

The Brazilian experience in updating geographic databases for surveys and census

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Summary

- About Brazil and IBGE's Structure
- Integration of statistical and geographic information
- 2010 Population Census
 - Census mapping in geographic database.
 - Integration of cartography and address file.
 - Use of GPS to update to reference buildings.
- Updates by Continuous Surveys and other sources in keeping address lists current
- The use of aerial and satellite imagery available to improve census geographic database

BRAZIL	
	Land area 8,515,767,049 km ²
	Sea area 3,600,000 km ²
	States 26 and DC
	Municipalities (2013) 5,570
	Population - 2010 Population Census 190,755,799

IBGE's Structure

Presidency

		National School of Statistical Science



Agencies (578)

Integration of statistical and geographic information

The close integration of geographic information in statistical applications yields large benefits to NSOs as it reduces the cost and time required to collect, compile and distribute information, and leads to a greater number of services and a much wider use of statistical information, thereby considerably increasing the return on investment in data collection.



IBGE = Geographic Information + Statistical Information

Aplications: Censuses / Spatial Data Infrastructures

The 2007 Censuses Innovations

More than 5 million agricultural holdings georeferenced with GPS



Integrated Territorial Database to support 2010 Census

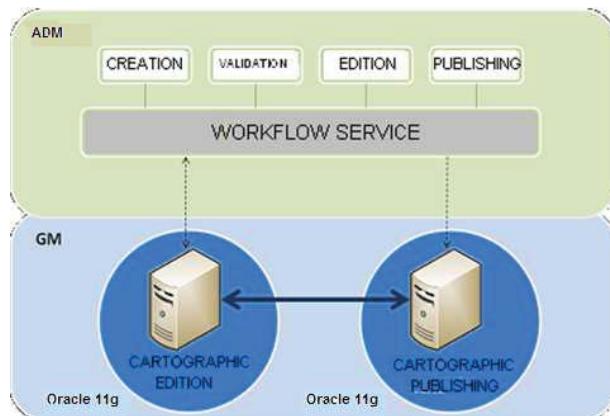
CNEFE – The Brazilian Master Address File

- file associated to blocks and block-face in urban enumeration areas
- Geometrical integration of urban and rural limits for each Municipality

SISMAP – Brazilian System for Census Mapping

- It tool developed for municipal mapping in a single continuous spatial database
- Input data from several sources of vector and imagery data, like GIS, GPS, satellite imagery and aerial photography

SISMAP - GeoDatabase Structure



- production of Municipalities mapping from a single continuous spatial database
- input data from other sources of vector and imagery data

Data Schemas

SISMALHA – Legal limits, boundaries, enumeration areas

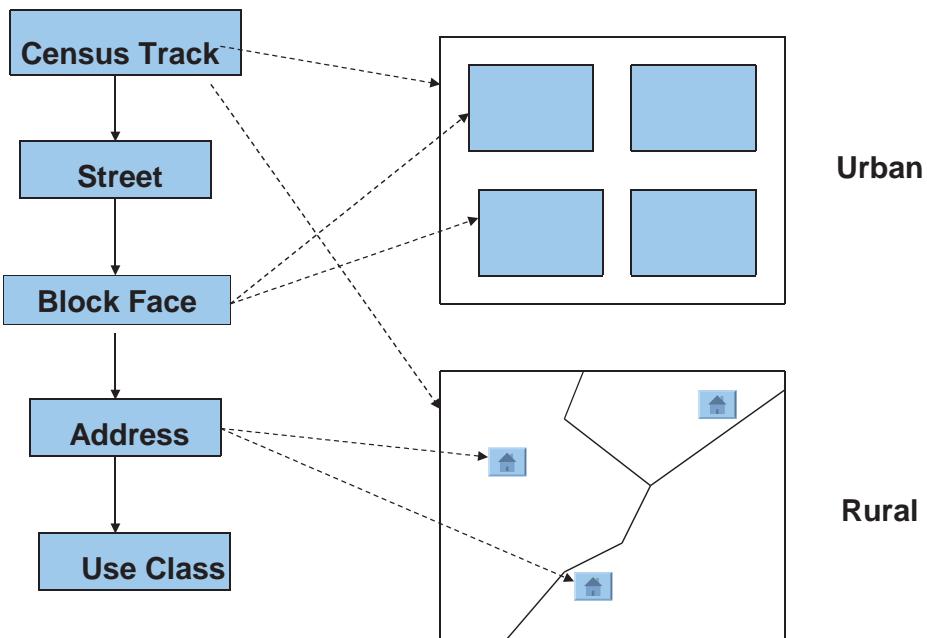
SISTOPO – vectorial topographic maps in 1:25,000 scale or smaller

