

Enriching SDI with Linked data infrastructure

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National Land survey of Finland

- National mapping and cadastral authority (NMCA)
- Also national Land registration authority
- Responsible of NSDI implementation

- Strategic goal: Interoperability
- Working to introduce a URI-based management of data infrastructure
 - A national recommendation for public administration on unique HTTP URI identifiers and specialization on spatial data (under approval process)

Content

Questions to address

- How to avoid spatial data falling into a silo?
- How to integrate spatial and non-spatial data
- How to increase flexibility in data delivery or update?

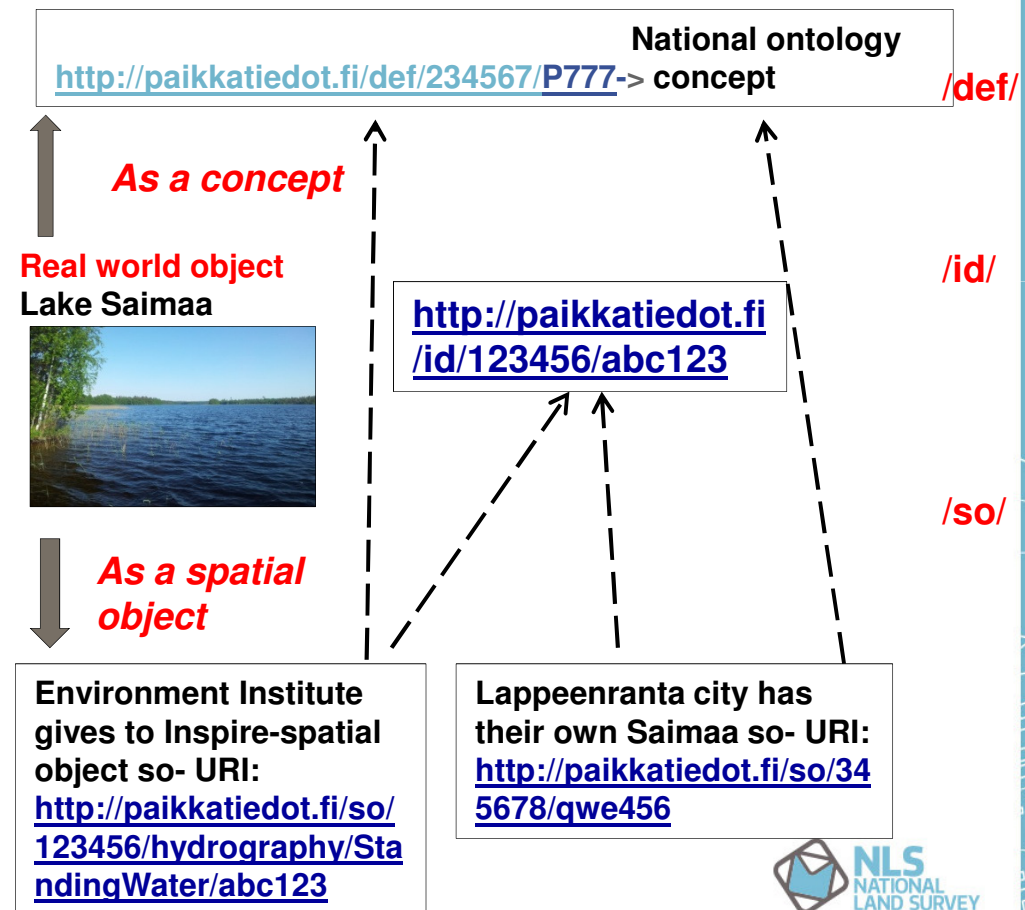
Drivers to change

- Financial conditions
- Digitalization
- Spatial data and web...

