Development of a Software Tool for Teaching Basic Concepts of Geospatial Standards

Morishige Ota
Kokusai Kogyo Co., Ltd.

Reese Plews
Plews Consulting

AutoCarto 2014
5-7, Oct. 2014
Pittsburgh, USA
1. What is **gittok** (geospatial information technology tool kit [jee-tock])?
2. What students can study with gittok?
3. Experimental trial to teach GIT with gittok
4. Issues in the future
5. How to download gittok and related information
Gittok is a study support software that assists both higher education students and industry professionals who are learning about Geospatial Information Technology (GIT) based on geospatial standards.

GIT is defined as a set of information technologies for modeling, acquisition, management, analysis, exchange and representation of geospatial information.

The specialized set of information technologies that support data acquisition, data storage and manipulation, data analysis, and visualization of geo-referenced data.

Dibiase, et al. (2007)
ISO/TC 211 Scope

Standardization in the field of digital geographic information.

These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations.

The scope is almost the same as the scope of GIT. Geospatial Standards are mostly consistent and implementable rules, and there are knowledge of GIT behind of the rules.
## GIT knowledge areas and related standards

<table>
<thead>
<tr>
<th>Knowledge Area</th>
<th>Related Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeling</td>
<td>ISO/TS 19103 – Conceptual schema language</td>
</tr>
<tr>
<td></td>
<td>ISO 19107 – Spatial schema</td>
</tr>
<tr>
<td></td>
<td>ISO 19108 – Temporal schema (not yet implemented)</td>
</tr>
<tr>
<td></td>
<td>ISO 19109 – Rules for application schema</td>
</tr>
<tr>
<td></td>
<td>ISO 19155 – Place Identifier (PI) architecture</td>
</tr>
<tr>
<td>Acquisition</td>
<td>ISO 19111 – Spatial referencing by coordinates</td>
</tr>
<tr>
<td>Analysis</td>
<td>ISO 19109 – Rules for application schema</td>
</tr>
<tr>
<td>Management</td>
<td>ISO 19115 – Metadata</td>
</tr>
<tr>
<td>Exchange</td>
<td>ISO 19118 – Encoding</td>
</tr>
<tr>
<td></td>
<td>ISO 19136 – Geography markup language (GML)</td>
</tr>
<tr>
<td>Representation</td>
<td>ISO 19117 – Portrayal</td>
</tr>
</tbody>
</table>

We simplified and modified schemata in the standards for the education.
What students can study with gittok?

Application schema design

Spatial analysis

Encoding and decoding

Data acquisition and editing of spatial data

Access and re-use of spatial data. Create metadata for personal geo-library.

Interactive map design
Application schema: conceptual schema for data required by one or more applications [ISO 19101]

It is used as the specification for data acquisition, spatial analysis, and map design

You can construct the application schema on the page called “Modeler”.
The rules for designing application schema are described as General Feature Model (GFM) in ISO 19109 – Rules for application schema.

Gittok uses simplified GFM.
Feature is an abstraction of real world phenomena.

A feature has properties (attributes and operations).

A feature may inherit properties of a parent feature.

An association describes a link from a feature to others.

An association also may have properties.
Attributes

Feature may have

spatial | temporal | place | thematic | attributes

The spatial attribute is one of several ways of describing the feature.
Several spatial attributes may be associated to the same feature.
A feature without spatial attributes is also possible.

Temporal attributes will be implemented in gittok in the future.
Operation is a function of a feature to get an attribute value.

An example:
A center of Maximum Inscribed Circle in the polygon.

Argument: a shape of building (= surface)

Return value: A center position.
An association describes a link from a feature to other features.

An association also may have properties.

An example: BtoR from building to its front roads.

Distance is an attribute of BtoR. Its value is derived from the operation called distancePtoC.
Attribute acquisition

You can digitize geometry, enter texts, images, movies, ..., in compliance with the application schema.
Acquisition of association instances

You can make association instance linking from features to others.

Association between features

Visualization of an association
Association between features without and with spatial attribute

A feature without spatial attribute

A feature with geometry
Association between features without and with geometry
Spatial analysis

You can execute the operation defined in the feature type.

1. Select a feature instance
2. Select the operation
3. Push the execute button
4. the result of the operation
You can describe a metadata for your spatial data.

Access to the data using metadata stored in the geo-library.
You can encode and decode data in gittok.
Representation

Symbol / label style design
  ↓
Symbol / label style dictionaries

Portrayal design
  ↓
Application schema

Portrayal schema
  ↓
Dataset (Kit)

Map editing
  ↓
Interactive map
Experimental trial to teach GIT with gittok

Title of the course:
   Human Interface 2
Department:
   Department of Information and System Engineering
   Faculty of Science and Engineering
   Chuo University
Duration:
   April – July, 2014
   90 min/lecture
   15 times
Participants:
   10 fourth-year
   undergraduate
   students

Type of the students:
I knew or I have heard of the words before the course

- Map services on the web
- Car / Human navigation
- Geospatial information
- Geographic information standards
- GIS
- Object oriented programming
- UML
- XML

The number of respondents: 9
Exercises and their evaluations

Introduction, hands-on experience with gittok

Students send the result of exercises by the e-mail to the teacher.

The teacher checks the results and evaluates the level of understanding.
The final project instead of the final exam.

Theme:
A map introducing the recommended places near the campus.

Submit
- application schema
- dataset (Kit)
- metadata
- symbol style dictionary
- label style dictionary
- portrayal schema
- map
- and the report to explain the practice.

Conditions
At least three features with
- shape, name, the reason of recommendation, and photo
as attributes
The best practice

Maki Yamada, 2014
The evaluation of the course by students

- **The usability of gittok**

- **The level of understanding (Knowledge areas)**

  - Modeling
  - Data acquisition
  - Management
  - Spatial analysis
  - Exchange
  - Representation

- **Legend**:
  - difficult
  - not difficult
  - understandable
Issues in the future

**Improvement of the software**
Implementation of temporal attributes
Encode/decode of maps to/from data with common format,
...

**Teaching materials**
Add examples
Improve slides for lectures

**Documentation**
Review and improve texts in gittok
English translation of the texts and instructions in gittok
How to download gittok

stinfodesign.net/gittok/

Version 0.2.0, updated 2014-09-02

Gittok is a study support software that assists both higher education students and industry professionals who are learning about Geospatial information Technology (GIT) and the basic concepts of geospatial standards.

You can download gittok as an AIR application by clicking cursor on the title logo-mark.

The author (Morishige Cts) releases gittok as an open source free software under the GNU Public License (GPL) Version 3 (source code) and Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported (texts and slides).

github

[1] Getting started with gittok (EN)
You should practice this exercise at first. Let's download HelloGittok_EN.zip. It includes a tutorial and a folder for exercise.

[2] Slides for Experimetal Lectures held In 2014 (Incompleted) (EN)

gittokを使って地理空間情報技術を学ぶ人は、最初にこの演習をするといいでしょう。HelloGittok_JP.zipをダウンロードして、解説するとチュートリアルと演習用のフォルダーがありますので、チュートリアルを読みながら体験して見て下さい。
Gittok was developed by Morishige Ota as a member of the team GIT set up under the research project on Geographic Information Sciences Education and Spatial Thinking supported by Grant-in-Aid for Scientific Research (A), Ministry of Education, Culture, Sports, Science and Technology (Project leader: Yasushi Asami, The University of Tokyo), 2009 - 2013.