Workshop

Practical Quality Assurance of Spatial Web Services

INSPIRE Conference 17th June 2014 at 9:00 am
Aalborg University, Badstuestræde 9/auditorium 1

Spatineo Inc.
Ilkka Rinne & Kristian Jaakkola
Session 1 schedule
9:00 - 10:30, auditorium 1

Ice-breaker: Say hello to the people around you and share your workshop expectations (10 min)

Presentation: Overview of the INSPIRE QoS requirements for Network Services (20 min)

Group discussions (45 min): INSPIRE QoS

Demo: Evaluating the Spatial Web Service availability and continuous performance with Spatineo Monitor (10 min)
Session 2 schedule
11:00 - 12:30, auditorium 1

Hands-on training: Spatineo Monitor (60 min)
- Finding and monitoring new services (exercise 1)
- Monitoring continuous performance & availability (exercise 2)
- Analyzing service usage
- Scheduled reporting (exercise 3)
- Notifications: Announcing maintenance breaks
- Validating service metadata

Live capacity testing session using Spatineo Performance (15 min)

Workshop wrap-up & discussion (10 min)
Our Common Expectations For This Workshop

Let’s make this a proper discussing workshop. See who’s sitting next to you, and introduce yourself.

What are you working with, if and how it relates to the INSPIRE network services, and what are your expectations for this workshop.
Inspire QoS Requirements for Network Services
INSPIRE Network Services
Quality of Service

**Performance:** Must succeed to continuously serve its data sets within the given time limits.

**Capacity:** Must handle at least the given number of simultaneous users / requests without degrading its performance.

**Availability:** Must be available for use 99% of the time excluding maintenance breaks announced early enough.
Criteria and Normalized Testing Procedures

The QoS metrics and the criteria are given in the directive legal text (Implementation Rules).

The technical details and normalized testing procedures are defined in the Technical Guidance documents for each of the Network Service types:

- Discovery Service: Catalog Service for Web (CSW)
- View Service: Web Map Service (WMS) or Web Map Tiling Service (WMTS)
- Download Service: Web Feature Service (WFS) or Atom + data files
Performance Criteria: Discovery Services

“The response time for sending the initial response to a discovery service request shall be maximum 3 seconds in normal situation.
[..]
Normal situation represents periods out of peak load. It is set at 90% of the time.”

(IR Network Services*)

Performance Testing: TG Discovery Services 3.1

Minimum of 10 Discovery Metadata (CSW GetRecords) requests per hour shall be issued to the service continuously during its lifetime.

Recommendation: Search metadata with filter PropertyName=AnyText, Literal=dataset, and with varying BBOX requests.

Evaluation: A minimum of 90% of the initial services responses have to comply with the mandated 3 seconds response time, thus, a normal situation is identified by the 90% best performing sample reference requests.

Capacity Criteria: Discovery Services

“The minimum number of simultaneous requests to a discovery service to be served in accordance with the quality of service performance criteria shall be 30 per second.”

(IR Network Services*)

Capacity Testing: Discovery Services

For the testing duration of one minute, send 30 new requests each second.

Recommended mix of operations: 10% Get Discovery Service Metadata (CSW GetCapabilities), and 90% Get Discovery Metadata requests (CSW GetRecord)

**Evaluation:** Performance must not be degraded during this test, so the fastest 90% share of requests for all operations must start returning data under 5 seconds.

Capacity testing must be done at least once before launching in production environment and should be done regularly after that (monthly or so during maintenance breaks).

Performance Criteria: View Services

“For a 470 Kilobytes image (e.g. 800x600 pixels with a colour depth of 8 bits), the response time for sending the initial response to a Get Map Request to a view service shall be maximum 5 seconds in normal situation.

Normal situation represents periods out of peak load. It is set at 90% of the time.”

(IR Network Services*)

Performance Testing: TG View Services 3.11

Minimum of 10 requests per hour shall be issued to the service **continuously during its lifetime**.

Request must contain only one layer at a time, the image color depth should be 8-bit, and it’s size 800 x 600 pixels (to make an approx. of 470kB file size).

**Evaluation**: Must return a non-empty image if data is present for the given request parameters (BBOX, scale, etc.)

A minimum of 90% of the initial services responses have to comply with the mandated 5 seconds response time, thus, a normal situation is identified by the 90% best performing sample reference requests.

Capacity Criteria: View Services

“The minimum number of served simultaneous service requests to a view service according to the performance quality of service shall be 20 per second.”

(IR Network Services*)

Capacity Testing: TG View Services 3.11

For the testing duration of one minute, send 20 new requests each second.

Recommended mix of operations: 10% Get View Service Metadata (Get Capabilities for WMS and WMTS services) and 90% Get Map requests.