SISBASE – cadastral maps at the 1:2,000 to 1:10,000 scales produced by digitalization or updated from GPS

SISATUA – updates using GPS for the vectorial topographic maps

Address File Structure

IBGE



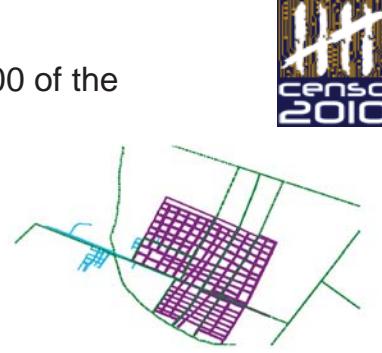
2010 Population Census

IBGE



Mapa Temático - I				
ENTID	TXTMEMO	COD_SETOR	QUADRA	FACE
75	R SIQUEIRA CAMPOS	360745605000004	001	999
76	R SIQUEIRA CAMPOS	360745605000003	001	999
83	R GUALTER LUIS FERNANDES	360745605000003	005	002
86	AV ROBERTO RAMOS FERNANDES	360745605000001	001	999
87	AV ROBERTO RAMOS FERNANDES	360745605000003	001	999
88	R ESTACIO FERREIRA MACHADO	360745605000004	003	999
89	R SEM DENOMINAÇÃO	360745605000005	002	999
90	R AGENOR S DE OLIVEIRA	360745605000002		999
91	R SEM DENOMINAÇÃO	360745605000005	001	999
92	R MARCIANO DE SOUZA	360745605000001		999
94	R SARATINO DANICI	360745605000004	004	002

- The “Pre-collection” Operation
 - Only urbanized areas (with block) 224.000 of the 314.000 census EAs
 - Map updating with GPS (blue faces)
 - Collecting addresses
 - Block Face characteristics - “Entorno”
- Enumerator uses the “Pre-collection” address list



• Streets –	3,732,066
• Faces –	10,360,217
• Addresses –	82,996,347
• SN(No numbering):	19,102,287

