FOSS4G for Global Urban Goals and K-Smart City

DATE | 2016. 8. 31

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CONTENTS

1 | SDG and Open Source GIS
2 | Emerging Mega Cities
3 | FOSS4G and New Urban Agenda
4 | FOSS4G and K-Smart City
Urbanization and Urban SDG

- Rapid urbanization in developing countries and cities are the center of achieving Urban SDG (SDG #11)
- Global dev. goals transition from MDG to SDG (2015)

Next step for New Urban Agenda

- UN HABITAT III conference will set up the New Urban Agenda in accordance with the SDG 11, URBAN SDG

All these activities are related to spatial phenomena

- What is the role of GIS to uniformly monitor and implement the global urban goals & the agenda?
- What FOSS4G can do for the K-Smart City?
FOSS4G for UN SDG and Developing Countries

- Regarding the role of SDG, FOSS4G Seoul 2015 dealt with such discussions
- UN open GIS was an outcome of such collaboration between UN and FOSS4G community

FOSS4G for Global Urban Goal and Agenda

- Analyze the open database from UN agencies and Multilateral Development Banks (MDB), etc. to measure and monitor the goal and agenda
- In case of urban SDG, it is possible to develop a monitoring system based on the open data and FOSS4G solutions such as GeoNode, Open layers
Emerging Mega Cities
Rapidly urbanizing cities

**Traditional urban structure**
- Concentrated to a urban core
- Multinuclei,

**Motorization**
- Suburbanization
- Urban-region

**Dev. of ICT**
- Decentralized, Decentralized concentration, etc.
- Urban network

**Housing Shortage**  **Transportation**  **Disaster/Crime**  **Environmental pollution**  **Energy**  **Community Spirit**
Urban Policy and Prosperity

• New generation of National urban policies
• Urban patterns for a green economy through City region planning
• Creating sustainable urban space through Planned city extensions
• Implementation through Land readjustment

SDG Measurable Indicators for Developing Countries

The wheel of urban prosperity (UN Habitat, 2012)
## GOAL 11
Make cities and human settlements inclusive, safe, resilient and sustainable

### Sub Goals
- 11.1 Affordable housing
- 11.2 Sustainable transport systems
- 11.3 Human settlement planning
- 11.4 Cultural and natural heritage
- 11.5 Decrease disaster
- 11.6 Environmental impact of cities
- 11.7 Green and public spaces
- 11.8 Nat’l & regional dev. planning
- 11.9 Hyogo Framework
- 11.10 Sustainable & resilient buildings

## GOAL 9
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

### Supportive goals
- 9.1 Resilient infrastructure
- 9.2 Sustainable industrialization
- 9.3 Access of small-scale industrial
- 9.4 Upgrade infrastructure
- 9.5 Enhance scientific research
- 9.6 Resilient infrastructure dev.
- 9.7 Domestic technology dev.
- 9.8 Increase access to ICT
Measurability
Quantifying the indicators using GIS

- Land cover
- Population Growth
- Public transportation

Efficient land use

National budget for heritage

Ratio of land consumption rate to urban population growth rate

Proportion of population resilient/robust to hazards and climate-related events

Number of people killed, injured, displaced, evacuated, relocated, by disasters

Proportion of income spent by urban families on transport

Jobs in the metropolitan area can access within 60/75 minutes without a private car

Financial support that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings

Cities implementing risk reduction and resilience policies that include vulnerable and marginalized groups

Built-up areas of cities in open space in public ownership and use

Number of housing units damaged and destroyed by disasters

Percentage of urban solid waste regularly collected

Proportion of the population that has a public transit stop within 0.5 km

Developing Countries

Developed Countries

Open-source GIS

Less-developed Countries

Multilateral Development Bank

NGO

United Nations
GIS Open Source S/W & Data

- Comprehensively collecting various field’s time series spatial data
  population, housing, land cover, environmental, ecological, infrastructure, river etc.

- Open data accessibility
  Any one can access and it needs a accountability in case of public domain data

- Easy work orchestration with open source data and FOSS4G
  Disaggregated analysis, combine text data like statistics

- Weak data infrastructure form spatial information divide of developing countries
  Use of remotely sensed data in those countries

- Solutions to technological issues
  Standardizations like coordinate systems and data
Benefits of application in Urban Field

Functional value:
- Fit of task
- Maturity of Open source software
- Usability
- Achievement of self-reliance on technology

Public value:
- Diffusion of spatial information knowledge
- Openness of spatial information and enhancement of its sharing

Economic value:
- Industry ripple effect
- Total cost of ownership
- Reusability

Data construction
Data management
Data sharing
Data utilization service

Source: Adapted from Junyoung Choi et al., 2016
- **Land and Housing Policy support Systems**
  - **National Spatial policy Information**: National Spatial Data Infrastructure (NSDI) system, GIS-based integrated building information, Spatial Big Data system (on-going) etc.
  - **Land Policy Information**: Korea Land Information System (KLIS), Real estate Transaction Management System (RTMS), Land for Housing information system, Onnara Real Estate Information Portal, etc.
  - **Housing Policy Information**: internet-based Architecture Information System (e-AIS), Housing supply statistics information system, Bogeumjari housing integrated information system, Rental housing information system, Housing allowance information system, etc.
  - **Urban Policy Information**: Urban Planning Information System (UPIS), Land suitability assessment, Restricted Development Zone Management Information System (RDZMIS), Land Use Regulation Information System (LURIS), factory location support system, etc.