**Evaluation**: Performance must not be degraded during this test, so the fastest 90% share of requests for all operations must start returning data under 5 seconds.

Capacity testing must be done at least once before launching in production environment and should be done regularly after that (monthly or so during maintenance breaks).

Performance Criteria: Download Services

“For the **Get Download Service Metadata** operation, the response time for sending the initial response shall be maximum 10 seconds in normal situation.

For the **Get Spatial Data Set** operation and for the **Get Spatial Object** operation, and for a query consisting exclusively of a bounding box, the response time for sending the initial response shall be maximum 30 seconds in normal situation then, and still in normal situation, the download service shall maintain a sustained response greater than 0.5 Megabytes per second or greater than 500 Spatial Objects per second.

For the **Describe Spatial Data Set** operation and for the **Describe Spatial Object Type** operation, the response time for sending the initial response shall be maximum 10 seconds in normal situation then, and still in normal situation, the download service shall maintain a sustained response greater than 0.5 Megabytes per second or greater than 500 descriptions of Spatial Objects per second.”

(IR Network Services*)

Performance Testing: TG Download Services 3.1

At least one request every 6 minutes (10 requests / hour) shall be issued to the service during test periods (?) (recommended to be monthly, during maintenance breaks).

All operations should be included in test requests: Get Download Service Metadata, Get Spatial Data Set, Get Spatial Object, Describe Spatial Data Set and Describe Spatial Object Type operations.

Use BBOX filtering (only) for Get Spatial Object operations. Include only one spatial object type and data set for Get Spatial Object and Get Spatial Data Set operations.

**Evaluation:** First bytes of the responses must arrive in less than 30s (data) and 10s (metadata) excluding the estimated network latency (?). After that the downstream speed must be > 0.5MB/s or > 500 objects/s for the fastest 90% of the test requests.

Capacity Criteria: Download Services

“The minimum number of simultaneous requests to a download service to be served in accordance with the quality of service performance criteria shall be 10 requests per second. The number of requests processed in parallel may be limited to 50.”

(IR Network Services*)

Capacity Testing: TG Download Services 3.1

For the testing duration of one minute, send 10 new requests each second. It’s allowed for the server not to respond in orderly fashion to requests exceeding 50 simultaneous request limit.

Recommended mix of operations: 10% Get Download Service Metadata requests, 10% Describe Spatial Data Set or Describe Spatial Object Type and 80% Get Spatial Data Set or Get Spatial Object. At least 2% of the requests should be Get Spatial Data Set.

Evaluation: Performance must not be degraded during this test, so the fastest 90% share of requests for all operations must start returning data under 30s and metadata under 10s.

Capacity testing must be done at least once before launching in production environment and should be done regularly after that (monthly or so during maintenance breaks).

Availabiltiy Criteria: All Network Services

“The probability of a Network Service to be available shall be 99% of the time”

(IR Network Services*)

Availability Testing: Same method in all TGs

Minimum 10 requests per hour shall be issued to the service continuously during its lifetime.

**Evaluation:** Service must be available 99% of the time. The reference time frame is one year, so it’s allowed for each service to be down maximum of 3.63 days / year. The pre-announced maintenance breaks (notified at least one week in advance) are excluded (recommendation for these is max. 10hrs / month).

“Available” is not explicitly defined: Does the response for all the test requests need to arrive in certain time, like 5 or 30 seconds? Has the service been “available” during a certain hour if 1 of 10 requests made during that time has failed?
## Network Services QoS

<table>
<thead>
<tr>
<th></th>
<th>Discovery</th>
<th>View</th>
<th>Download</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance</strong></td>
<td>3s, 24/7</td>
<td>5s, 24/7</td>
<td>10/30/10s, &gt;0.5MB</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>30 reqs/s</td>
<td>20 reqs/s</td>
<td>10 reqs/s, max. 50 simult.</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td></td>
<td></td>
<td>99% early uptime</td>
</tr>
</tbody>
</table>
QoS Group Discussion
Work in groups

- Split into small groups, select one QoS-related topic per group.
  - Some suggestions for topics on the next slide

- 10 minutes to discuss about the topic in each group + 5 minutes to finalize a short wrap-up to present.

- 5 minutes for each group to present their wrap-up for others.
Some discussion topics

• INSPIRE QoS requirements: Difficult or easy to achieve? Useful or not? Any ideas to making them more useful?

• How to make it worthwhile and easy enough for the INSPIRE data providers to improve the QoS of their services?

• Application developer perspective: What QoS indicators would be most useful for the developers? How should they be published for INSPIRE services?