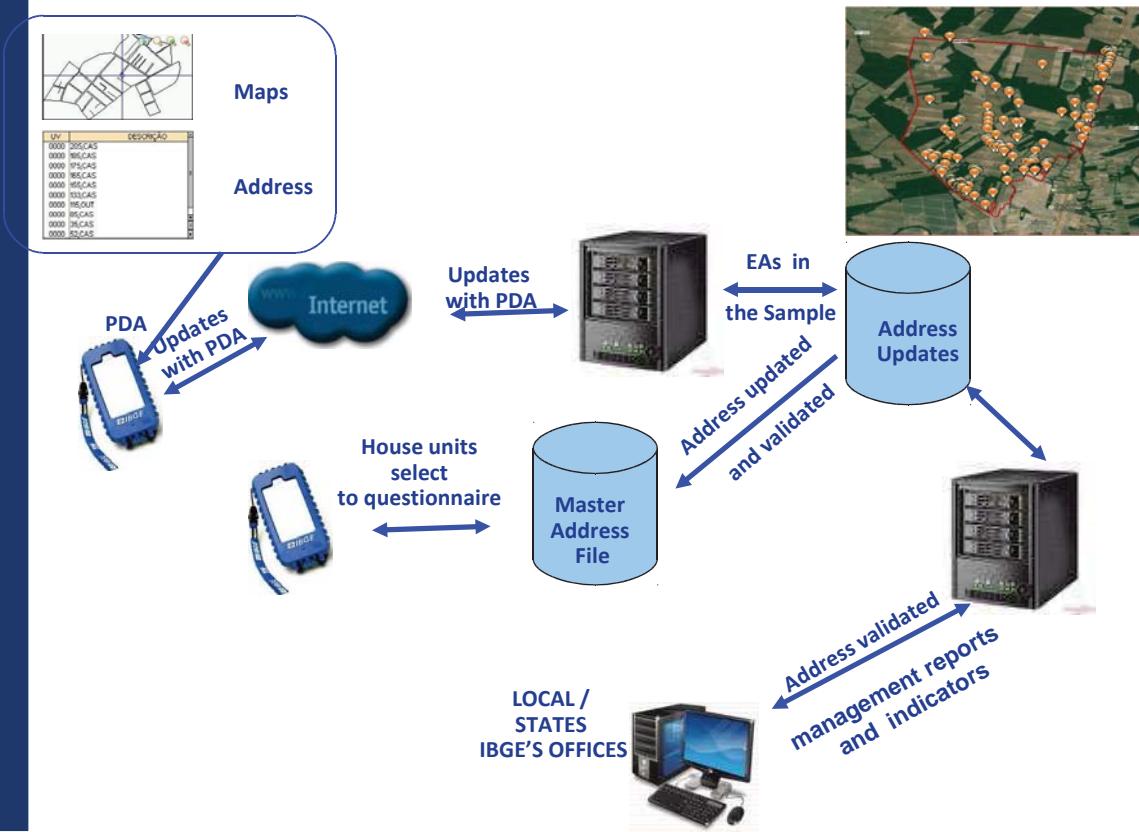
2010 Census Application

The screenshots illustrate the census application's interface for address location and mapping:

- LOCALIZAÇÃO - QUADRAS/FACES:** Shows a list of blocks (QUADRAS) and faces (FACES) for the area "LOGRADOURO". The list includes:

QUADRAS/FACE	LOGRADOURO
004	003 RUA FRANCISCO DE CÁ
008	001 RUA DONA MACRINA
008	006 RUA DONA MACRINA
008	007 RUA DONA MACRINA
- ENDERECOS:** Shows the address "RUA OVIDIO ALENCAR ARARIPE" with "QUADRA: 001" and "FACE: 001". Below is a table of units (UV) and descriptions:

UV	DESCRIÇÃO
0000	205,CAS
0000	185,CAS
0000	175,CAS
0000	165,CAS
0000	155,CAS
0000	133,CAS
0000	115,OUT
0000	85,CAS
0000	35,CAS
0000	52,CAS
- LOCALIZAÇÃO - QUADRAS/FACES:** Shows a map of the area with a grid overlay, indicating the location of the previously listed addresses.



Updating Challenge – Address File

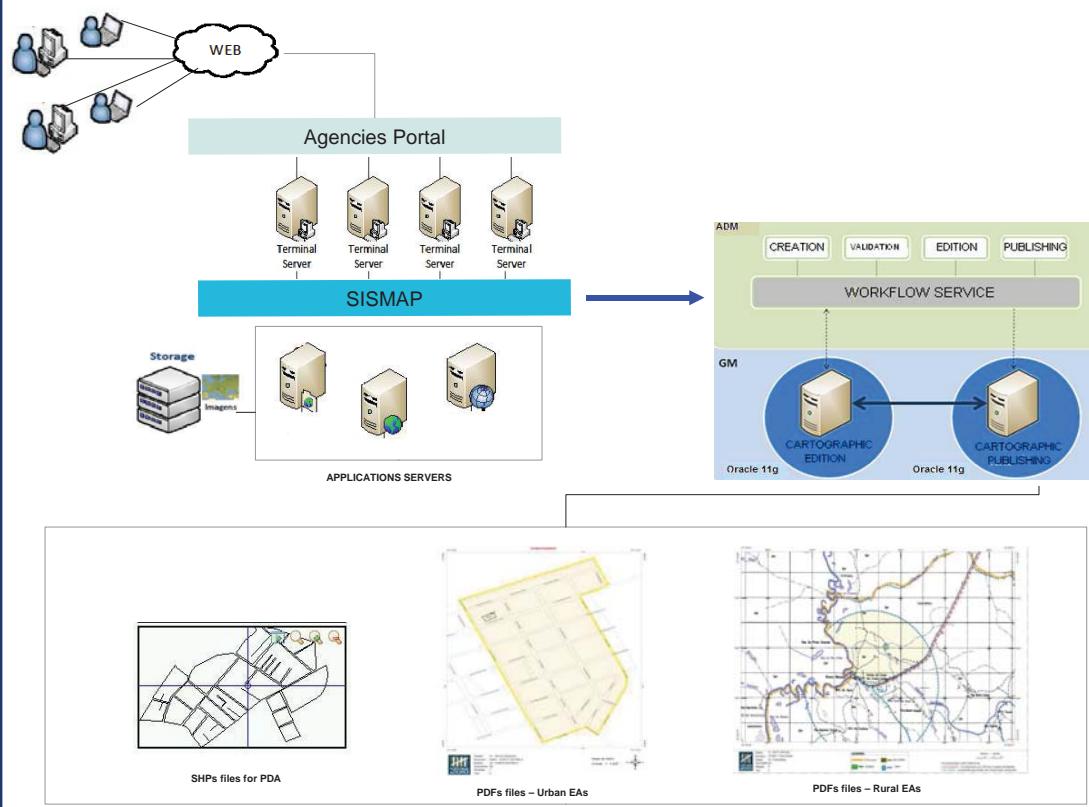
- Alternatives
 - IBGE's field operations in continuous Surveys

