, standards and people necessary to promote geospatial data sharing
- NSDS sets strategy for statistical development;
 - No reference to location information in NSDS
- Greater cooperation allow full implementation of Statistical Geospatial Framework

Location Analytics for Policy Innovations

- Using information to **assess**, **predict**, and **evaluate** community events, behaviors, well-being, and development, so as to mitigate negative trends and adapt to changes;
- Pool information from various sources, structured and unstructured;
- Output includes statistical indices, predictive values, maps, information portals, apps;
- Have been extensively used for disaster preparations and assessment of disaster impact, as well as security-related analysis;
- Can be easily extended to social and community services.

From Polygons to Point-Based Information: Unit of Analysis

- Points likely to complement Polygons as the organizing framework for data integration, providing location-specific Information;
- The dynamic movement from Point to Point will pull out packets of Point-of-Relevance information on a string;
- Point-based information able to facilitate the convergence of information from multiple sources for a particular location, moving away from community-level systems;
- Points identified by Geocodes or Addresses.

Hierarchical Data Structure : Location as Basic Unit of Observation

25 Smith St, Town Z x,y: 35.5676, 135.6587



Address / Geocode



Cadastral property parcels



Census Districts/Postal codes



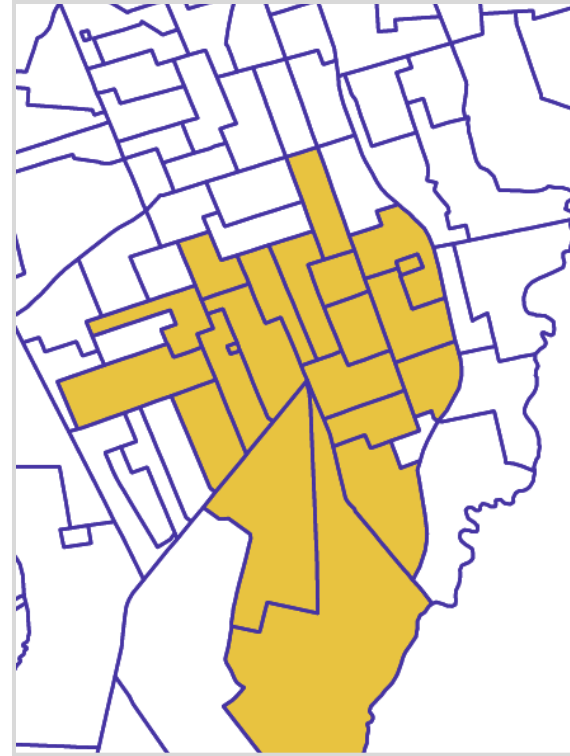
Block Face

From Polygons to Points of Relevance (POR)

Users demand increasing precision.
What is the smallest spatial unit possible??