• Data provider view: How to integrate QoS measuring and improvements to a daily / monthly / yearly development plans & practices? Dev. team / management view?
Demo: performance & availability
Session 2 schedule
10:30 - 12:00, auditorium 1

Hands-on training: Spatineo Monitor (60 min)
• Finding and monitoring new services (exercise 1)
• Monitoring continuous performance & availability (exercise 2)
• Analyzing service usage
• Scheduled reporting (exercise 3)
• Notifications: Announcing maintenance breaks
• Validating service metadata

Live capacity testing session using Spatineo Performance (20 min)

Workshop wrap-up & discussion
Spatineo Monitor

Hands-on training
Finding and Following New Services

• We already know and monitor a lot of publicly accessible spatial web services:
  • Currently over 21500 WMS, WMTS and WFS services monitored around the world.
  • Free search engine Spatineo Directory: http://directory.spatineo.com/
  • Add a service to your followed a services by clicking “Follow in Spatineo Monitor” button on the Directory service page.
  • If your service is not found, paste the GetCapabilities URL to the search field of Spatineo Directory and we’ll check it out immediately.

• Monitoring will start automatically, but the owners of the services can modify how the monitoring is done by adding or changing **meters**: layer, image format & size, CRS etc.
Abstract
Spatineo demo WMS service

Available offerings

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearfish streams</td>
<td>sf:streams</td>
</tr>
<tr>
<td>Tasmania cities</td>
<td>topptasmania_cities</td>
</tr>
<tr>
<td>Tasmania roads</td>
<td>topptasmania_roads</td>
</tr>
<tr>
<td>Tasmania state bounds</td>
<td>topptasmania_state_boundaries</td>
</tr>
<tr>
<td>Tasmania water bodies</td>
<td>topptasmania_water_bodies</td>
</tr>
<tr>
<td>USA Population</td>
<td>toppt:states</td>
</tr>
<tr>
<td>World rectangle</td>
<td>tiger:giant_polygon</td>
</tr>
<tr>
<td>mosaic</td>
<td>nu:mosaic</td>
</tr>
<tr>
<td>sfidem is a Tagged Image File...</td>
<td>sf:sfidem</td>
</tr>
<tr>
<td>spearfish</td>
<td>spearfish</td>
</tr>
</tbody>
</table>

Currently active meters
- EPSG:4326, 256x256, Image/png

Add new meter

Abstract USA Population
This is some census data on the states.
Exercise 1: Add a new meter

• Group-up with the people nearest to you.
• At least one laptop per group: select who’s “the operator”.
• Each group has their own demo credentials to Spatineo Monitor.
• Login address and the credentials are included in the printed training material sheets provided each of the groups.
• Complete the exercise in your group.
• Review will be done in 10 minutes.
Monitoring continuous performance & availability

• For each of your followed services the continuous performance and availability analysis is provided:
  • Graphical timeline-based navigation.
  • Service availability percentage for the selected time period.
  • Response time analysis and list of monitoring requests with selected response time category highlighting.
  • For any of the meters used for monitoring, you can add an indicator to get alerts if the performance measurements exceed given thresholds.
    • Alerts are sent by email or SMS
    • Also get notified when the service is back in a normal state again.
### Service: Spatineo WMS

Service not visible in Spatineo Directory

#### Meters & Alerts

| Meter | topp:states (EPSG:4326, 256x256px, image/png) | 1 old meters available |

**Response time (ms) average**

#### Period

<table>
<thead>
<tr>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/12/2014</td>
<td>6/15/2014</td>
</tr>
</tbody>
</table>

#### Service availability

- **100.0% of the selected time period**

#### Response times

<table>
<thead>
<tr>
<th>Response time</th>
<th>Request time</th>
<th>Status code</th>
</tr>
</thead>
<tbody>
<tr>
<td>11148</td>
<td>6/13/2014 2:23 PM</td>
<td>200 show details</td>
</tr>
<tr>
<td>10882</td>
<td>6/13/2014 3:11 PM</td>
<td>200 show details</td>
</tr>
<tr>
<td>8325</td>
<td>6/15/2014 11:18 AM</td>
<td>200 show details</td>
</tr>
<tr>
<td>6766</td>
<td>6/14/2014 7:08 AM</td>
<td>200 show details</td>
</tr>
<tr>
<td>6998</td>
<td>6/15/2014 2:51 AM</td>
<td>200 show details</td>
</tr>
<tr>
<td>6121</td>
<td>6/13/2014 7:34 PM</td>
<td>200 show details</td>
</tr>
<tr>
<td>5234</td>
<td>6/15/2014 1:23 PM</td>
<td>200 show details</td>
</tr>
<tr>
<td>5137</td>
<td>6/14/2014 8:32 AM</td>
<td>200 show details</td>
</tr>
<tr>
<td>4850</td>
<td>6/14/2014 3:50 AM</td>
<td>200 show details</td>
</tr>
<tr>
<td>4463</td>
<td>6/14/2014 5:55 AM</td>
<td>200 show details</td>
</tr>
</tbody>
</table>

