Fourth Session of
OIC Statistical Commission

21-23 April 2014, Ankara–Turkey

LINKING PEOPLE AND SOCI-ECONOMIC INFORMATION TO A LOCATION :

INTEGRATING STATISTICAL AND GEOSPATIAL INFORMATION

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GGIM Secretariat

Summary

- **Need for Integration of Statistical and Geospatial Information**

- **Example of the Census**

- **Trends in Technology**

- **UN Activities/Future Actions**

- **Conclusion**

UN working with two professional communities

- Working with **National Statistical Offices** to evolve a global statistical system -- Many achievements over 65 years;

- Working with **National Geospatial Information Authorities** to evolve a global geospatial information platform with common practices and standards;

- Now working to bring these two communities together to evolve an **integrated national/global information system**.

Divergence and Overlaps

- Two communities operating on different analytical schemes and data structures, with minimal overlaps;

- Distinct culture, terminology, and practices;

- Comfortable as distinct professional communities;

- But now compelled by emerging trends to look for the common ground;

- What is the Common Ground? How to get there??

statistics as spatial information

Statistical world

| Statistisches Bundesamt Deutschland | | | | | | | DESTATIS wissen.nutzen. |

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level up

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GENESIS-Online
Federal Health Monitoring System

Research and development
Scientific forum

National Accounts

Important economic indicators

Specification	Unit	2007	2008	2009
Gross value added [1]	EUR bn.	2,176.57	2,239.24	2,149.88
Agriculture, hunting and forestry; fishing	EUR bn.	20.67	20.25	18.11
Industry, including energy	EUR bn.	568.38	572.72	471.74
Construction	EUR bn.	88.28	95.23	98.58
Trade, transport and communications	EUR bn.	379.58	397.43	378.23
Financial, real-estate, renting and business activities	EUR bn.	639.37	659.16	666.81
Other service activities	EUR bn.	480.29	494.45	516.41
Gross domestic product [1]	EUR bn.	2,428.20	2,495.80	2,404.40
Final consumption expenditure	EUR bn.	1,810.96	1,861.48	1,888.43
Final consumption expenditure (households and NPISHs)	EUR bn.	1,375.39	1,409.71	1,416.36
Government final consumption expenditure	EUR bn.	435.57	451.77	472.07
Gross fixed capital formation	EUR bn.	455.53	474.71	431.95

Google maps | trapani, italy | Search Maps Show search options
Find businesses, addresses and places of interest.
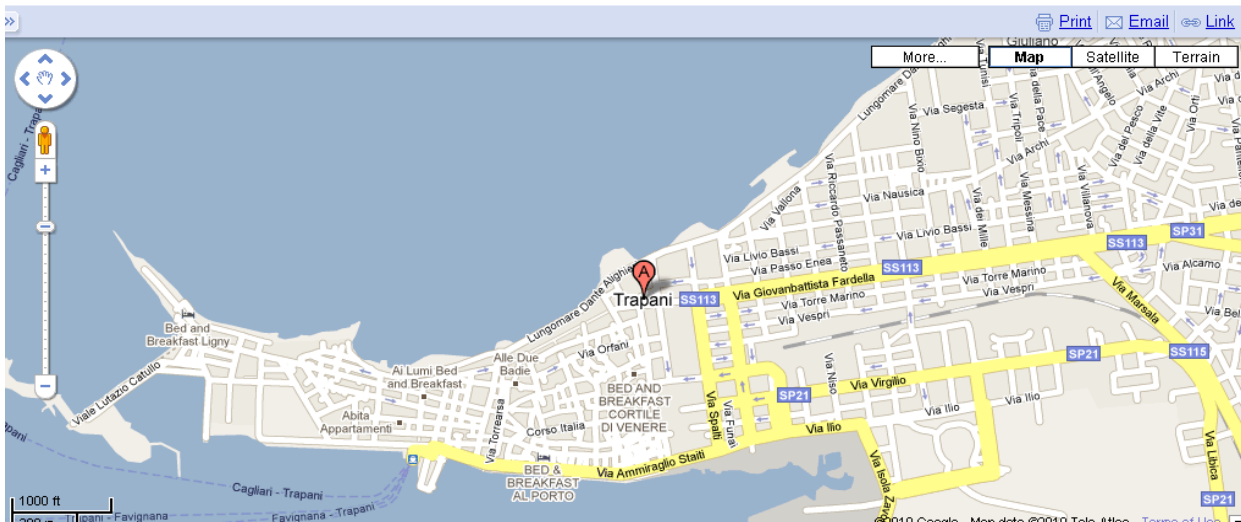
Physical world

Source: Eurostat

Statistics are about human characteristics and activities which are geographic in nature.

Matrix: Data Structure for Statistics

UNdata — A world of information

Data   Glossary   Metadata   More   [Search]

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Statistics

Gender Inequality Index and related indicators   ☑ Search glossaries

Source: Human Development Indices: A statistical update 2011 | United Nations Development Programme

⬇ Download   ▪ Explore

HDI rank	Gender Inequality Index		Maternal mortality ratio	Adolescent fertility rate	Seats in national parliament (% Female)	Population with at least secondary education (% ages 25 and older)		Labour force participation rate (%)		Reproductive Health			Total fertility rate
	Rank	Value				Female	Male	Female	Male	Contraceptive prevalence rate, any method (% of married women ages 15-49)	At least one antenatal visit (%)	Births attended by skilled health personnel (%)	
	2011	2011	2008	2011[a]	2011	2010	2010	2009	2009	2005-2009b	2005-2009b	2005-2009b	2011[a]
VERY HIGH HUMAN DEVELOPMENT													
1 Norway	6	0.075	7	9.0	39.6	99.3	99.1	63.0	71.0	88.0	..	..	2.0
2 Australia	18	0.136	8	16.5	28.3	95.1	97.2	58.4	72.2	71.0	100.0	100.0	2.0
3 Netherlands	2	0.052	9	5.1	37.8	86.3	89.2	59.5	72.9	69.0	..	100.0	1.8
4 United States	47	0.299	24	41.2	16.8	95.3	94.5	58.4	71.9	73.0	..	99.0	2.1
5 New Zealand	32	0.195	14	30.9	33.6	71.6	73.5	61.8	75.7	75.0	95.0	100.0	2.1
6 Canada	20	0.140	12	14.0	24.9	92.3	92.7	62.7	73.0	74.0	..	98.0	1.7
7 Ireland	33	0.203	3	17.5	11.1	82.3	81.5	54.4	73.0	89.0	..	100.0	2.1
8 Liechtenstein	..	..	..	7.0	24.0	..	..	..	..	..	..	..	..
9 Germany	7	0.085	7	7.9	31.7	91.3	92.8	53.1	66.8	75.0	..	..	1.5

This data structure may explain to some degree why it took a long time
 to adopt the geographic approach