- **Land and Housing Information**
  - Land and Housing Spatial Information
  - Land and Housing Business Information
  - Land and Housing Statistics
Tackling issues with GIS and Big data

Provide alternative urban spatial measures between regions

Dev. Restricted Zone

Urban Plan Information

Ecological zoning

Level of public transit supply

Sprawl around Jakarta Metropolitan Area, Indonesia

25k

Sprawl around Santa Cruz, Bolivia

Base map: Open street map
Imagery: arirang.kari.re.kr
Tacking issues with GIS and Big data

Could Big Data provide alternative measures for poverty and welfare?

Affordable Housing demand
Mobile phone data & Consumer credit scoring data

Affordable housing demand
Low income group
Senior citizen households

Someone who is just starting out in a career
University student

Mass transit planning
Transportation smart card

Affordable Housing demand

Affordable Housing demand

Low income group

Senior citizen households

Someone who is just starting out in a career

University student

Senior citizen households

University student
# FOSS4G application in urban field: Examples

<table>
<thead>
<tr>
<th>Some Project</th>
<th>Data</th>
<th>Interface</th>
<th>Open Source Applied</th>
<th>Spatial data processing tech.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water supply network management system of a Korean local gov.</td>
<td>Raster/Vector</td>
<td>WMS/WFS</td>
<td>Open layers2, Geo Server, MySQL</td>
<td>Processing and representation of line data using Geotools, need additional data handling like insert water supply network</td>
</tr>
<tr>
<td>Hazardous material safety transportation management system of a Korean gov.</td>
<td>Raster(Open API)</td>
<td>WMS, Vector using native coding</td>
<td>Open layers2, Geo Server</td>
<td>Link external data using Open API which is needed to monitor the hazardous vehicle</td>
</tr>
<tr>
<td>Geobolivia</td>
<td>WMS, WFS, WCS, CWS, T-WFS</td>
<td>WMS, Intermap, Kamap, Openlayers</td>
<td>Geo Server, MapServer, Deegree, Geonet work</td>
<td></td>
</tr>
<tr>
<td>Online What If Planning Support System</td>
<td></td>
<td></td>
<td>PostGIS, PostGIS, Couch DB</td>
<td></td>
</tr>
<tr>
<td>Wildfire management tool(WMT), World Wind project</td>
<td>REST</td>
<td>WebGL, Globe</td>
<td>WMT REST Service 2, PostGIS, GeoServer, MySQL</td>
<td>Computing Fire Behavior Using selecting fuel models, adjusting and conditioning the fuel to the environment and computing the &quot;fine&quot; fuel moisture content based on solar heating combined with the cooling effect of wind</td>
</tr>
<tr>
<td>Word Bank PUMA 1)</td>
<td>Google map</td>
<td>Google Maps API, Openlayers2, ExtJS</td>
<td>Google Maps API, Openlayers2, ExtJS, Pycsw(OGC CSW Server Implementation)</td>
<td>Word Wind</td>
</tr>
<tr>
<td>1) PUMA: Platform for Urban Management and Analysis</td>
<td></td>
<td></td>
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</tbody>
</table>
| 2) CPS internally uses WMS Map Servers, USGS Landfire Servers, etc.
#3 New Urban Agenda and FOSS4G
New Urban Agenda

Sendai framework for disaster risk reduction 2015-2030

Instanbul action plan for least developing countries

Instanbul action plan for least developing countries

Small Island Developing States Accelerated Modalities Of Action (SAMOA) Pathway

Collect and analyze confident and transparent urban data
# HABITAT III policy unit and FOSS4G