#### Recent alerts

<table>
<thead>
<tr>
<th>Timestamp</th>
<th>Status</th>
<th>Email sent</th>
<th>SMS sent</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/15/2014 3:52 PM</td>
<td>Ok</td>
<td>×</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/15/2014 3:47 PM</td>
<td>Warning</td>
<td>×</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/15/2014 3:41 PM</td>
<td>Ok</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exercise 2: Add an alert to a meter

- Use the same demo credentials to Spatineo Monitor as in exercise 1.
- Complete the exercise in your group.
- Review will be done in 5 minutes.
Analyzing service usage

- Usage analytics is a an add-on component of Spatineo Monitor.
- Similar to website analytics, it provides information about how much the services are used, where the users come from and how are they using the service.
  - Graphical timeline-based navigation with number of requests and server-side response time.
  - Segmented analytics: by user country, ISP, device, CRS, image size & format etc.
  - Graphs for access by time of day, day-of-week and a map of request area.
  - See statistics by layer or feature type.
  - Drill-down user interface: Select an analytics segment to limit the visualization to those requests only.
Scheduled reporting

- Reporting features of Spatineo Monitor offer an easy way to follow the statistical trends for the followed services.
- Weekly, monthly or yearly reports of usage analytics, for example to be used in the yearly INSPIRE monitoring spreadsheets, can be configured.
- You can order the reports to sent automatically by email or download them at any time from the Report archive.
- Select any of your followed services to be included in a each of the reports.
### Report archive

<table>
<thead>
<tr>
<th>Created on</th>
<th>Type</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/12/2014 12:08 PM</td>
<td>Graphical</td>
<td>Monthly usage by offering</td>
</tr>
</tbody>
</table>

### Scheduled reporting

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Schedule</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly usage by offering</td>
<td>Graphical</td>
<td>monthly</td>
<td>✓</td>
</tr>
</tbody>
</table>

- **Generate**: monthly
- **Start on**: 6/12/2014
- The next report will be automatically created on 7/1/2014

**Services to include (1)**

- Spatineo WMS

**Send by email to**

- likka.rinne@spatineo.com
Exercise 3: Create a usage report

- Use the same demo credentials to Spatineo Monitor as in exercise 1.
- Complete the exercise in your group.
- Review will be done in 5 minutes.
Notifications: Announcing Maintenance Breaks

• Maintenance breaks for your own services can be announced using Spatineo Monitor notification features.

• Breaks and other notifications are published in the Spatineo Directory page for the selected services.

• The users can also subscribe using Atom and iCal feed syndication.

• Designed to fulfill the INSPIRE requirement for pre-announcing maintenance breaks to the users.
Service maintenance / downtime event

- **Publish time**: 5/3/2014 11:00 PM (+0200 a month ago)
- **Start time**: 6/2/2014 11:00 AM
- **Expected end time**: 6/11/2014 11:00 AM
- **Language**: English
- **Title**: Planned service downtime
- **Notification text**: Our demo services are down for the preparation of the INSPIRE conference workshop

Affected services:
- Spatineo WMS
- Spatineo WFS

**Notification settings**:
- **Publish time**: 6/2/2014 11:00 AM
- **Affected services**: Spatineo WMS, Spatineo WFS

**Options**:
- Add service group
- Add individual service
- Cancel
- Ok
Validating Service Metadata

• Spatineo Monitor contains a standards compliance validator for service metadata documents (GetCapabilities)

• Checks for the OGC and INSPIRE requirements.

• Supported standards: WMS 1.3.0, WMTS 1.0.0, INSPIRE Profiles for WMS and WMTS.

• On-going work to integrate with the “commonly agreed”, official INSPIRE validator software:
  • Spatineo is active in MIG subgroup MIWP-5 “Validation and conformity testing”
Service: Spatineo WMS

http://54.73.122.159:8080/geoserver/ows

Service not visible in Spatineo Directory

Assigned to service groups: Demo view service group

Standards compliance

Standards compliance targets for this service

This service is currently validated using following standardization test suites:
- OGC Web Map Service 1.3

Validation results (5/28/2014 12:04 AM)

X OGC Web Map Service 1.3: failed
General XML compliance tests

2 passed tests

Web Map Service tests

20 passed tests

1 failed test

Styles must have a Title
Each Style element must contain a non-empty Title element.
row 5395, position 9: No Title
row 5762, position 9: No Title
Chapter 7.2.4.6.5, OGC WMS 1.3.0 IS, page 26

Capabilities document source code
Spatineo Performance

Live capacity testing session
Wrap-up: What have we learned this morning?

Slides: http://www.slideshare.net/iorinne/practical-quality-assurance-of-spatial-web-services