Solution – Linked data

Flexible & interoperable

- URI-design:
[http://{domain}/{type}/{datasetId}/{localId}\[/{versionId}\]](http://{domain}/{type}/{datasetId}/{localId}[/{versionId}])
- Publishing URIs also
- For concepts to enable harvesting spatial objects by concepts - **/def/**
- For real world entities as a placeholder-URI to enable combining data and searches for spatial objects representing the same real world entity - **/id/**
- For real world entities as a placeholder-URI to enable combining data and searches for spatial objects representing the same real world entity - **/so/**



Linking concepts - /def/

- Concepts used in data models are populated in /def/-component of URI
- Concepts can be from any controlled vocabularies like thesauri, code lists, schemas etc.
 - Specific case under investigation: Place names
 - In this work our intention is to develop a platform to provide applications for tagging different assets (scientific, commercial like travel or diverse interest topics, to locate spots in textual docs, further linking to auxiliary resources etc.)
- Harmonisation:
 - /def/-concepts to be annotated in concept hierarchy of General Finnish ontology (Finto.fi)
- Linking to national ontology (Finto.fi)
 - Provides a wider Linked data framework to integrate spatial and non-spatial data
 - SKOS employed

Linking to real world objects - **/id/**

- The real world entities are represented by URI type **/id/** employing a placeholder-URI
 - with the same namespace and local identifier as the URI of the spatial object.
- Accordingly the **/id/-URI** for the real world entity is **principally** populated by the responsible INSPIRE data provider
 - the responsibilities assigned for each of the INSPIRE spatial data type in Finland.
 - However, if the 'id'-URI is not established yet, also other data providers are allowed to do it
- **/id/-URIs** representing the same real world objects can be linked employing **skos:sameAs**

Data Linking - **/doc/**

- The 'doc' URI type of a spatial object accommodates references to
 - 'id'- and 'def'-URI types
 - representations of the spatial object (coordinate systems and formats)
 - other spatial objects representing the same real world entity
- /doc/-URI is implemented as RDF, also JSON-LD recommended
 - enables e.g. harvesting the spatial objects representing the same concept or the same real world entity
- Example for /doc/-URI:
 - <http://www.syke.fi/doc/123456/abc123>
 - Where [123456](#) stands for the source dataset
 - the domain of a "doc" URI is decided by the data provider (paikkatiedot.fi is not used for as a domain for "doc" URIs)

URI-redirections

Concept

<http://paikkatiedot.fi/def/234567/P777>

redirected



<http://finto.fi/pto/fi/page/?uri=http://paikkatiedot.fi/def/234567/P777>

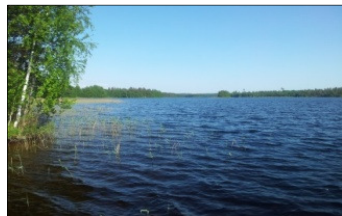
response



HTML-page with links:

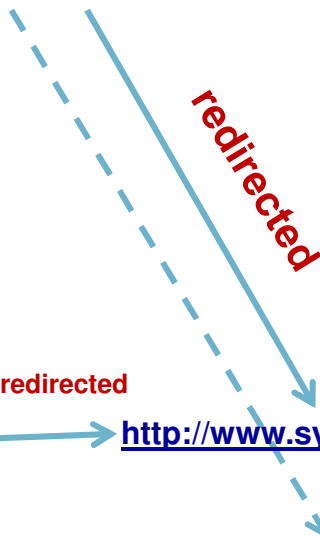
- RDF/XML ja TURTLE representations of concept
- For INSPIRE concepts: link to Register service of EC

Real world: Lake Saimaa



<http://paikkatiedot.fi/id/123456/abc123>

redirected



Spatial object (INSPIRE-data):

<http://paikkatiedot.fi/so/123456/hydrography/StandingWater/abc123>

redirected

<http://www.syke.fi/doc/123456/abc123>

response



In another dataset:

<http://paikkatiedot.fi/so/345678/qwe456>

redirected

<http://www.lpr.fi/doc/345678/qwe456>

response



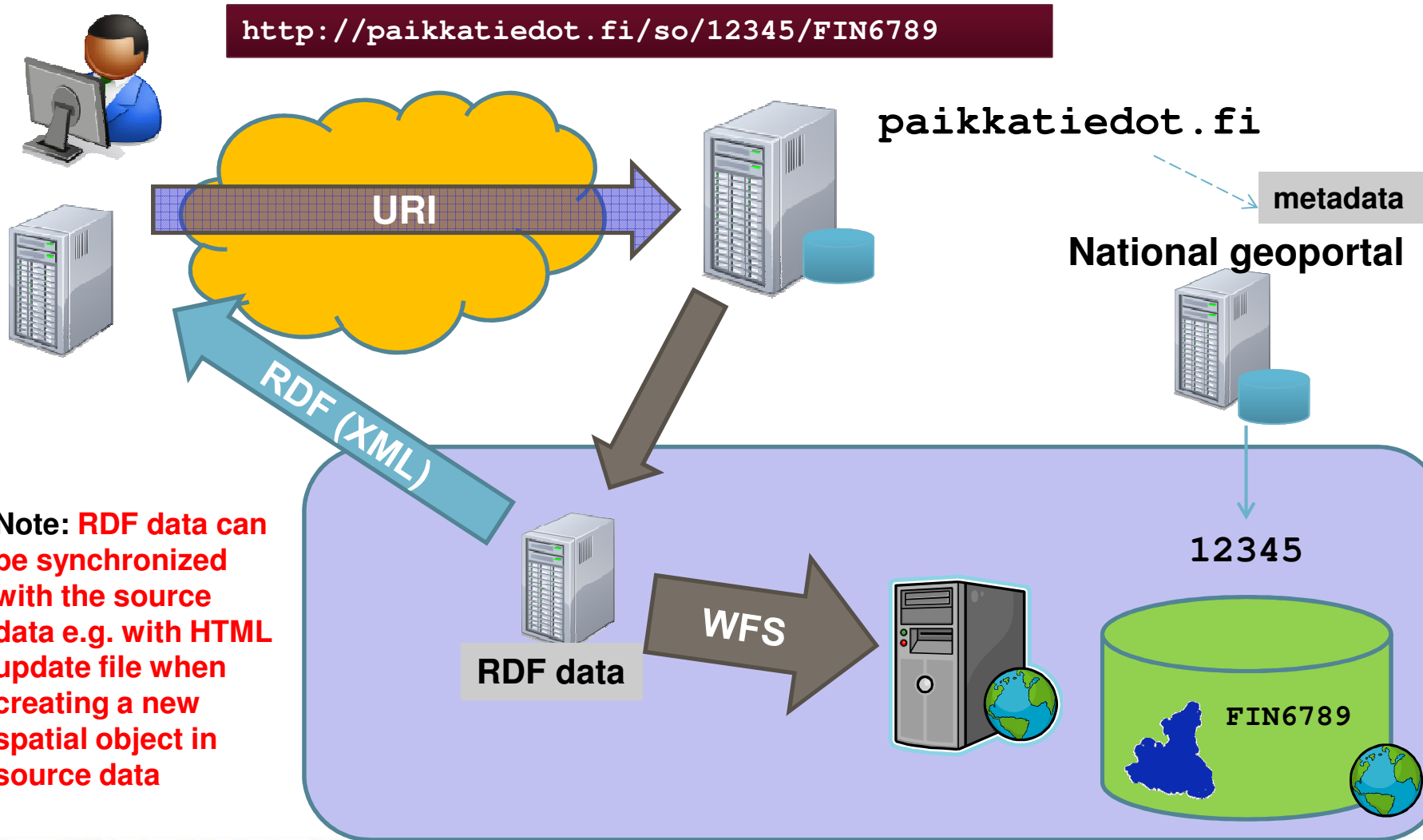
In RDF-format

- representation of the spatial object (GML, JSON jne.)
- /id/-link to the real world entity
- links to other spatial objects on the same real world entity
- links to concept and additional documentation related

URI-redirections

- Paikkatiedot.fi
 - Centralized resolution service redirecting to the service interface of data provider ((URI-service)
 - Possibly to add redirections to the metadata of the dataset (centralized catalogue service)
 - Resource identifier ((datasetId) register is maintained by NLSfi
- URI-service of data provider
 - Returns the documentation of /doc/ - URI in RDF/XML ... JSON-LD
 - All /so/- and /id/-URI-references to paikkatiedot.fi redirected to /doc/-URI
 - Queries to representations are directed to WFS-service returning data in co-ordinate system and format as requested

Technical structure



Note: RDF data can be synchronized with the source data e.g. with HTML update file when creating a new spatial object in source data

Implementation strategy

- The implementation strategy proposes that the data providers populate /id/- and /def/- URIs with same as /so/-URI
- The URIs for spatial data are all minted in nationally centralized domain with redirections to URI-services of data providers.
- As a first stage the infrastructure is established with INSPIRE data - a critical mass and stepping stone
- URIs to be delivered through national geoportal (/so/- and /id/-)
- Current view is also to establish a URI-based production of national core location data.