Structure for Geographic Data
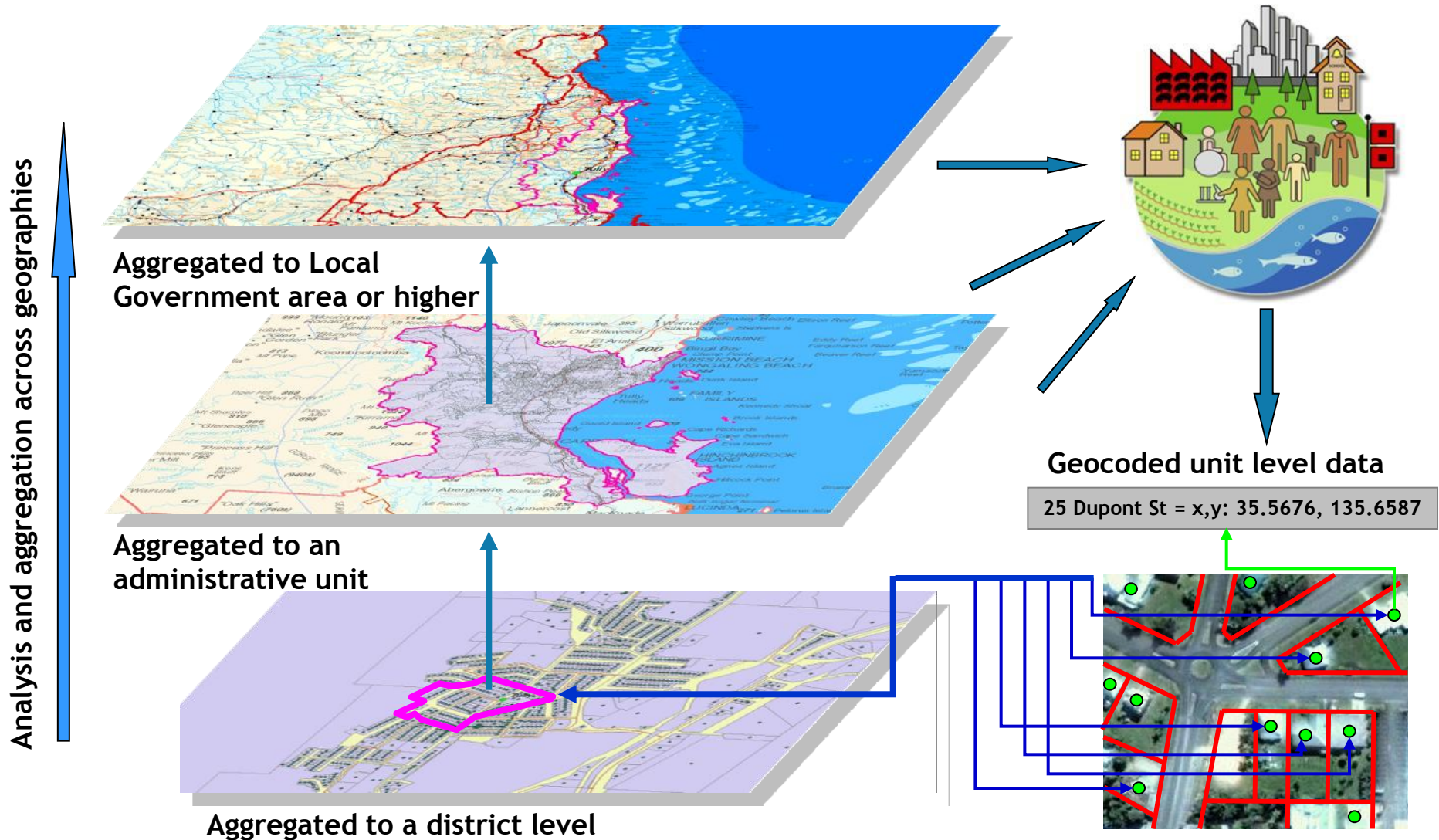

25 Smith St, Town Z
x,y: 35.5676, 135.6587
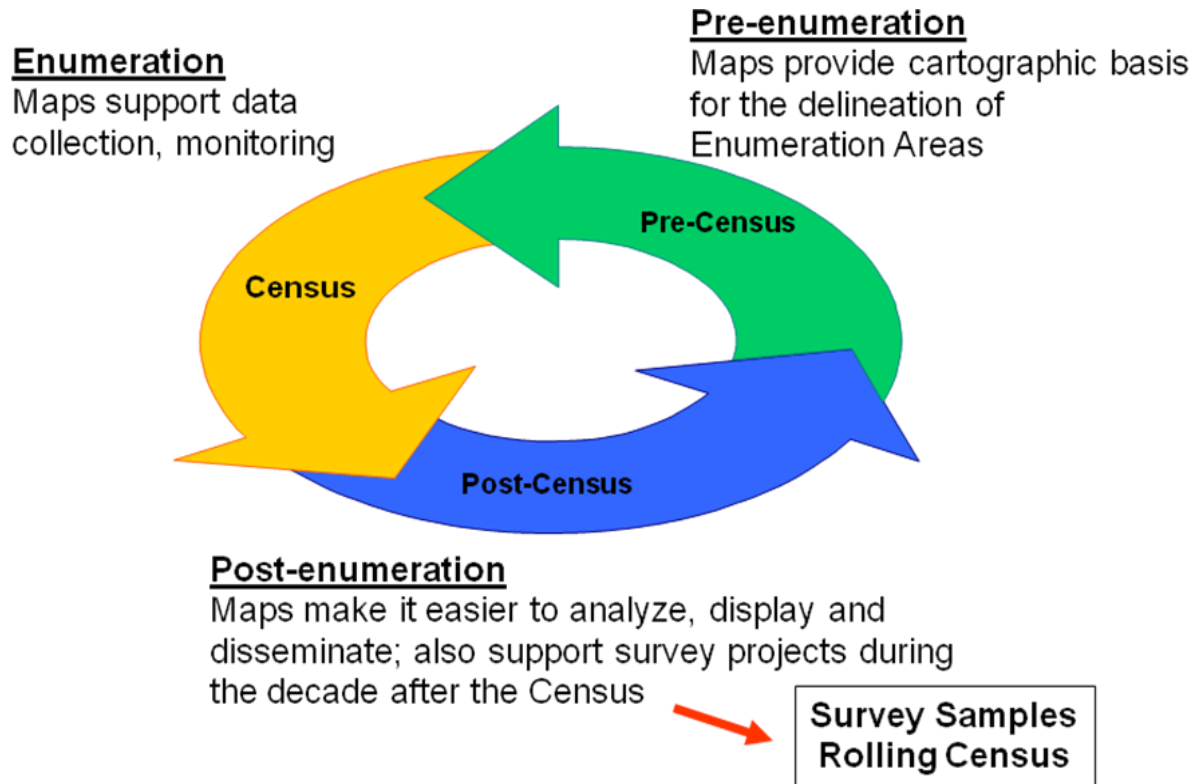
Point location

Cadastral property parcels

Geographic Data Structure: Polygons, Lines and Points

Need for a Statistical Spatial Framework

Analysis and aggregation across geographies

Aggregated to Local Government area or higher

Aggregated to an administrative unit

Aggregated to a district level

Geocoded unit level data

25 Dupont St = x,y: 35.5676, 135.6587

A common geographic framework is fundamental to integration
Need for appropriate standards to support the linking of socio-economic information to location

Census Geography

Enumeration
Maps support data collection, monitoring

Pre-enumeration
Maps provide cartographic basis for the delineation of Enumeration Areas

Census

Pre-Census

Post-Census

Post-enumeration
Maps make it easier to analyze, display and disseminate; also support survey projects during the decade after the Census

Survey Samples
Rolling Census

Census geography: Shift from " redoing from scratch" to "up-to-date-approach"

Coding Scheme

- Enumeration Area (EA): a basic geographic feature

- **Coding scheme**: relating EAs and administrative units:

   (A unique code assigned to each EA, used in data processing)

- Example of a hierarchical coding scheme:

