Cloud-based Geospatial Information Services

- With the case study on the Platform for Common Geospatial Information Services (Tianditu)

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June 11, 2014 Beijing
Outline

■ Why web-based services instead of data providing?

■ What the ‘one-stop’ service platform can do?

■ The case of Tianditu – the Platform for Common Geospatial Information Services in China
Surveying and Mapping Agencies in China

**NASG**: National Administration of Surveying, Mapping and GeoInformation
Multi-scale Topographic Map in China

National invested and maintained
- 1:4 m
- 1:1 m
- 1:250k
- 1:50k
- 1:10k
- 1:2000
- 1:5000
- 77 map sheets
- 816 map sheets
- 24218 map sheets

Provincial invested & maintained
- 1:500

Municipal invested & maintained
- 1:500

Cover 50% territory
Cover built-up area of most cities

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Problems Encountered in data sharing and integration

- Administration
- Decision Making
- Disaster Reduction
- Engineering
- Public Services

Urgent requirements from various fields

Point-to-point data providing
- Inefficient
- Expensive (technology, time, money by the end users to handle the spatial data)
- Difficult to update
- ...

Isolated Information ‘Island’
- Managed by different agencies, difficult to integrate
Requirements from public

- Most of the data products are classified, complicated, not ready-for-use for public

- LBS
- Mobile network
- VGI / Crowdsourcing
Solution to the problems/requirements

- "One-stop" portal
- 7 × 24 Hours on-line Services

Platform for Common Geo-Spatial Services

- National: 1:1M, 1:250K, 1:50K
- Provincial: 1:10K, 1:5K
- Municipal: 1:2K, 1:1000, 1:500

Service Integration:
- Unique data standards
- Distribute & autonomous
- In time updating
- Services providing instead data-providing
- Dominated based on common-agreed rules
- ...

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Outline

- Why web-based services instead of data providing?

- What the ‘one-stop’ service platform can do?

- The case of Tianditu – the Platform for Common Geospatial Information Services in China
- Integrate distributed spatial data resources
- Provide an unified spatial data framework for statistical & social/economic information representation, analysis, ...

![Diagram showing the integration of various data resources and services.]

- Social/Economic Data
  - Integration
  - Value Added
  - Location Based Services
  - Statistical Information

- The Platform
  - Integrated spatial data infrastructure
  - Value Added

- Public
  - Governments, Professional Agencies

- Thematic Spatial Data
  - Industry
  - Gov. Agency
  - Public

- Surveying and Mapping Data
  - National
  - Provincial
  - City
Outline

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- What the ‘one-stop’ service platform can do?
- The case of Tianditu – the Platform for Common Geospatial Information Services in China
TianDiTu(Map World) (http://www.tianditu.com)

• Started to build in April, 2010;
• Beta version was released on Oct. 21, 2010;
• Version 2011 was released on Jan. 18, 2011
• Version 2012 was released on March 2012
• Version 2013 (with English version) was released on March 2013
• Intranet version (in Chinese E-government network) was released on May 2013
General Structure of the Platform

- **Government Network (Intranet):** for e-government users
- **Public Network (Internet):** for public users
Operation Pattern of the Platform

- **SOA Structure Distributed Data Center**

Service management system

Portal & website

Access Interface

User

HTTP/JS

Access Interface

National Node

Data center 1

Data center 2

Data center 3

Prov. Node

Prov. Node

Network

Municipal Node

Municipal Node
Rules and regulations

- 关于认真做好地理信息公共平台建设工作的通知（国测成字[2008]7号）
- 关于印发地理信息公共服务平台专项规划的通知（附国家地理信息公共服务平台专项规划（2009-2015））（国测成字2009-1）
- 关于加快推进国家地理信息公共服务平台建设的指导意见（附国家地理信息公共服务平台技术设计指南）（国测成字2009-7）
- 关于加快公众版地理信息公共服务平台建设的通知（国测信发[2010]1号）
- 关于印发贯彻落实国家地理信息公共服务平台共建工作目标责任书实施方案的通知（国测信[2010]13号）
- 关于印发“天地图”省市级节点建设方案的通知（附“天地图”省市级节点建设方案）（国测信发[2011]1号）
- 关于做好“天地图”省市级节点服务接入测试有关工作的通知（国测信发[2011]2号）
- 关于加强天地图建设与应用工作的通知（国测信发[2012]3号）
- 关于做好2013年天地图建设与应用工作的通知（国测信发〔2013〕3号）
- 关于加快数字城市公众服务系统接入“天地图”主节点工作的通知（测办〔2013〕24号）
- 关于在政务外网提供天地图在线地理信息服务的函（国测函〔2013〕53号）
- 关于开展2013年天地图省市级节点服务评估工作的通知（测办〔2013〕53号）
Technical standards

Data Model, Product Specification, Interface, etc., including National Standards and Industrial Standards

- 《CH/Z 9010-2011 地理信息公共服务平台地理实体与地名地址数据规范》
- 《CH/Z 9011-2011 地理信息公共服务平台电子地图数据规范》
- 《CH/Z 9018-2012 地理信息网络分发服务元数据内容规范》
- 《CH/Z 9019-2012 地理信息元数据服务接口规范》
- 地理实体数据规范
- 地理信息 兴趣点分类编码
- 志愿者地理信息服务数据采集规范（获科技部支持）
- 网络地理信息服务分类与命名规范
- 三维导航电子地图产品规范
- 室内外一体化导航与位置服务地理信息系列标准