EAs (2013) – 316,579

Updated beyond 2010:	28,454
With one updates:	23,374
With more updates:	5,080
hole updates:	33,534

- External Cadastre Incorporation – Energy
- Address-match geocoding requires a database of properly-formed addresses and analyzes of different classification in household
 - Local Administration
- Customized GIS, training – demand on develop abilities
 - Postal Service
- Demand on uniforming types, titles, names and zip code

Updating the Census Geodatabase



Using aerial /satellite imagery to improve Geodatabases



RAPIDEYE (5 M) 2011 e 2013 <= 1:25,000

SPOT 5 HVR (2,5 M) <= 1:10,000

QUICKBIRD 2 (0,6 M) /
WORDVIEW 2 e GEOEYE 1 (0,5 M) <= 1: 5,000

AERIAL PHOTOS <= 1: 2,000



Advantages

- Updated coverage of very large low cost-low-resolution images areas;
- Variety of information can be extracted from the images;
- Updating topographic maps in rural areas.

Difficulties

- Resolution of some images is not sufficient for the required application;
- The cloud cover and vegetation restricts the interpretation of the image;
- Image processing requires great technical skill.

National Mapping Agency and / or military maps.

Municipal governments - may include urban or planning areas.

Private organizations of spatial data.

Difficulties

- quality of georeferencing data
- knowledge of different data models and topological rules
- objective of the original mapping may not complete the object area
- GIS technology requires technical skill and training;





National Spatial Data Infrastructure of Brazil - INDE

- Established by Presidential Decree 6666 of November 27, 2008
- Coordinated by the National Commission on Cartography - CONCAR

<http://www.visualizador.inde.gov.br/>

The goals

- To promote the proper generation, storage, access, share, dissemination and use of geospatial data produced at federal, state, and municipal level
- To promote the use of standards and specifications certified by the National Commission on Cartography – CONCAR
- To avoid duplication of efforts and waste of resources in obtaining geospatial data by public administration bodies



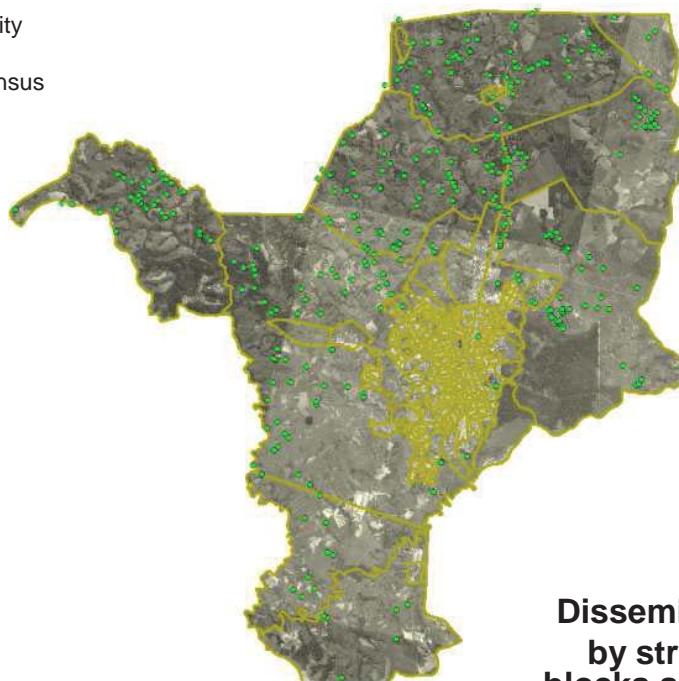
The new web based technologies allow NSO to produce **Census Mapping** in a full digital way, integrating maps, enumeration areas boundaries, graphic and text files, and addresses register.

Availability and investments in satellite images of high resolution would extend the update of the morphology of urban and rural areas, the contours of the EAs and consequently the road infrastructure that connects these regions, improving the Census Maps.

A permanently updated register is a basic condition for the good quality of statistical information and the determination of new tasks in the scope of the national statistics system. **A big challenge is how to manage the balance of disclosure risk with dissemination of spatial statistics.**

New ways to disseminate statistical data

Rio Claro municipality
SP State
Results from 2010 Census



**Dissemination
by streets,
blocks and user
defined areas**

The statistical infrastructure represented by these registers opens several possibilities for the Brazilian agricultural and statistical surveys



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Thanks!

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