Provinces

Districts

Localities

Enumeration areas

1	2	0	3	4	0	1	2	5	0	0	2	4

province   **district**   **locality**   **Enumeration area**

Geocoding

Statistical Data

Geographical Data

Geocodes

GIS — A GIS works on geocoded data

Maps, tables, reports

United States Census Bureau
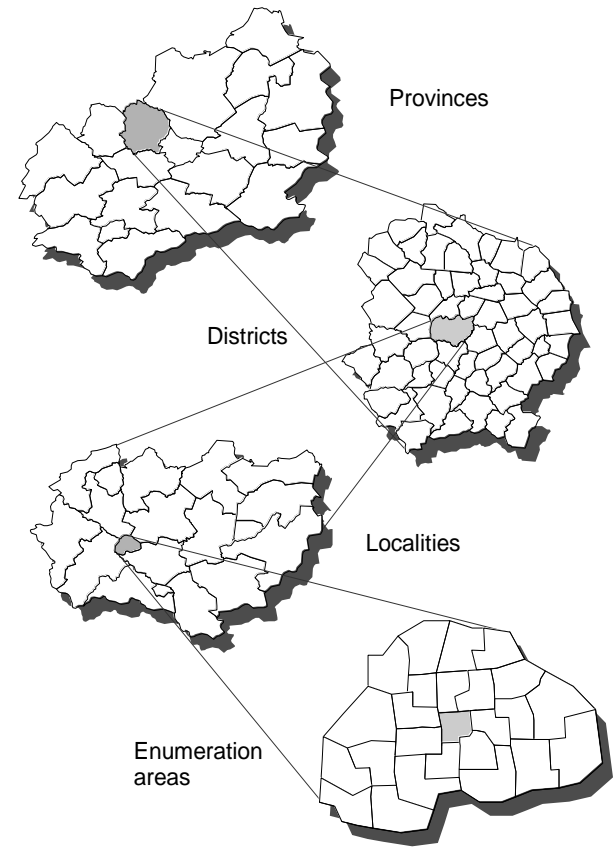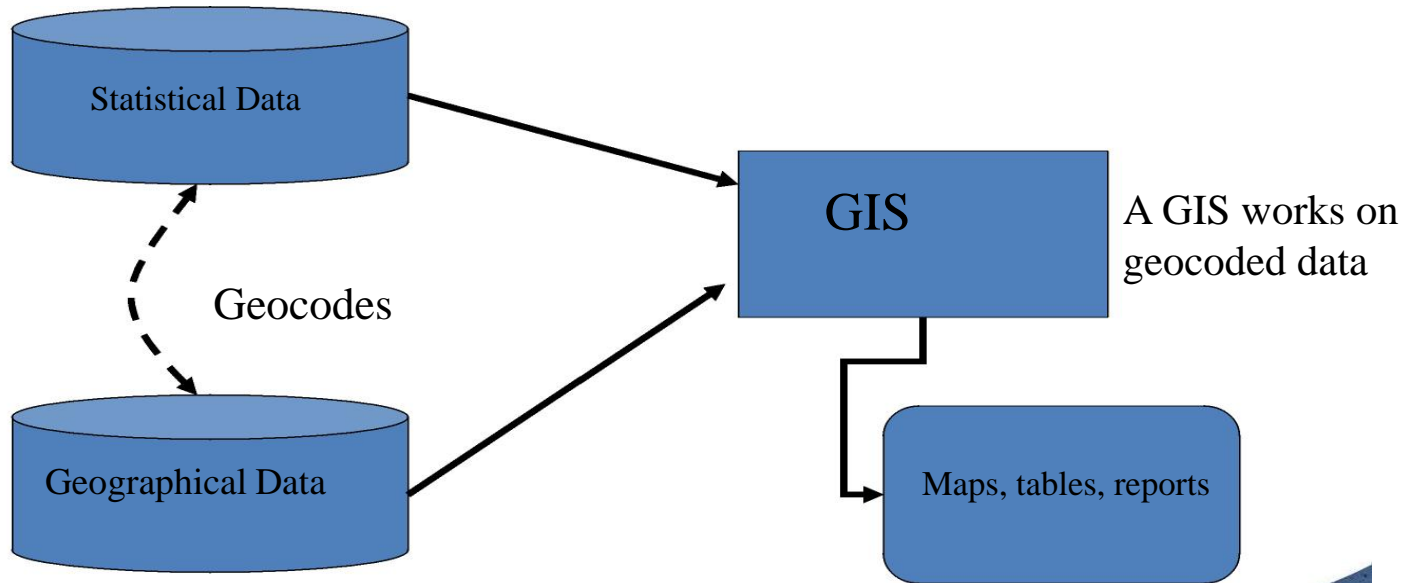
The Coding scheme is the basis to build a GIS which works on geocoded data.

Each NSO which has its coding scheme has already a "GIS", even if it is not in a digital form!

Components of a hypothetical urban EA map

Main components are:

Street network,
Buildings
EA boundaries layer
Annotation,
Symbols,
Labels
Building numbers
Neatlines
Legend

Enumeration Area Map

Province: Cartania 14
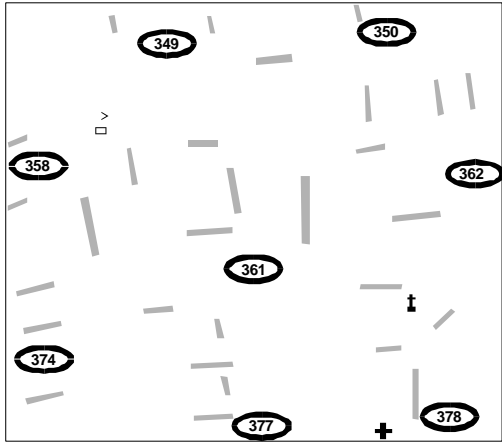District: Chartes 032
Locality: Maptown 0221
EA-Code: 00361

N

Approximate scale

0   50   100   200m

Census 2000 National Statistical Office - July 1998

Symbols

———	District
—·—·—	Locality
– – –	EA
17	Building number

358 EA-Code

✚ Hospital

✝ Church

⚑ School

EA features stored as map layers in the same spatial reference system

Main Components

Street Network
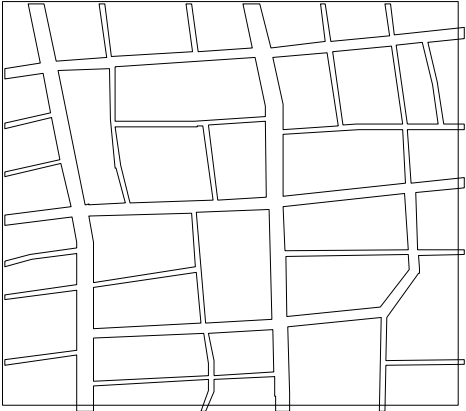
Buildings

Boundaries
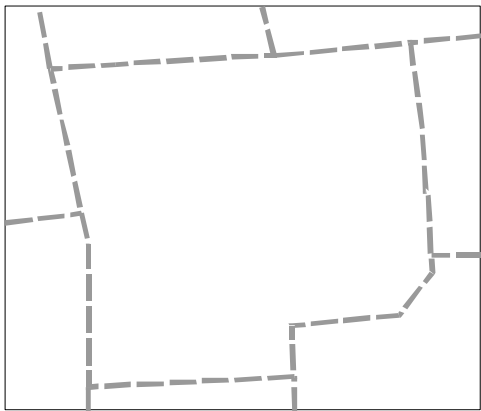
Building numbers

Neatlines and legend

Annotation and symbols

Enumeration Area Map

Province:	Cartania	14
District:	Chartes	032
Locality:	Maptown	0221
EA-Code:		00361

N

Approximate scale

Symbols

District
Locality
EA
Building number

358 EA-Code
Hospital
Church
School

Census   National Statistical Office -

349 350 358 362 361 374 377 378

Building a Geographic Database at EA level

EA Id	Population	Male	Female
1200071	560	282	278
1200072	489	242	247
…	…	…	…

Geographic attributes table

EA Id	Area
1200071	42.3
1200072	26.8
…	….

