Testing of Geoportals: INSPIRE demands and challenges

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Development according to Swedish geodata strategy

The initiative was launched as a joint venture between Lantmäteriet, FPX and the GIS-institute at the University of Gävle.

It should contribute to Swedish infrastructure for geodata and to the implementation of the INSPIRE directive in Sweden.
INSPIRE testing facility in Gävle
Collaboration between Lantmäteriet, Gävle University and the clusternetwork Future Position X, FPX

2008: Testteam and testenvironment established at FPX in Gävle. Transformation of five themes for Lantmäteriet performed according to JRC call for testing dataspecifications of Annex I.

2009: Validation of the method and development of GeoTest framework consisting of transformation test and validation for dataspecifications and datasets, performance test of geowebservices, usability test of user framework and cost-benefit analysis of geowebservices etc. e-learning mapping & matching to GML in collaboration with EuroSDR.


Transformation Methodology overview

- NLS database
- Data extraction
  - NLS shapefiles
  - Shape to GML conversion
  - Source GML files
  - Schema transformation
  - Target GML files
  - Schema transformation report
- NLS schema
- Source data consistency test
  - Transformation rules
  - Source data consistency report
- INSPIRE schema
- Schema matching and mapping
  - Schema matching & mapping report
Result of schematransformation for five themes

(addresses, geographical names, transportnetworks, hydrography and Cadastral parcels)
GIS-Arena

A regional approach to a portal service. Three counties cooperates in collecting national grounddata for roads, addresses, cadastral information etc. and to deliver useful information packeged into digital maps to the regional customers.
1. Aktivera "Karlstadsbuss"
2. Välj den buslinje som passerar närmast din sök adress (uppgift 1)
3. När du har valt en buslinje leta rätt på information om den.
Performance of WMS Data services

Data sets

Metadata

Data quality testing

GIS-Arena

Download

View

Invoke

catalogue

Cost Benefit Consideration

CBC

Usability testing

Different Use-cases

Metadata

Invoke

Download
Performance testing

• Performance qualities are measured in terms of the system’s ability to respond to the users operations and queries.

• Obligatory quality criteria to be maintained by data and service providers at the member state as described in the Commission Regulation (EC) No 976/2009 of 19 October 2009 (Official Journal of the European Union, 2009) :
  – **Web Map Services ’WMS’**
    • Maximum 5 second response time for an image of 470 Kb
    • At least 20 concurrent requests in normal situation (Normal situation represents periods out of peak load. It is set at 90 % of the time).
  – **Availability**
    • A download service, view service and discovery service should be available 99 % of the time. This represents high demand on the service providers in each member state.
Testing methodology

Pre-testing settings

Define test matrix

Define:
1. Test duration
2. Number of virtual users.
3. Time delay between users.
4. User think time in seconds

Define scenario for each user

Pages and service to be tested

Collect statistic and computation
Calls to server

http errors 0.01 %
Socket errors 16.8 %
Timeout 14.9 %
Successful calls 68.3 %
Concurrent users

Max: 500
Breakpoint: 250
INSPIRE: 20
## Summary of the Perf.Test

<table>
<thead>
<tr>
<th>Services</th>
<th>INSPIRE Requirements</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WMS</strong></td>
<td>GetMap</td>
<td>For a 470Kb image, should be of maximum 5 second in normal situation, with a frequency of request of 20 requests per second.</td>
</tr>
<tr>
<td></td>
<td>Get Download Service Metadata</td>
<td>10 seconds in normal situations, with a frequency of request of 10 requests per second.</td>
</tr>
<tr>
<td><strong>WFS</strong></td>
<td>Get Spatial Objects</td>
<td>30 second initial response, then the service shall maintain a sustained response &gt; 0.5 MB/s, alternatively 500 spatial objects/s in normal situations, with a frequency of request of 10 requests per second.</td>
</tr>
<tr>
<td></td>
<td>Describe Spatial Object Types</td>
<td>10 second initial response, then the service shall maintain a sustained response &gt; 0.5 MB/s, alternatively 500 spatial objects types per second in normal situations, with a frequency of request of 10 requests per second.</td>
</tr>
</tbody>
</table>
View Service Response Time (ms) VS No. of Users

<table>
<thead>
<tr>
<th>No. of Users</th>
<th>Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1136</td>
</tr>
<tr>
<td>6</td>
<td>3051</td>
</tr>
<tr>
<td>11</td>
<td>6441</td>
</tr>
<tr>
<td>16</td>
<td>8512</td>
</tr>
<tr>
<td>20</td>
<td>11175</td>
</tr>
<tr>
<td>30</td>
<td>15857</td>
</tr>
<tr>
<td>50</td>
<td>27097</td>
</tr>
</tbody>
</table>

- **WMS**: 1136, 3051, 6441, 8512, 11175, 15857, 27097
- **INSPIRE**: 5000, 5000, 5000, 5000, 5000, 5000, 5000
Usability study

• User testing is an empirical method observing users while they are interacting with the system during execution of different task scenarios (Kalen, 1997)

• Usability testing gave direct information of how GIS-Arena works for each user and many usability problems were detected when the system was actually used by the end-user.