area of interest



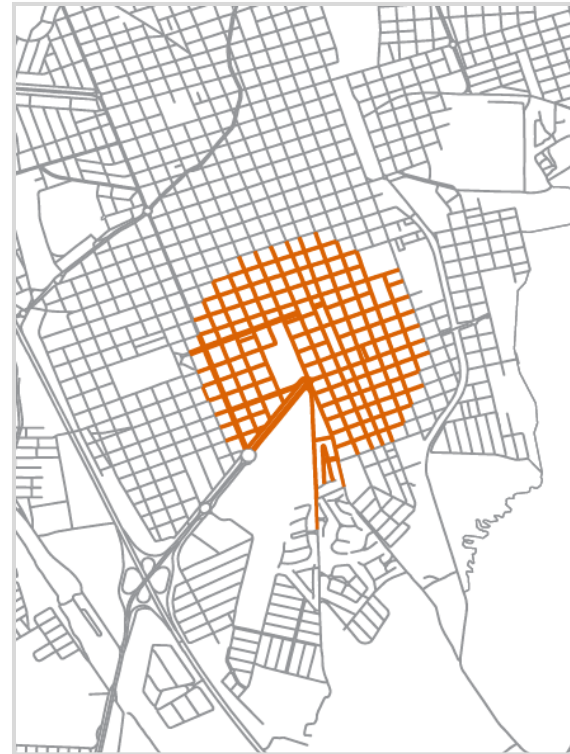
intersection result

Smaller Polygons, More Precise Data

Confidentiality the key constraint
But users demand (and will supply) POR data



area of interest

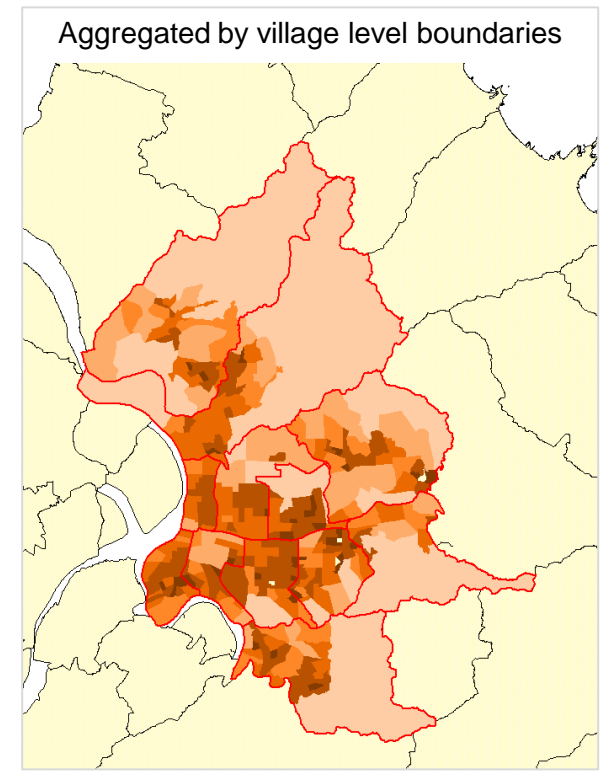
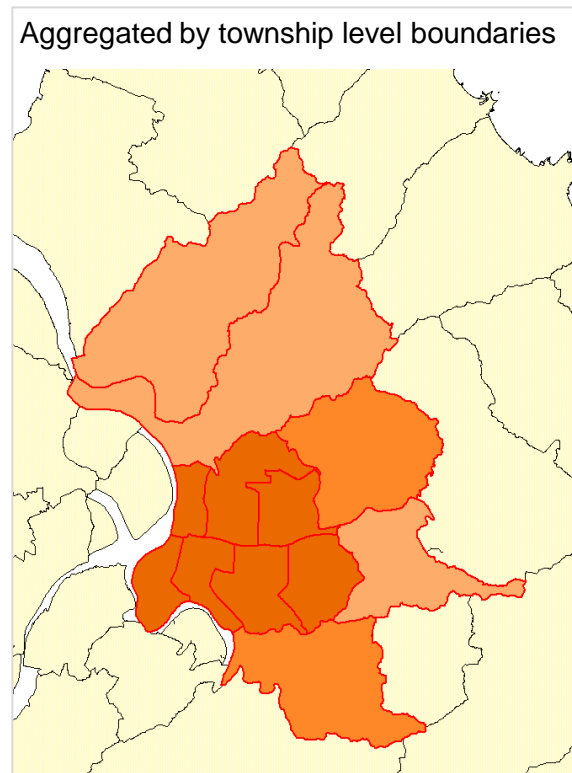
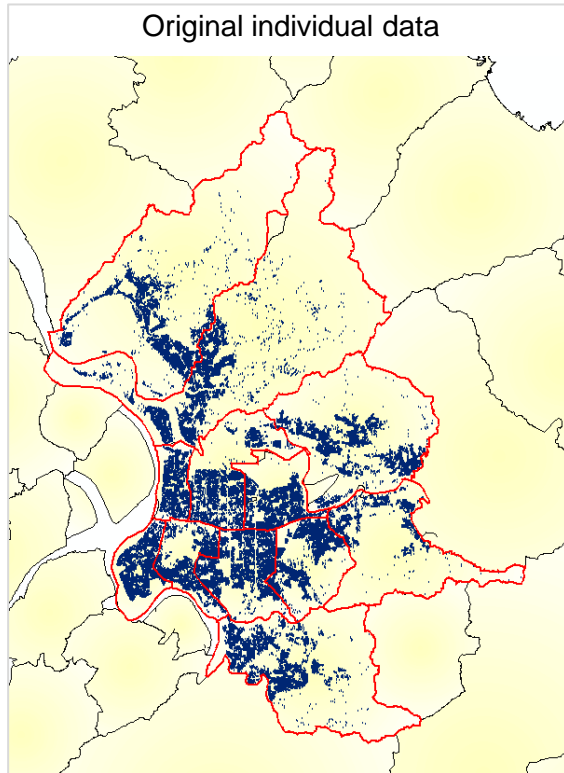