Census data tables

EA Id	Num HH	Avg HH size
1200071	86	4.3
1200072	98	5.1
…	…	…
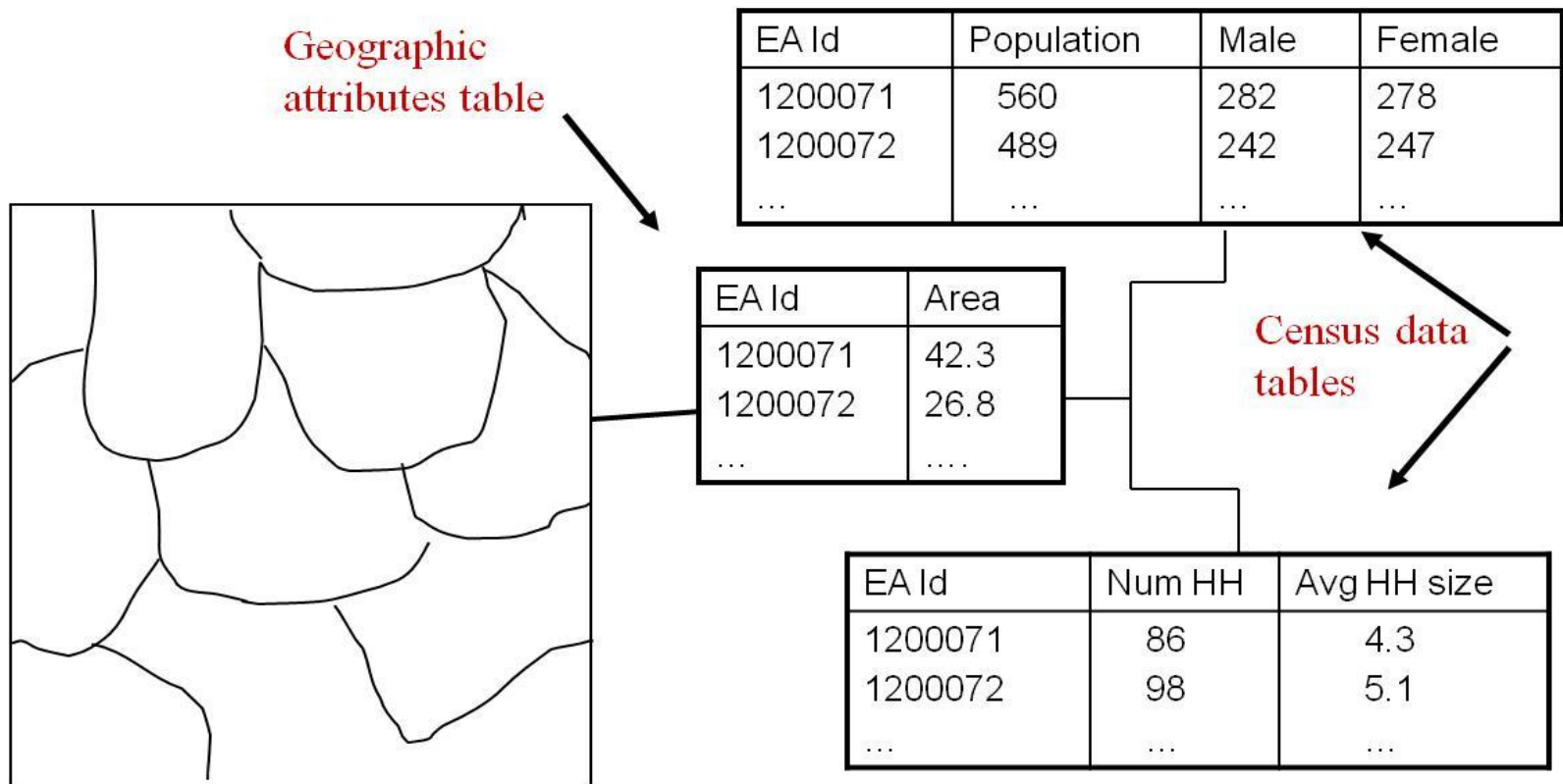
Working with data stored in a geodatabase, you will organize and prepare data for analysis, create geoprocessing models.
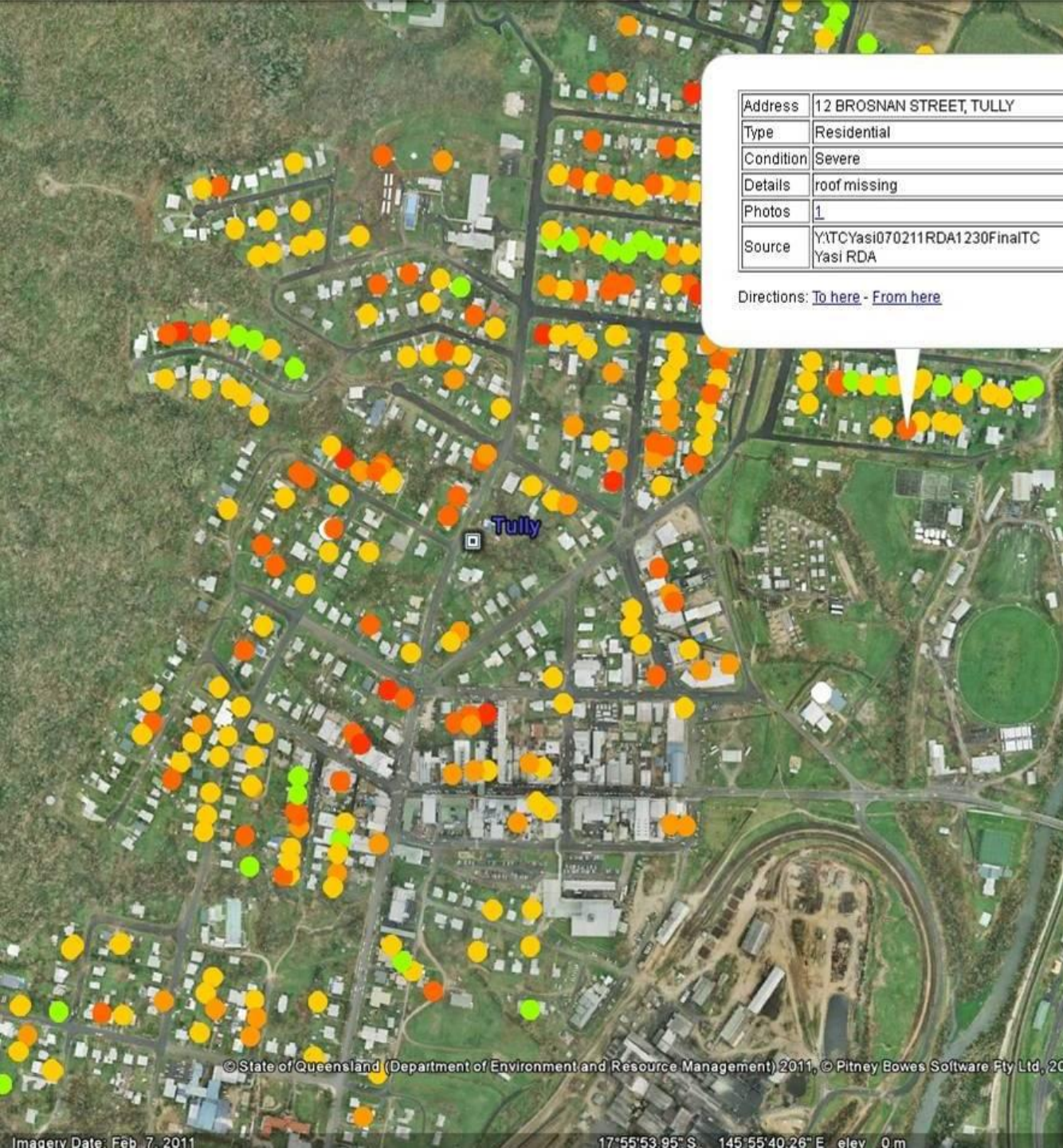
Address	12 BROSNAN STREET, TULLY
Type	Residential
Condition	Severe
Details	roof missing
Photos	1
Source	Y:\TCYasi070211RDA1230FinalTC Yasi RDA

Directions: To here - From here

Tully

© State of Queensland (Department of Environment and Resource Management) 2011, © Pitney Bowes Software Pty Ltd, 2011, © PSMA Australia Limited 2011

Queensland Government

Department of Environment and Resource Management

Imagery Date: Feb 7, 2011   17°55'53.95" S   145°55'40.26" E   elev   0 m   Eye alt   1.76 km