列入2013国家标准计划
列入2013行业标准计划
Data published in the National Node

- **overseas**
  - 1:1M vector data; OSM data
  - 250 meter image (global); 30 meter image (neighbour countries); 2.5-2.1 meter image (parts of)

- **Domestic**
  - 1:250K and 1:10K vector data with placenames and POIs (the whole country), **updated twice a year**
  - 2.1-2.5 meter satellite image (the whole country), **updated once a year**
  - 0.5 meter satellite image or aerophotos (built-up area of about 490 cities), **updated irregularly scheduled**
  - Public traffic data, streetscape in more than 100 cities
  - Tourism, population, etc.
  - 3D building models for 6 cities
  - ...

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Map browse - globe view
30 meter image (Cambodia)
2.1 meter image (Australia)
Vector data (with placename and POI)
2.1-2.5 meter satellite image
0.5 meter satellite/aero image
3D view
Streetscape
3D Building Model
Feature-based query
Routing for car and bus
Integrate the population data
Spatially represent the statistical yearbook information
2012年08年
工业增加值_同比增长(%) 13.3
Integrate social/economic information
Integrate tourist information
Service URLs and APIs
Softwares

- User management system
- Services management system
- Data management system
- Data processing systems

Registration, management, ...

Application system

Protoral

Interface/API

On-line service system
- Catalogue
- WMS
- WFS
- WPS

Framework data
- Entity
- Add.
- Cache
- 3D
- Street scope
- Vector
- Image

- DLG
- DEM
- DOM
- DRG
Data Processing Systems

Cartography tools
Tile produce
Tile exchange
Format transform
Quality control

Data management system

Geo-entity processing
Address/POI processing
Image processing
3D modelling
VGI processing
Clustered Image Processing System (CIPS)

- Automation
  - Auto matching
  - Auto scheduling
  - Preprocessing support

- High productivity
  - Multi-nodes distributed
  - Collaborative data reading, processing and storage
  - Enhanced workflow and productivity

Can finish the processing of the 2.5 M satellite image, 26000 Square Kilometermeter with 7 hours (products include DOM and DEM)
Data Management System

Data Sources:
- On-line data
- Product
- Main database
- Source data

Data Processing Flow:
1. **Data Extraction**
   - For Intranet: Build and extract geographic data based on GBT13923-2006 code standards.
   - For Internet: Extract data from corresponding geographic data.
2. **Data Transformation**
   - Format conversion
   - Code conversion
3. **Data Structuring**
   - Database organization
4. **Data Processing**
   - Consistency processing
   - Object representation
5. **Data Validation**
   - Quality inspection
   -成果数据

For Intranet: Geographic data from various sources are integrated and processed to ensure consistency and accuracy.

For Internet: Geographic data is extracted and transformed to meet specific requirements, ensuring data integrity and usability.

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Cloud-based On-line Service system

On-line data storage

Spatial searching

Global Load Balancing

Computers and network in single node
Web & Mobile Websites
Provincial and Municipal Notes

- 30 provincial nodes and 107 municipal nodes have been established
- All nodes have been connected via OGC protocols
Distributed Data Centers

- **National**: back-up each other; divert page view
  - Beijing, Tianjin, Kelamayi, Hunan
- **Regional**: upgrade the provincial software; merge the provincial data into the national data; divert local page view
  - Gansu, Jiangsu, Heilongjiang, Jiangxi, Hubei

Global Load Balancing
Before national-provincial data merging

- Concurrent response for tile map browse service exceeds 15000 times/sec
- Concurrent response for POI search service exceeds 2000 times/sec and response time less than 0.6 seconds
- Support page view 4 million/day;
- System reliability improved, maintenance workload reduced, the hardware cost is reduced by 40%

After merging
Tianditu

Other map website
Tianditu has drawn great attentions

- More than 0.7 billion visits from 216 countries/regions since Oct. 21, 2010;

89.21% from China Main
Thousands of applications have been established based on TIANDITU

- For Governments
- For key projects
- For Professional departments
- For emergency response
- For public services
- …
For Key National Projects
For Professional Department

Ministry of Water Resources
For Professional Department

State Administration of Work Safety
Air quality (PM 2.5)
Primary School Campus information system
Land Resource Management

Mine Resource Management
Channel management
Geology information
Integration and sharing
Cultural Heritage Management
Disaster management
For public service
Emergency response
A Whole System for GeoSpatial Data handling, mapping, maintenance and service

Data processing

Data → Service → Application

Technical Supporting, Training, technical cooperation, joint-venture, etc
...a long way to go

• **Requirements--- Improve the performance of the services**
  – high performance for map browse, query and processing;
  – various easy-to-use functions;
  – Interfaces for multi-browser, devices, network;
  – ...

• **Research /technique issues**
  – Cloud
  – advanced visualization, virtual reality and multimedia methods
  – open standards of service, system architectures, geospatial information
  – legal issues, information security
  – ...

Any kind of cooperation welcomed!
Thank You.

谢谢