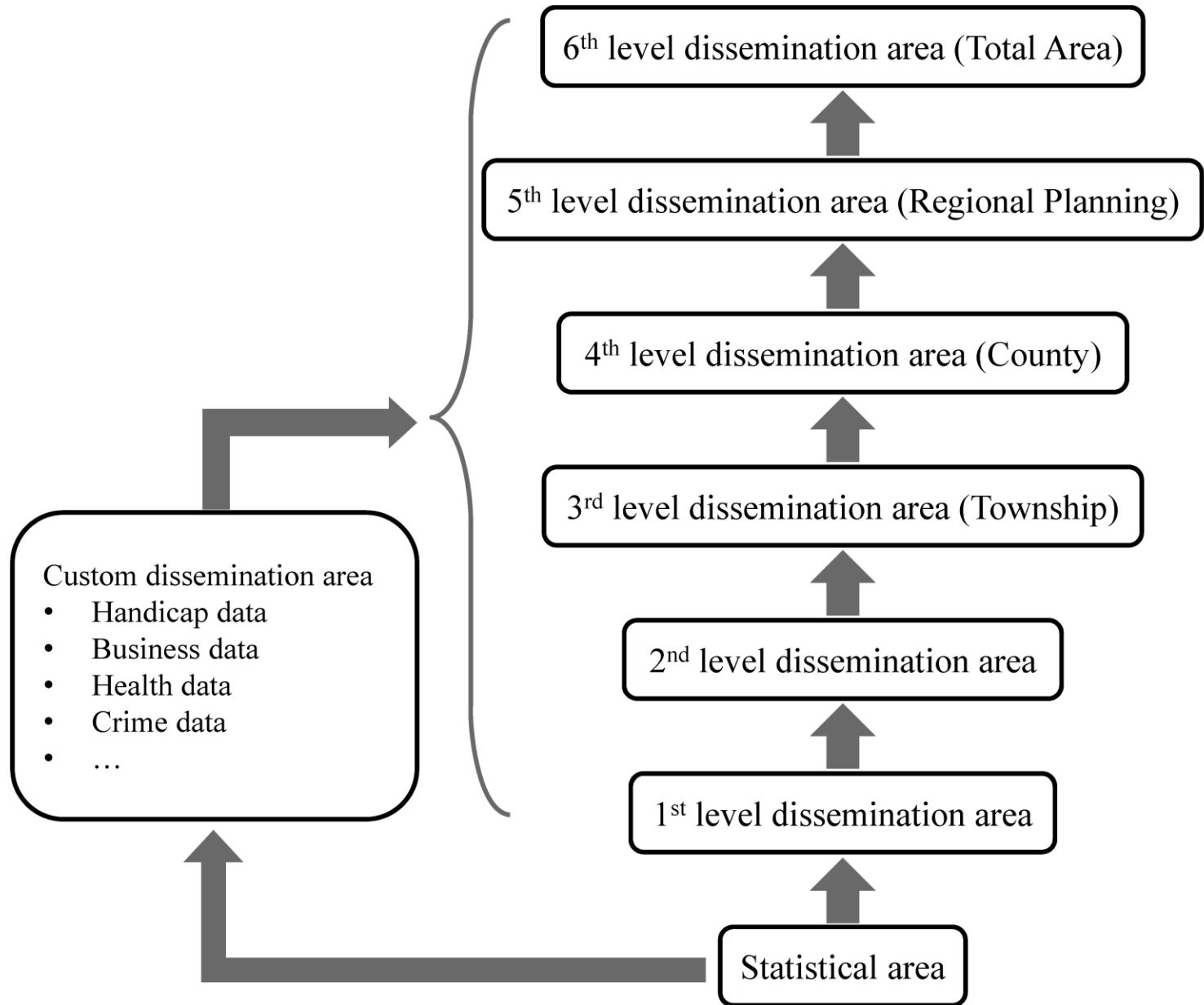
intersection result

Problems

Jurisdictional units are usually too large to provide detailed information on local area of interest

- Example from Chinese Taipei:





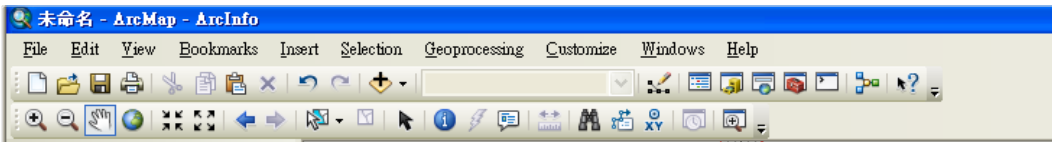
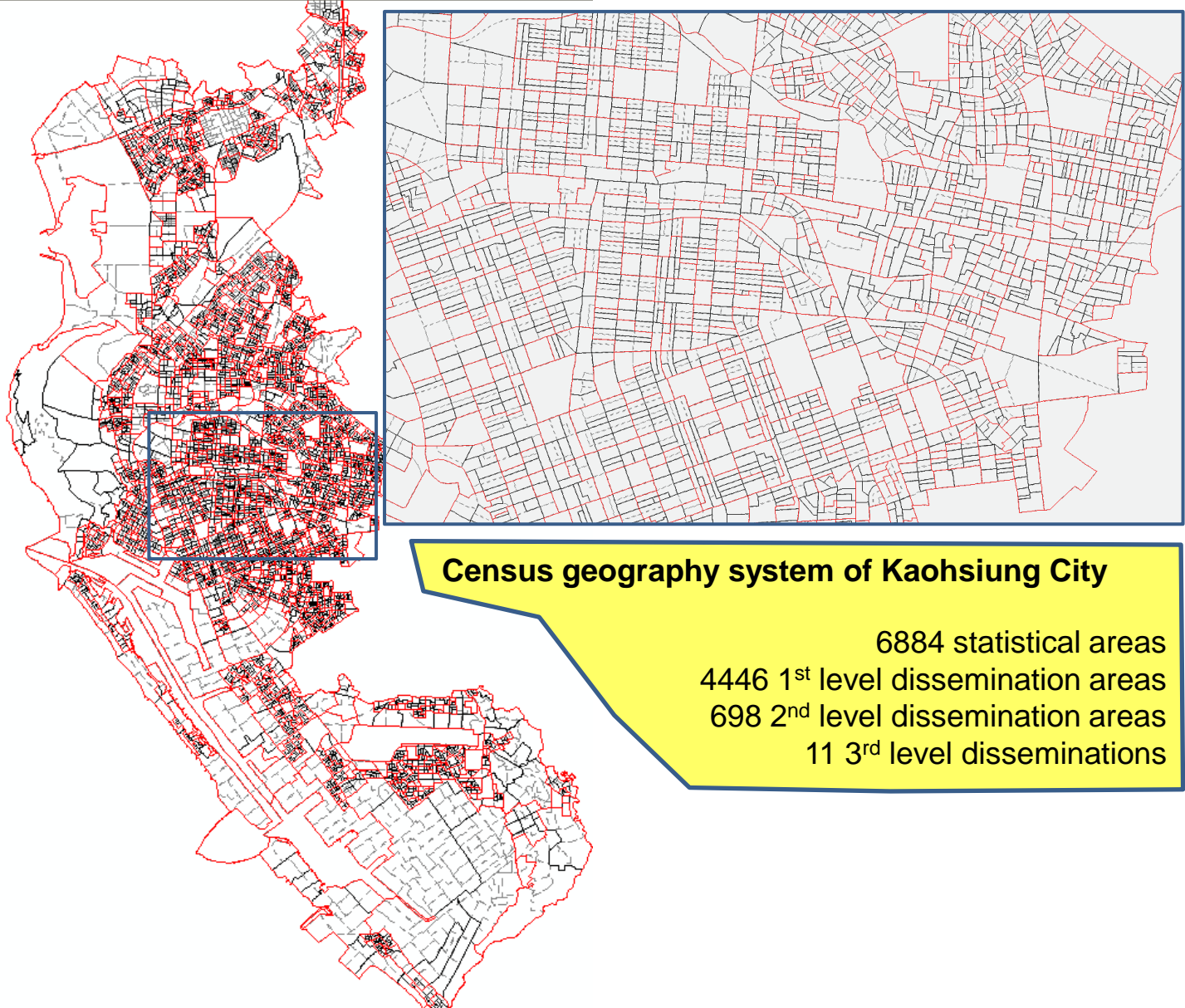


Table Of Contents

- Layers
 - 2nd Dissemination Areas
 - 1st Dissemination Areas
 - Statistical Areas



Census geography system of Kaohsiung City

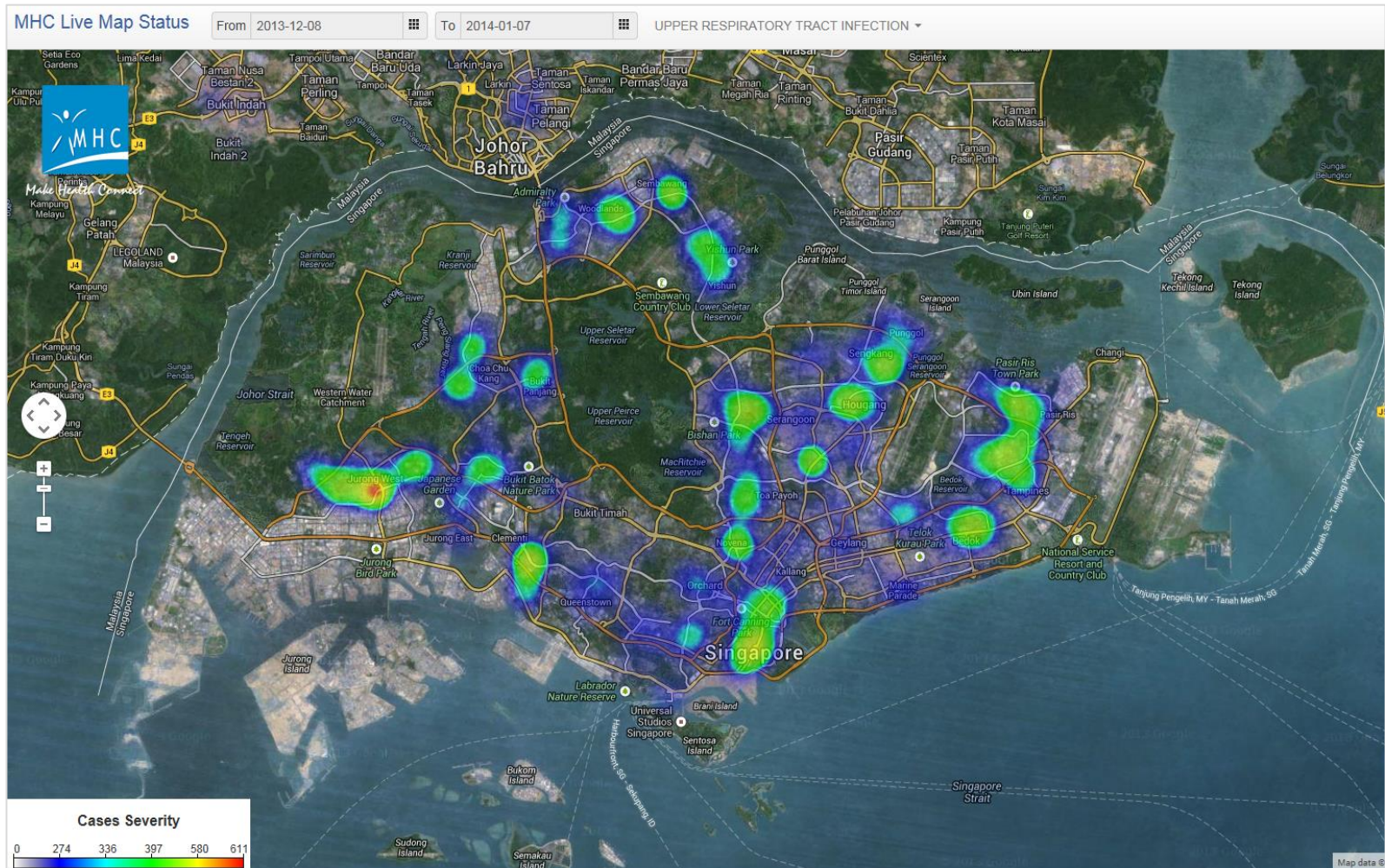
6884 statistical areas
4446 1st level dissemination areas
698 2nd level dissemination areas
11 3rd level disseminations