Migration Analytics

Internal Migration in England & Wales, year ending June 2010
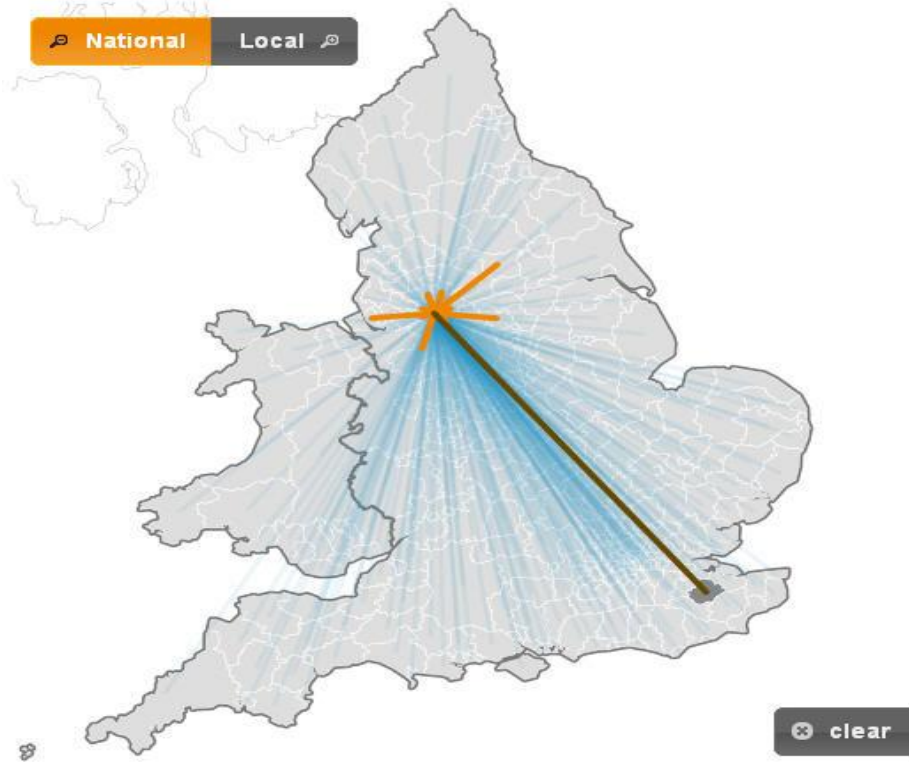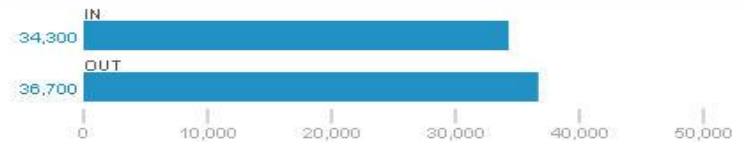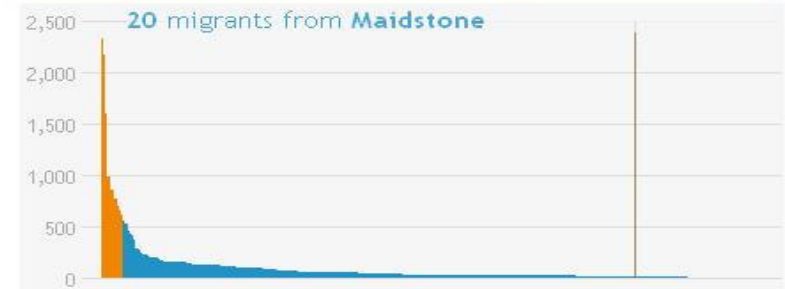
Interactive Map of Chile Administrative Districts-
(Population and Housing Census 2002)
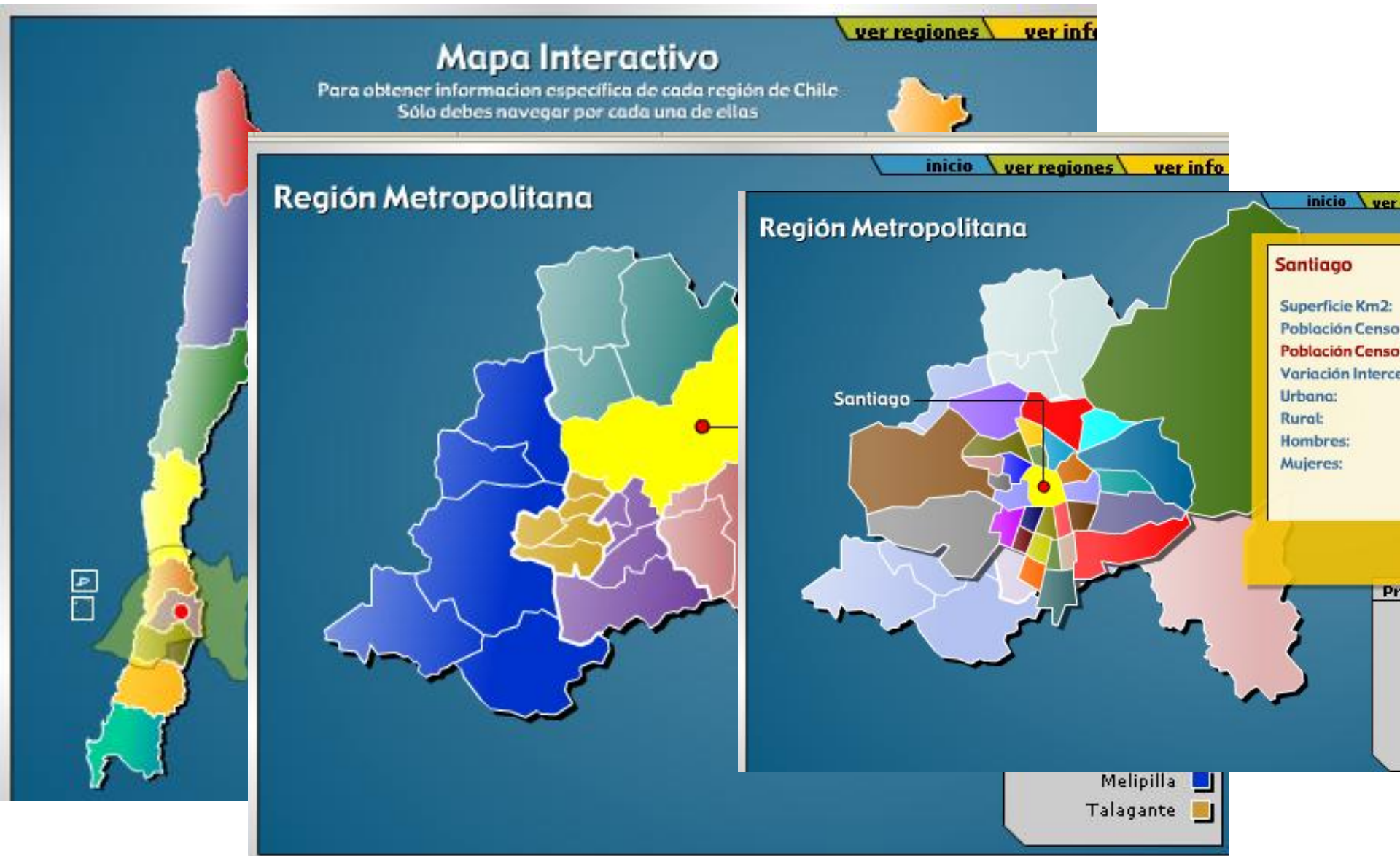
Personal Digital Assistant (PDA):

Integrated Field Data Collection

(Electronic Questionnaire + GPS, etc.)

UN-GGIM

United Nations Initiative on
Global Geospatial Information Management

ggim.un.org

Integrated Mobile Devices (PDA, Tablets,etc) – Brazil: an example of massive use

-Data Collection and Entry: automated/built-in

- Embedded "GPS": georeference units visited/track location of data entry/positioning and guidance of the enumerator

- Integrated field platforms with GPS, cellular, camera and OS applications

- Commercial or In-house devices, Tablet, Cell…

Assortment of IBGE

Figure 15 - Satellite image on PDA screen.