<table>
<thead>
<tr>
<th>Policy Unit</th>
<th>Data</th>
<th>FOSS4G</th>
</tr>
</thead>
</table>
| 1. Right to the City and Cities for All         | • Measure the formal and informal sector equitably using the spatial information  
• Provide decision support information for the citizen participation | • Georeferencing of social network data such as Twitter, Facebook, etc.  
Community Mapping                                                             |
| 2. Socio-Cultural Urban Framework               | • Open up and construct socio-cultural POI inclusively               | • Mashup technologies                                                 |
| 3. National Urban Policies                      | • Using NSDI not from government agency but from private sector including Open Street Map | • Land Management System(LMS)  
Diffusion of LMS to local area                                                 |
| 4. Urban Governance, Capacity and Institutional Development | • Consolidated data between for urban and rural area  
Consolidated data for the international comparison | • Linking national and regional data seamlessly  
Setting the area of interest                                                   |
| 5. Municipal Finance and Local Fiscal System    | • Improving transparency and accountability by opening and standardization of municipal finance data  
• Spatial reference of municipal finance data | • Municipal finance monitoring system  
• Municipal government climate change finance system                          |
<table>
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<th>FOSS4G</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Urban Spatial Strategies: Land Market and Segregation</td>
<td>• Spatial Information which can detect urban sprawl or expansion of metropolitan area</td>
<td>• Sustainable urban design system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Land market monitoring system for prevention of segregation of land market</td>
</tr>
<tr>
<td>7. Urban Economic Development Strategies</td>
<td>• Open data for employment, income and population</td>
<td>• Linkage and standardization of International organization</td>
</tr>
<tr>
<td>8. Urban Ecology Resilience</td>
<td>• Data governance for the nature and ecology</td>
<td>• Urban ecology monitoring system of macro spatial unit</td>
</tr>
<tr>
<td>9. Urban Services and Technology</td>
<td>• Accessibility for the municipal data</td>
<td>• Open Smart City Consolidating FOSS4G</td>
</tr>
<tr>
<td></td>
<td>• Extraction and manipulation of municipal data</td>
<td>• Slum mapping, Informal Settlement detection</td>
</tr>
<tr>
<td>10. Housing Policies</td>
<td>• Incremental and inclusive data collecting approach for the affordable housing and informal settlement</td>
<td></td>
</tr>
</tbody>
</table>
8 type Scenarios based on U-City Vision
Case Study on Myong-Dong Streets (Korea Famous CBD)

#4
FOSS4G for K-Smart City
Korean version of Smart city: U-City
Bridging the gap between Information rich and poor countries

**Fundamental Service**
- Transportation Efficiency
- Management | Safety | Total Facility Management | Disaster/Fire Prevention

**Personalized Service**
- Parental Assurance | Personal Medical Service | Preferential Service

**Ubiquitous/Mobile Communication Device Service**
- U-Device | Notebook | Mobile Communication | PDA

**Spatial Service**
- U-Street | U-Park | Field Trip | Museum/Experience Center

**Wireless Communication**
- High-Speed Broadband Network

**Urban Integrated Operations Center**
- UIOC

**Sentinel Service**
- Forest Fire Alarm Sensor
- Disaster Detect Sensor
- Traffic Aware Sensor
- Pollution Detect Sensor
- Intelligent Sensor
- Underground Facility Detect Sensor
- USN (Ubiquitous Sensor Network)
- Water Contamination Sensor

**Environment Service**
- Environment Detect Sensor

**Traffic Service**
- Traffic Management

**Emergency Service**
- Emergency Service

**Facility Management**
- Facility Management

**Crime Prevention**
- Crime Prevention

**Parental Assurance**
- Parental Assurance

**Medical Service**
- Personal Medical Service

**Parental Assurance**
- Personal Medical Service

**Preferential Service**
- Preferential Service

**Ubiquitous Service within the City**
- U-Device | Notebook | Mobile Communication | PDA

**Data/Context Collection**
- Information Process

**Spatial Service**
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**Medical Service**
- Personal Medical Service

**Preferential Service**
- Preferential Service
Cases of new town U-City constructed by LH

**Sejong**
(Multifunctional administrative city)
- Integrated traffic info.
- Collection of traffic info.
- Provision of mass transit info.
- Installation and management of CCTV

**Youngjong**
(Incheon Free Economic Zone, IFEZ)
- U-City communication duct
- Mobile internet
- Installation of CCTV
- Urban integrated operation center

**Paju**
(New town)
- Bus information terminal
- Crime monitoring
- U-City communication infra.
- Street light and park light
Urban Information Operating Center

- Manage over 3,000 CCTV's and environmental monitoring sensors real time in the city (only some of CCTV's in the city)
- Integrated fire station, police station, traffic monitoring CCTV's into the center
- CCTV's and sensors are operated and monitored by GIS systems
- Have a plan to install more display boards

* Photos taken at 16 Feb. 2015
ISO/DIS 37120 Sustainable development and resilience of communities Indicators for city services and quality of life


Location is primary method for organizing Smart City Services

Smart Cities and Spatial technologies

- Framework for authoritative data → CitGML and GML Coverages(IndoorGML, InfraGML)

- Access and processing of geospatial information → OGC service-oriented architecture
OGC Smart Cities Spatial Information Framework

- **Deploying the spatial information**
  - Building a CityGML model of urban environment
  - Implementation of OGC services architecture for a broad set of applications
    - Sensor Web Enablement, Access Services, Discovery Services, Processing Services, Catalogue Services, Workflow, Context, Document and GeoPackages, Visualization and Augmented Reality

- **Open Data**
  - Public ability to access and use spatial data Reality

- **Crowdsourcing**
  - Crowdsourcing and Volunteered Geographic Information (VGI)
Example: OGC Smart Cities Framework

- **Urban Economic Analysis**
  - Urban economic modeling and effective spatial planning

- **Environment : Noise pollution**
  - 3D visualization of noise mapping based on the OGC CityGML standard

- **Common Operating Picture (COP) for emergency response**
  - Service architecture for a COP based on OGC Web Services

- **Energy indicator : Renewable energy sources**
  - Urban energy performance optimization
THANK YOU