Philippines/ Indonesia VGI

Crowdsourced map of disaster zones and intensity (Typhoon Yolanda and Jakarta floods)



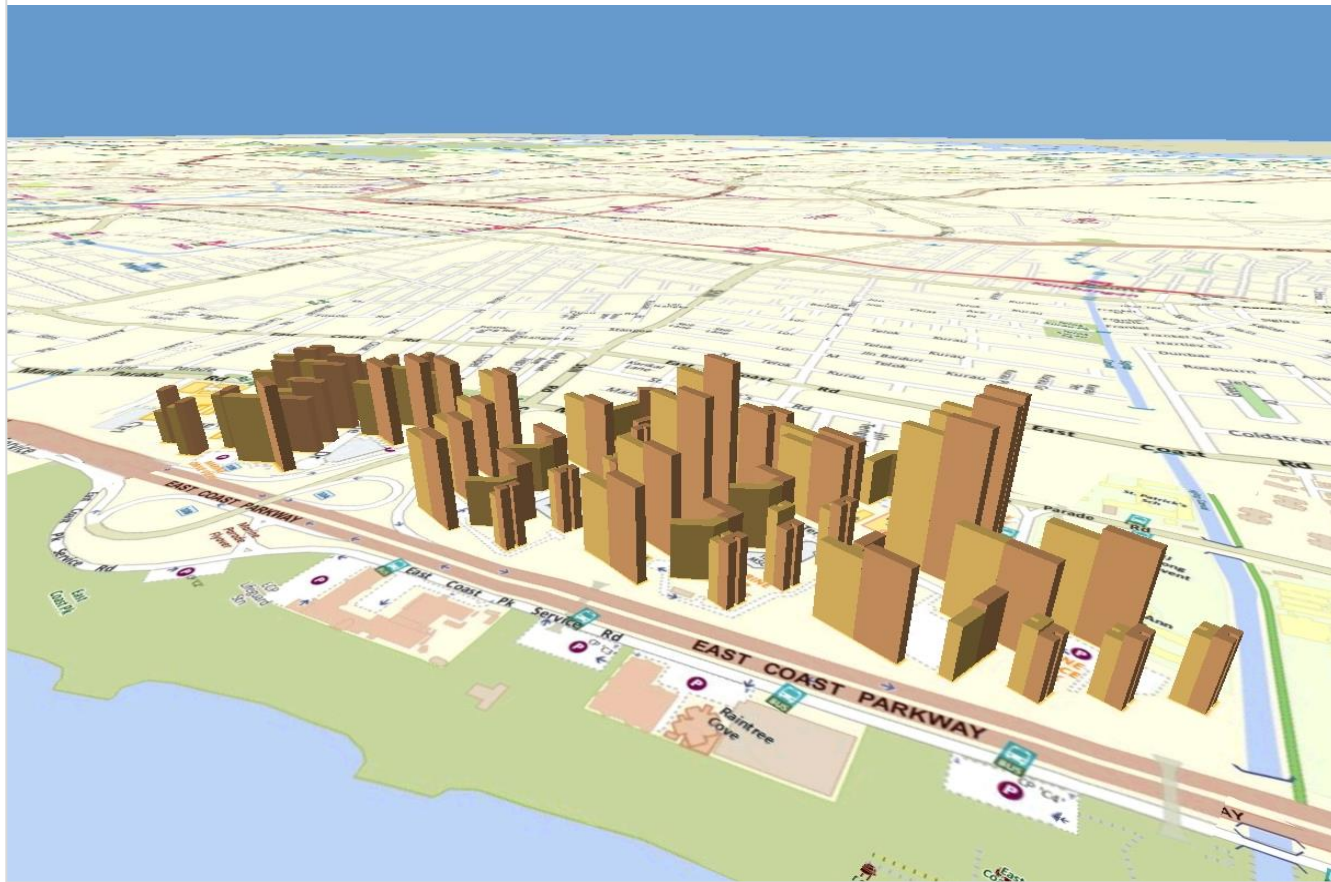
Intensity: Upper Respiratory Tract Infection Map