Data Access

As technological developments and data availability advance rapidly, statistical agencies must be prepared to respond to user expectations for data access and interaction

- Customized to Census dissemination

- Use of SMS to disseminate some census results (e.g. Kenya)

Scalable Hardware -

Server Cluster

Server

Server

Desktop

Laptop

Tablet PC

PDA

Cell Phone

Web Services

- **Faster**
- **Multi Processors**
- **Loosely Coupled**
- **Connected**

. . . and Services Oriented

Handbook on Geospatial Infrastructure in Support of Census Activities

- Audiences: managerial and technical

- "Cook-book" to illustrate the role of geospatial technology in each step of the census process

- Each country has to find its own best possible solution

- Available in the six UN official languages

http://unstats.un.org/unsd/demographic/standmeth/handbooks/default.htm

Regional Workshops on Census Mapping with GIS

- For English-speaking African countries: Lusaka, Zambia, 8-12 October 2007 : 30 participants from 14 countries

- ESCAP region: Bangkok, Thailand, 15-19 October 2007: 31 participants from 16 countries

- CARICOM: Port-o-Spain, Trinidad, 22-27 October 2007: 28 participants from 16 countries

- For French-speaking African countries: Rabat, Morocco, 12-16 November 2007: 48 participants from 10 countries

- For SPC region: Noumea, New Caledonia, 4-8 Feb. 2008: 30 participants from 10 countries and two territories

- ESCWA region: Doha, State of Qatar, 18-22 May 2008: 44 participants from 12 countries

- Latin America region: Santiago, Chile, 24-27 November, 2008: 47 participants from 17 countries

- CIS region: Minsk, Belarus, 8 - 12 December 2008, 41 participants from 11 countries

(**300 participants from 106 developing countries and two territories**):

Statistical Commission Decision on the Integration of Statistical and Geospatial Information

Decision 41/110 (of the 41st SC session in 2010):

- Recognized the importance of the integration of geographic and statistical information and the opportunities provided in that context by the swift development of information technology, noting that national statistical offices are playing an increasing role in such integration, especially in the area of census management

Global Geospatial Information Management (GGIM)

– **ECOSOC decision 2011/24** established the UN

Committee of Experts on GGIM (UN-GGIM)

– *"Recognizing the importance of **integrating cartographic and statistical information, as well as spatial data**, with a view to fostering location-based geospatial information, applications and services"*

An Action Agenda for the Integration of Statistical and Geospatial Information

- Establishment of UN Expert Group on the Integration of Statistical and Geospatial Information
  - First meeting in New York, 30 Oct. – 1 Nov. 2013

- The United Nations facilitates the collaboration of the two communities globally and nationally in:
  - **Developing a Statistical Spatial Framework**
    - Common geographic framework, fundamental to integration
    - Need for appropriate standards to support the integration

- International Workshop on Integrating Geospatial and Statistical Information, Beijing, 9-12 June 2014

- Global Forum on the Integration of Statistical and Geospatial Information-New York, 4-5 August 2014

Conclusions:

- Location matters!

- The revision of UN Principles & Recommendations for the 2020 Round of Censuses has shown that NSO are increasingly recognizing the importance of the use of Geospatial tools (GIS, GPS, Imagery, Web Mapping, etc.) in support of statistical activities

- Strong Recommendation: Census Geography/Mapping should be a continuous process

- Need for cooperation between NSOs and NMAs to develop a national geospatial infrastructure in support of statistical activities

- Integration of Statistical and Geospatial Information is key for Evidence-based Decision Making

- Driver: "Data Revolution"… "Big Data"

Paradigm shift: Location is the 4th dimension of decision making
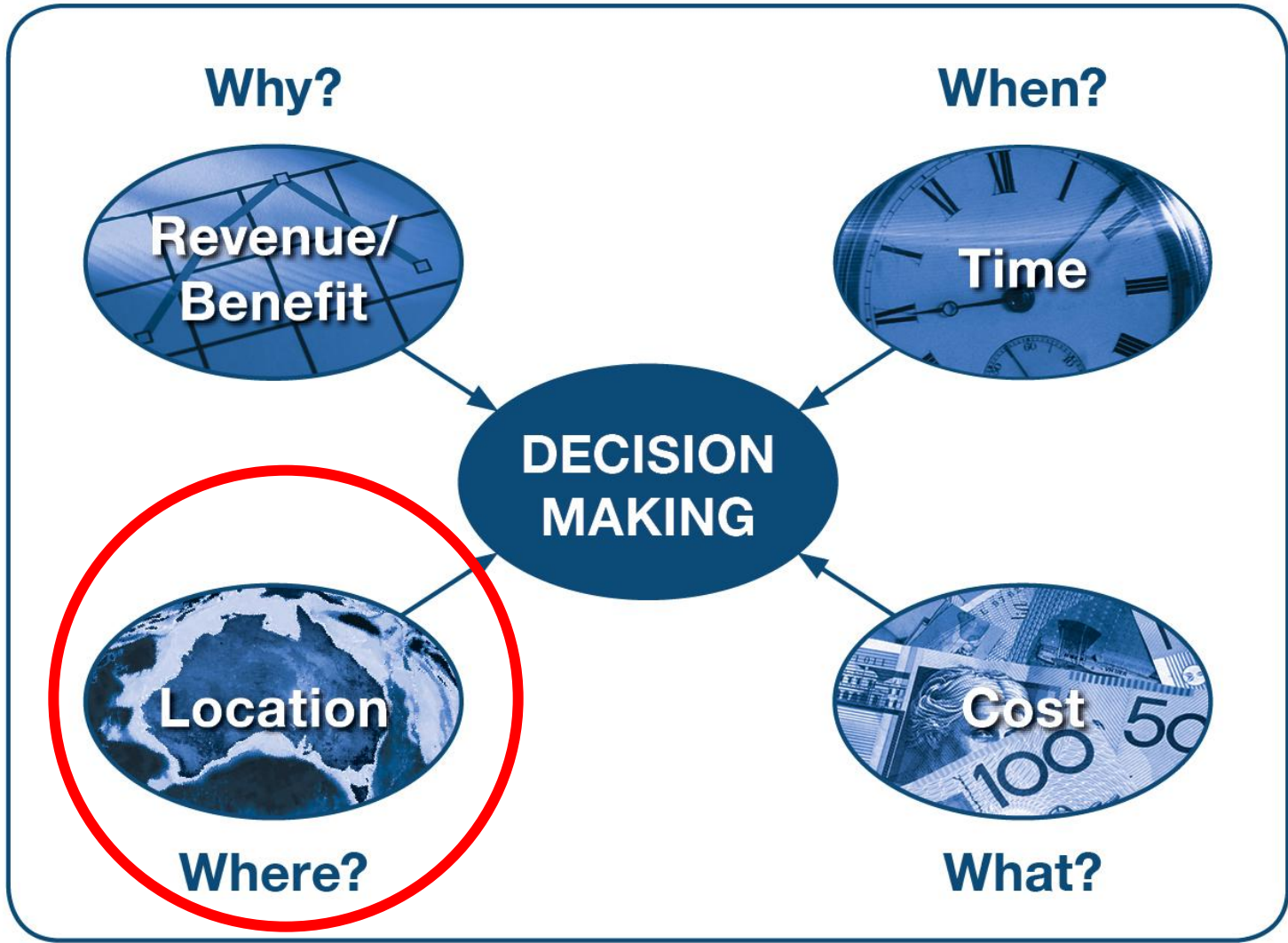
Vital Statistics of a Deadly Campaign: the Minard Map
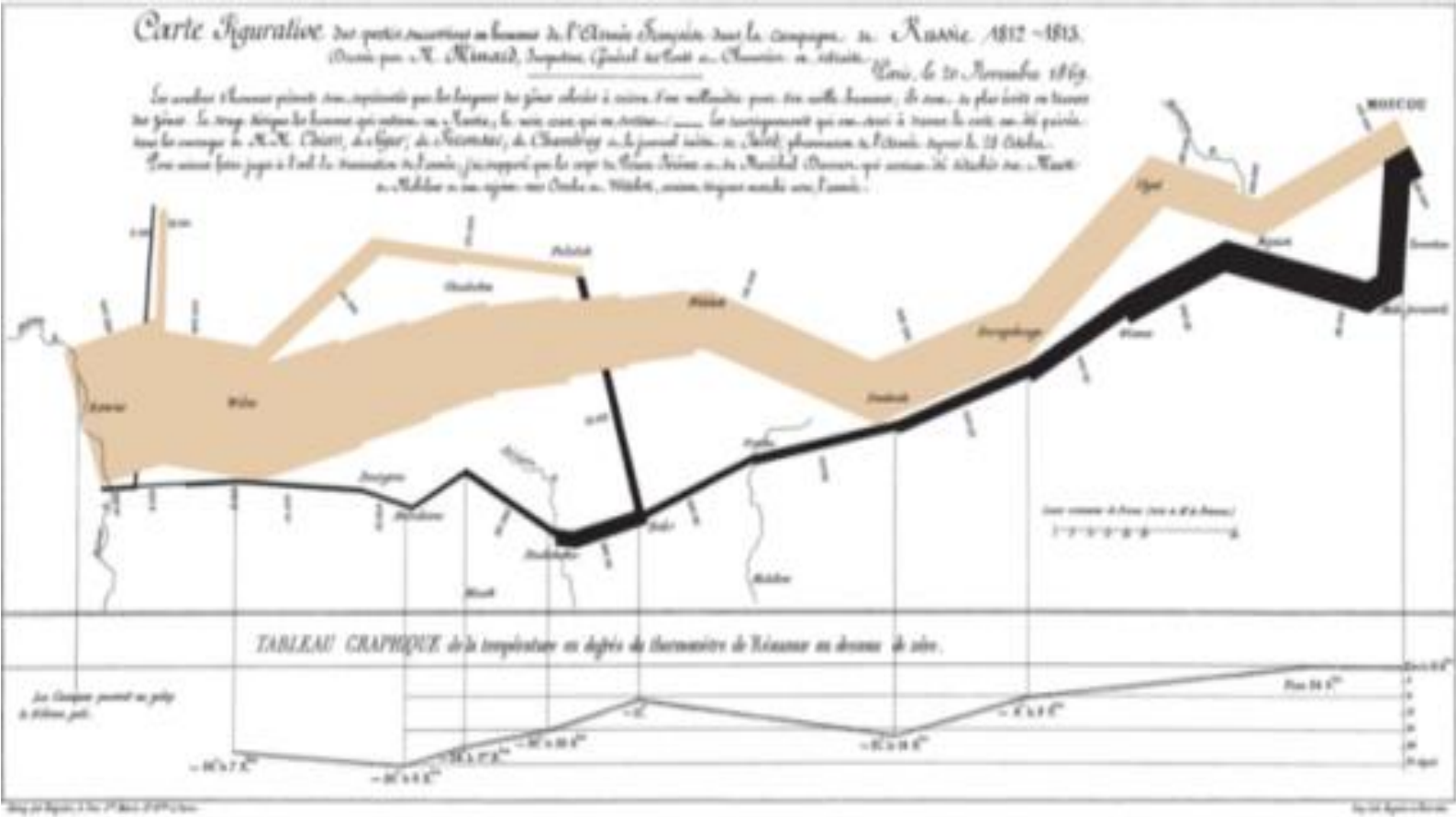
"The **best statistical graphic ever drawn**",
 is how statistician Edward Tufte described this chart in his authoritative work 'The Visual
Display of Quantitative Information'.