• The participants in the usability test had different background, and education level. The majority were middle-aged women and men and two students from secondary school with technical background.

Participants background

- Working with GIS: 67%
- IT specialist: 6%
- Non-GIS background: 27%
Heuristics used in the evaluation for GIS-Arena

Guidelines to follow when designing user interface. The evaluation was performed by analyzing each of them:

– Layout, visual clarity, overall impression
– Consistency
– Navigating the system
– Terminology and compatibility
– Feedback, user control and help
– Functionality
– Error handling
## Summary of the results

<table>
<thead>
<tr>
<th>Usability &amp; performance issues</th>
<th>Usability study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout, visual clarity</td>
<td>unsatisfactory</td>
</tr>
<tr>
<td>Consistency</td>
<td>Several inconsistencies</td>
</tr>
<tr>
<td>Navigating in the system</td>
<td>Not easy to navigate</td>
</tr>
<tr>
<td>Terminology</td>
<td>Appropriate</td>
</tr>
<tr>
<td>Feedback, user control and help</td>
<td>Poor feedback</td>
</tr>
<tr>
<td>Functionality</td>
<td>Not easy, e.g. search</td>
</tr>
<tr>
<td>Error handling</td>
<td>Poor error handling</td>
</tr>
<tr>
<td>General opinion</td>
<td>GIS-Arena is not easy to use</td>
</tr>
</tbody>
</table>

### Performance

| Response time                                  | > 5 sec with more than 250 user |
| Errors                                         | All types of errors were detected e.g. timeout-, socket- and http errors |
Survey of user satisfaction -1-
Skulle du kunna tänka dig att ställa upp flera gånger och göra liknande tester?

- Ja
- Nej

What do you think of GeoTest and GeoUsability lab?

- Interesting! It is a good way of testing and to define strong and weak sides of an application before it is implemented.
- The scenarios and tasks were good. I could reach an understanding for using GIS-Arena. It is also good to meet with other users, discussions are important.
- GeoUsability lab approach is very nice!
- Nice environment and I learned something about testing!
Costbenefitanalysis

The objective:
To investigate the potential costs and benefits of municipalities and municipal companies as the result of using the GIS-Arena platform and services.

- The study was based on interviews with representatives from the project leadership as well as several municipalities and municipal companies.
- The purpose of the interviews was to explore the expectations of the potential benefits of using the basic function and services.
- It was not possible to quantify the results since the platform has not been released for use yet, and the respondents have not had the opportunity to see and test the product.
- Therefore the report should be considered as a pre-study aimed at identifying and mapping possible benefits for municipalities and municipal companies based on their expectations due to the information they had about the product.
Important steps forward

Continue development of new methods

Operating the GeoUsability lab

Certification & licensing methods & model to other organisations

Learning and information
Cooperating nationally and internationally

- FPX partner to be with GEOIDE in Canada and others in Networks for Networks (NfN)
- GIS-Institute Coordinating PTB network for R&D exchange in Europé (Persistent Test Bed)
- Cooperating with Lantmäteriet and EU-commission R&D organisations for testing of geodata
- Cooperating with European e-content plus programme ESDIN to perform tests on service for exchanging data between Sweden and Norway
- Cooperating with Swedish Standards Institute workgroup to perform tests on GML specification for hydrography
- Cooperating with Swedish INSPIRE geodataproject concerning usability and performance testing of www.geodata.se
Conclusion

• Expertise knowledge, *in collaboration with others*, about testing methodology and performing testing process for geodata.

• GeoTest framework as a *portfolio to be used as a strategic development tool in IT and GIS development*? By doing so, the testing will provide knowledge about errors early in the development process.

• GeoTest v.0.1 and GeoUsability lab have been evaluated with good marks and are *ready to take next step towards implementation of GeoTest v.1.0*

• Costbenefitanalysis need some more validation cases
www.geotest.se

Thank you!

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