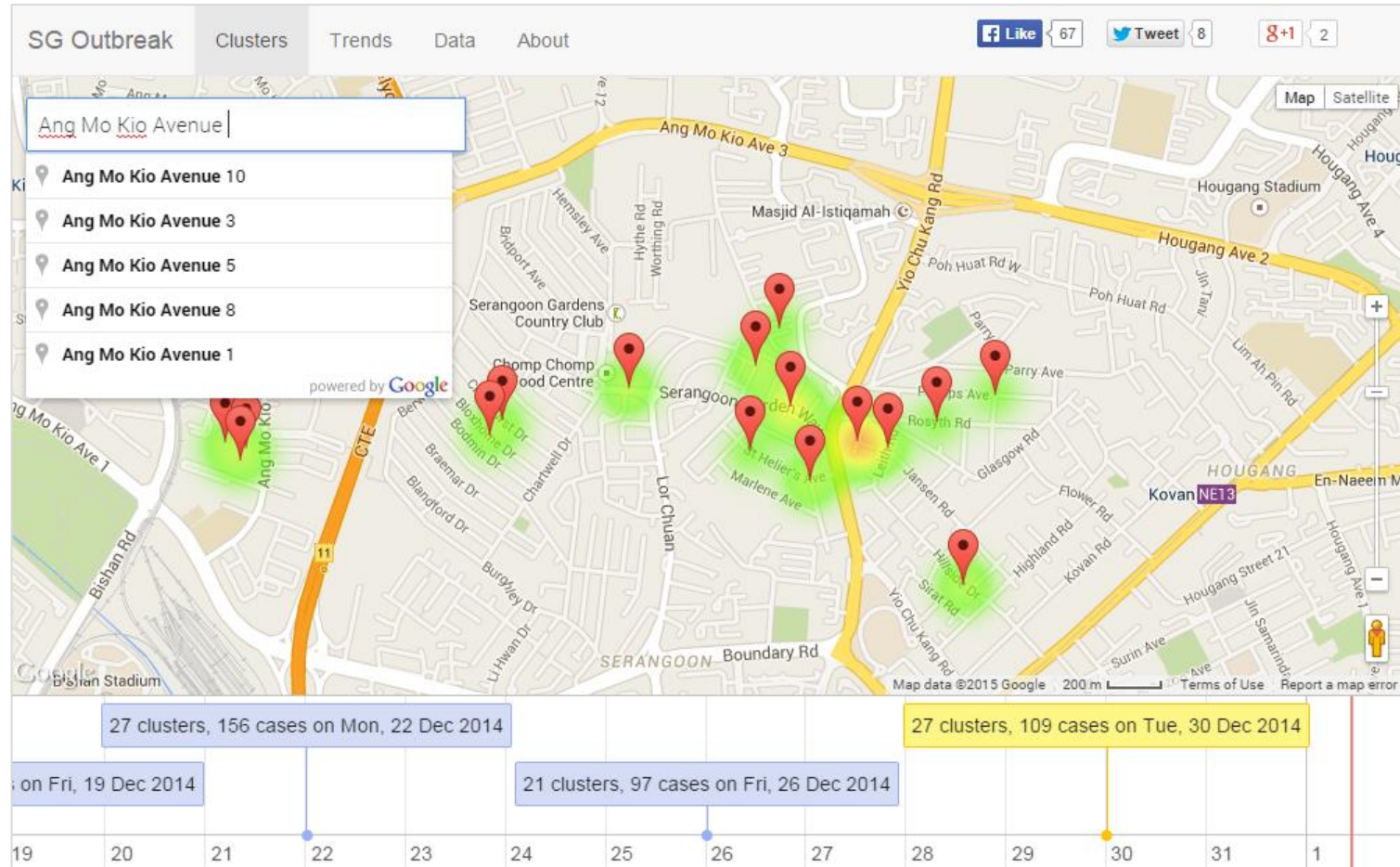
<https://livemap.mhc.asia/>

Measuring Concentration: Planning of Elderly Services

Current and Projected Individuals aged above 65, 2012-2022

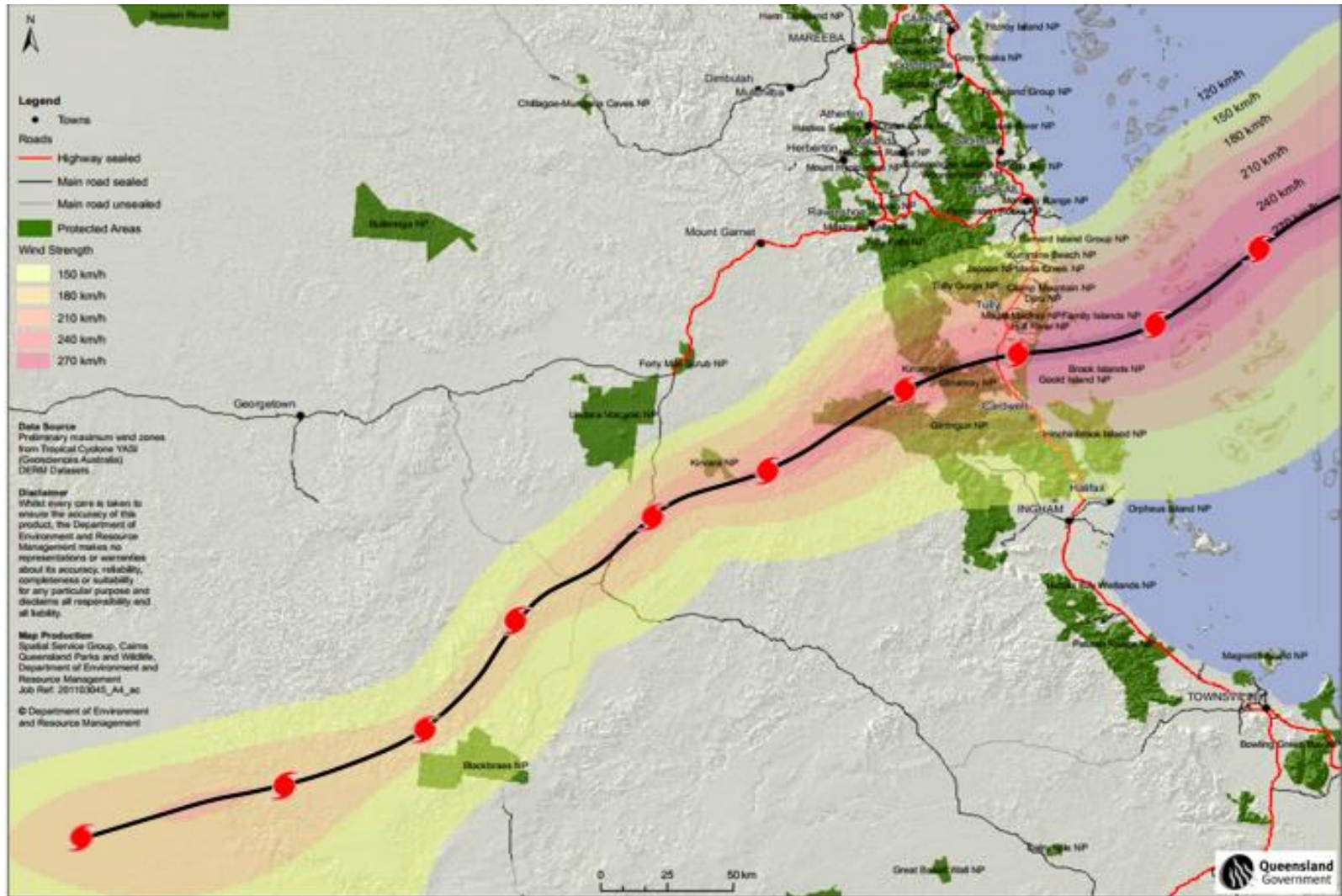


Example: Dengue Outbreak

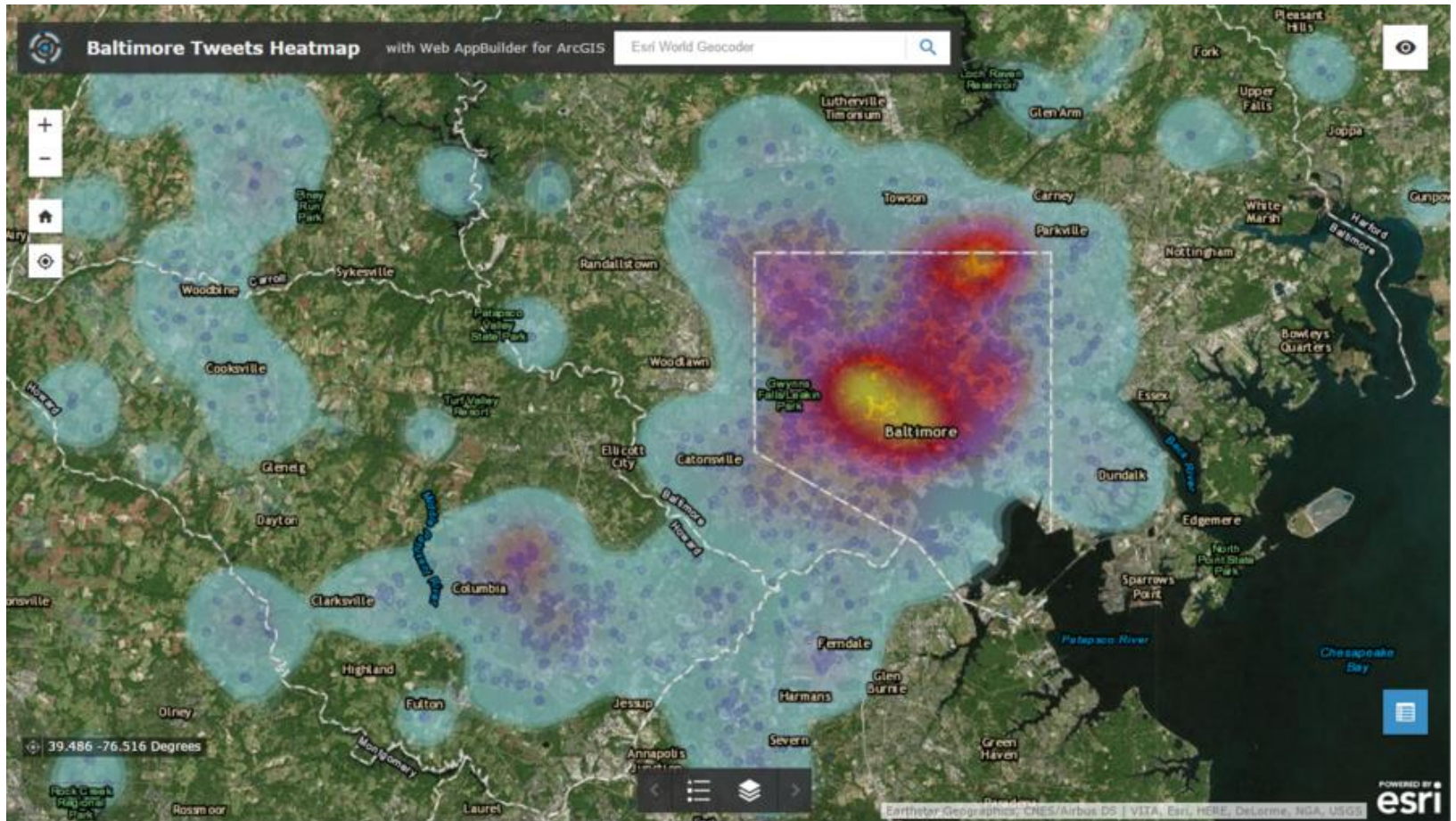


<http://outbreak.sgcharts.com/>

Line Trajectory of Cyclone Yasi



Correlational Analysis: Baltimore Riots and Twitter Heatmap



Source: <http://www.clearterra.com/locatext-ago/>

Main NSDS Objectives and Goals

1. Strengthening the Architecture of Myanmar's Statistical System through...
 - Enhancing the effectiveness of decentralization
 - Integrating systems, data and people
 - Advancing professionalism and technical competencies

2. Empowering CSO by...
 - Strengthening its legal mandate
 - Exercising organizational and professional leadership
 - Developing a substantive National Statistical Program
 - Establishing a National Framework for Data Dissemination and Revision
 - Establishing a National Integrated IT Platform

Main NSDS Objectives and Goals