THANK YOU !!

Laaribi@un.org

Entity-Relationship:
Example

- EA entity can be linked to the entity crew leader area. The table for this entity could have attributes such as the name of the crew leader, the regional office responsible, contact information, and the crew leader code (CL code) as primary code, which is also present in the EA entity.
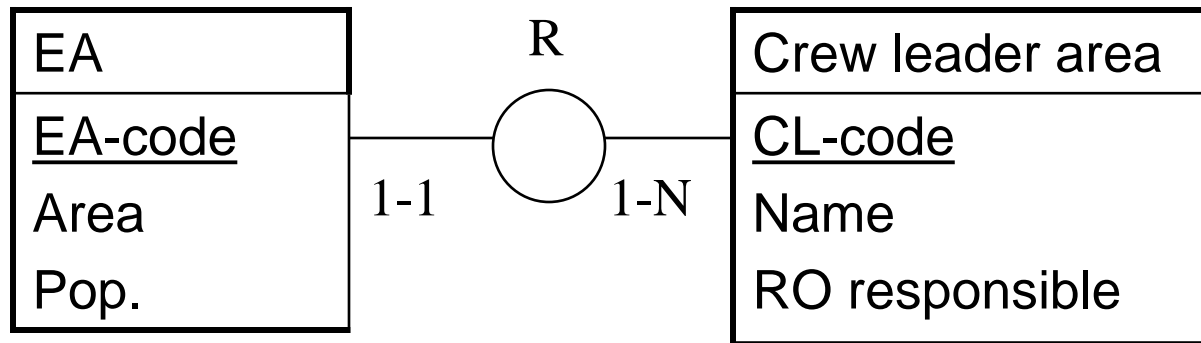
Implementation of an EA database

- Example of an entity table – enumeration area

Entity: Enumeration areas

Type (attributes)

Instances

EA-Code	Area	Pop	CL-Code
723101	32.1	763	88
723102	28.4	593	88
723103	19.1	838	88
723201	34.6	832	88
723202	25.7	632	89
723203	28.3	839	89
723204	12.4	388	89
…	…	…	…

Primary key

How a Mashup Works: APIs

- API is an abbreviation for **Application Programming Interface**, a set of routines, protocols, and tools for building software applications. A good API makes it easier to develop a program by providing all the building blocks. A programmer then puts the blocks together.

- Google Maps has a wide array of APIs that let you embed the robust functionality of [Google Maps](#) into your own website and applications, and overlay your own data on top of them.
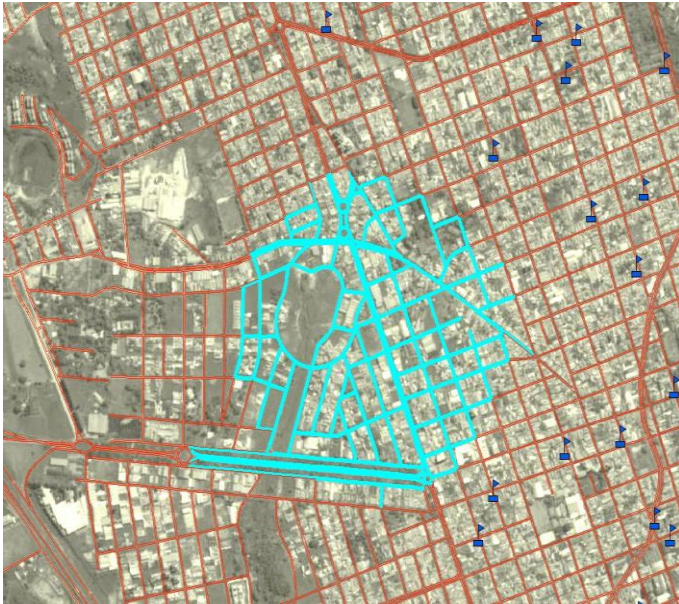
Example of a Mashup

- A web application that combines data from more than one source into a single integrated tool

  - an example is the use of data from Google Maps to add location information to statistical data, thereby creating a new and distinct web service that was not originally provided by either source
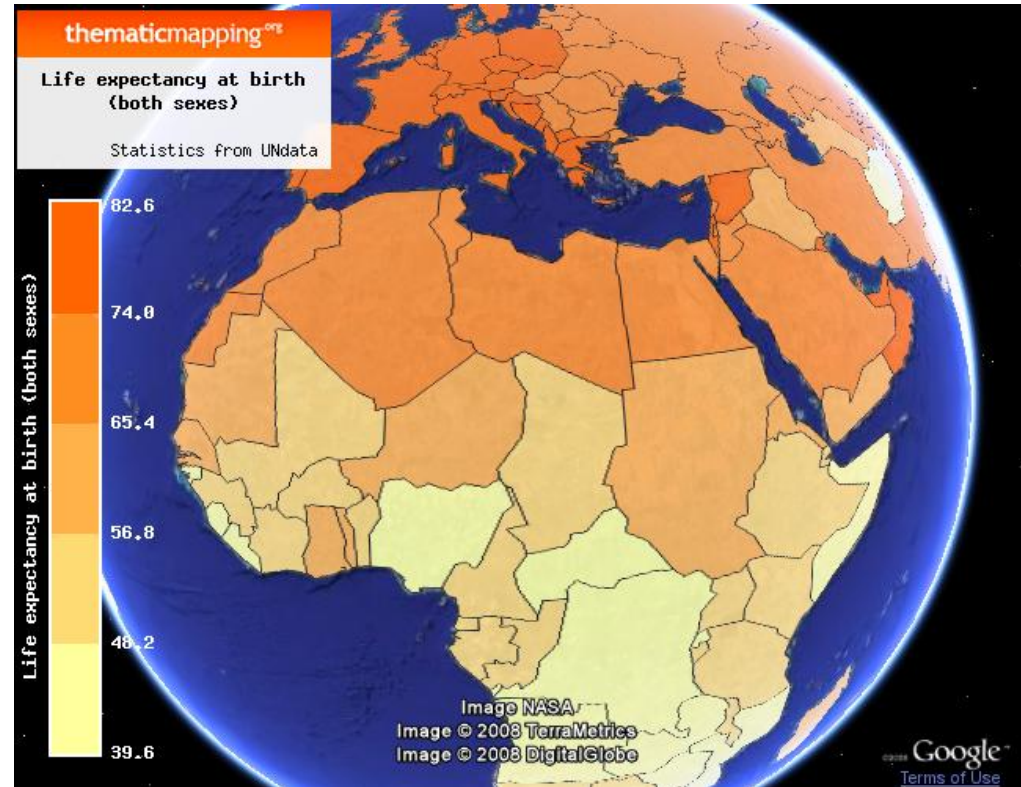
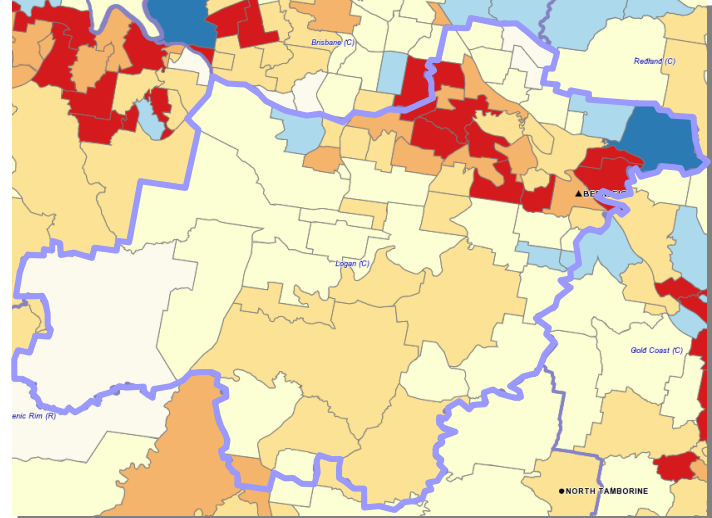# Polygons Representing a Unit or Groupings of Units

Block Face
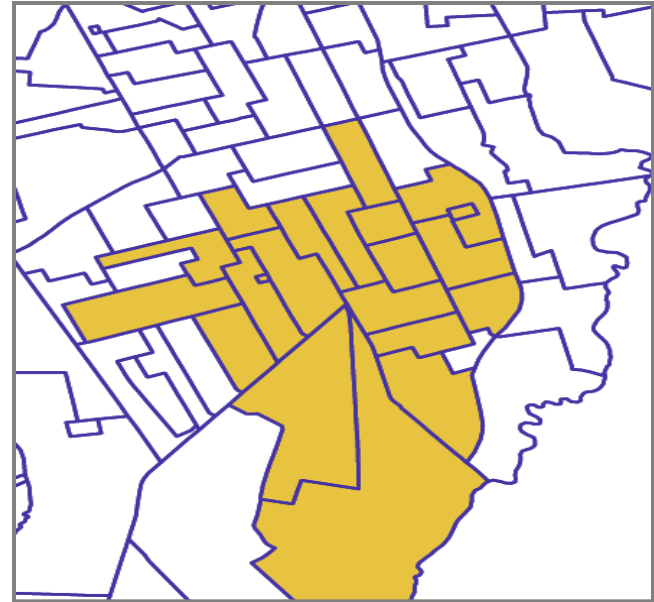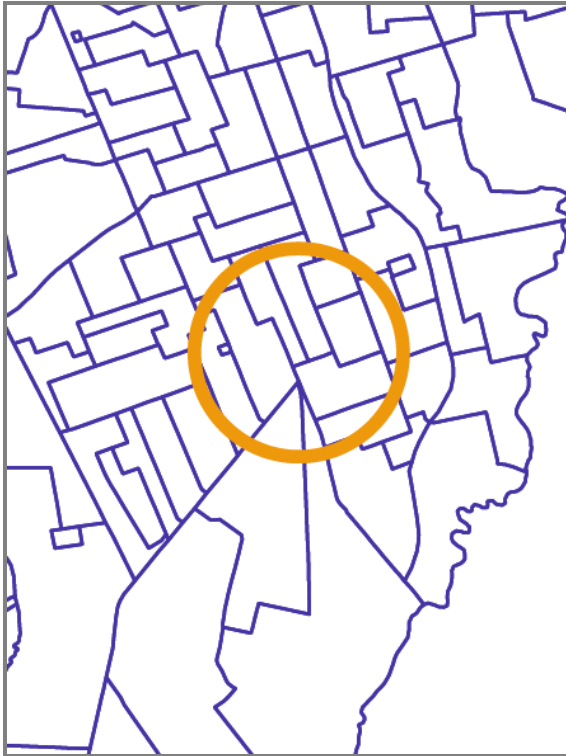

Mesh Blocks

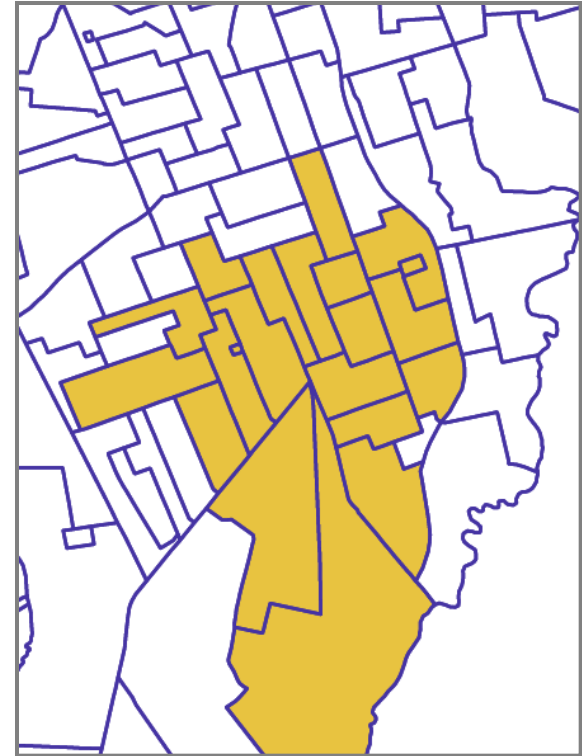# Higher Level Aggregations

Census Districts/Post codes

Local Government Areas

From Polygons to Points of Relevance

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

area of interest
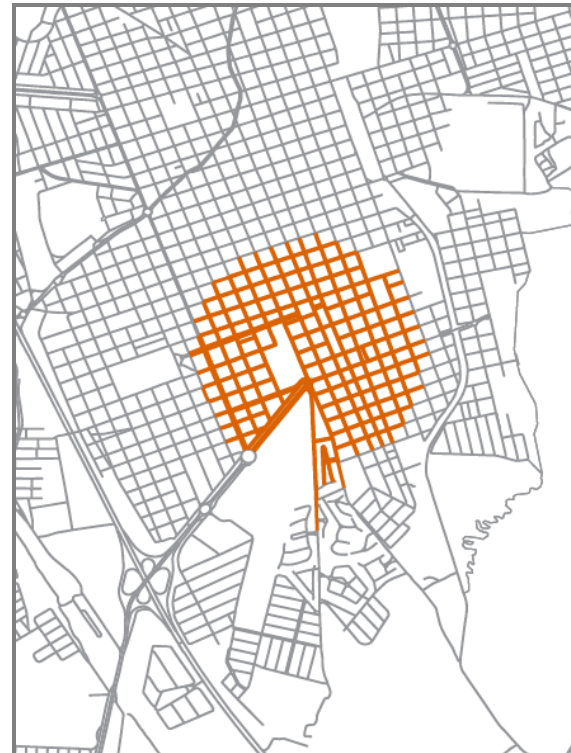
intersection result

Smaller Polygons, More Precise Data

Confidentiality the key constraint

But users demand (and will supply) POR data

area of interest

intersection result

Location Analytics/ Spatial Analysis: Pulling the Information Together

- Greater, better use of information at specific location helps promote further integration;

- Confidentiality a major issue. Countries need to define clear boundaries. Crowd Sourcing, VGI and mobile device will push this boundary;

- Location Analytics provide location-based evidence to solve problems and gain insights;

- Many organizations actively developing Location Analytics.