3. Improving Stakeholder Relations by...

- Engaging the users
- Engaging the media
- Relating to respondents

4. Improving Critical Statistical Areas by...

- Undertaking detailed gaps and needs assessments of specific sectors and domains
- Launch projects to improve specific sector statistics
 - System of National accounts, Price Statistics, External Trade Statistics, Agriculture and Rural Statistics, Poverty, Employment and Social Statistics, Civil Registration and Vital Statistics etc.

Goal	Drivers	Key Activities	Time-frame
A2. An integrated system for statistical production, analysis and dissemination	a) Integrated system for managing statistical personnel and expertise	<ul style="list-style-type: none"> • Provide common professional reference point for statistical personnel with national statistical coordinator as apex entity • Accord professional identity and status • Create a system of training for statistical personnel • National Statistical Coordinator to meet all statisticians in ministries and agencies 	From 2016
	b) Integrated data platform for official statistical information	<ul style="list-style-type: none"> • Begin efforts to build national databases • Establish common definitions and meta data to facilitate data transfer • Establishing policies and protocols on data sharing and governance mechanism for data pooling in databases 	From 2016
	c) Integrated platform for merging geo-information and statistical information	<ul style="list-style-type: none"> • Establish geo-information database for sharing of geospatial information including base map, address system • Improve national address system for geo-coding 	From 2016
	d) Integrated IT infrastructure for efficient data capture, transfer, processing and dissemination	<ul style="list-style-type: none"> • Harmonize the It systems across the ministries for statistical production and related processes • Provide adequate training to manage and deploy new IT software and systems • Establish a system to collect new information sources such as mobile phone or internet 	From 2016

THANK YOU

paul.cheung@nus.edu.sg