Data modeling aspects 1

- The approach suggests a data model based URI design and implementation of geodata as Linked data
- URI network published in RDF is linking the data model views of spatial objects
 - To other data objects and datasets
 - To the real world entities
 - To national concept ontology and semantic web
- Piloting has successfully combined data (properties) from different data sources and organisations
- **A complementary way of making use of data models – expanding their scope of use**

Data modeling aspects 2

- Identifier-based interoperability **does not require that data modelling methods or level of details are equivalent or identical**
 - One or more spatial objects may refer to one or several spatial objects in another data system
 - As relations and correspondences of spatial objects are defined, the transformations to desired object or result can be generated
 - E.g. collecting properties from different data sources to create a new object

To summarize:

URI linking also mirrors data models providing a framework for data infrastructure or data distribution

Data delivery and integration

- Using URIs service providers and data consumers can
 - combine additional data from different data sources
 - consume data different sources with better quality or coverage and from local to national
 - have more flexibility in enriching data and delivery
- Data integration through URI's brings great benefits to the society at large
 - Finnish Government Open Data Program (2013-2015): "The greatest benefits result from linking different type of data"
 - URIs are glue integrating processes using the same data
 - Digitalisation enabler
 - Crowdsourcing enabler – to identify the very spatial object

More information

www.nls.fi



RDF Schema of **/doc/**

Class	Property	Range	Cardinality	Description
jhs:doc				Related documentation
	jhs:so	URI of spatial object	0..1	Reference to the spatial data object concerned
	jhs:id	URI of real world entity	0..1	Reference to the (placeholder-id of) real world entity represented by spatial data object concerned
	dc:hasFormat	jhs:data	1..n	Representations available (WFS, GEOJSON...)
	dc:subject	URI of concept represented by the spatial object	0..n	Reference to the resource of the concept represented by the spatial object
	rdfs:seeAlso	Additional information related to the spatial object or concept	0..n	E.g. Reference to another spatial data object representing the same real world entity
jhs:data				Representation of the resource
	jhs:CRS	Co-ordinate system(s) of the representation	0..1	EPSG-code of the co-ordinate system(s) (only to the spatial objects)
	dc:format	Format(s) of the representation	1	MIME-type of the representation
	jhs:so	URI of spatial object	0..1	Reference to the spatial data object concerned (this is only to connect representation details)
	jhs:def	URI of concept represented by the spatial object	0..1	Reference to the resource of the concept represented by the spatial object

Example of RDF data content in **/doc/-URI** (current RDF Schema)

- **Domain name of data provider** = kartat.tampere.fi

- **/doc/-URI** = <http://kartat.tampere.fi/uri/doc/1000358/6447>

- **Reference to corresponding real world URI** =

`<jhs:id rdf:resource="http://paikkatiedot.fi/id/1000040/172353"/>`

- **Reference to the spatial object related** =

`<jhs:so rdf:resource="http://paikkatiedot.fi/so/1000358/6447"/>`

- **Reference to the spatial object related** =

`<dc:subject rdf:resource="http://www.yso.fi/onto/yso/p17892"/>`

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```
<rdf:RDF
  xmlns:jhs="http://paikkatiedot.fi/jhs-skeema#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
  <rdf:Description rdf:about="http://kartat.tampere.fi/uri/doc/1000358/6447">
    <rdf:type rdf:resource="http://paikkatiedot.fi/jhs-skeema#doc"/>
    <dc:hasFormat>
      <rdf:Description rdf:about="http://kartat.tampere.fi/uri/doc/1000358/6447/EPSG:3067.json">
        <rdf:type rdf:resource="http://paikkatiedot.fi/jhs-skeema#data"/>
        <dc:format>application/json</dc:format>
        <jhs:CRS rdf:resource="http://www.opengis.net/def/crs/EPSG/0/3067"/>
      </rdf:Description>
    </dc:hasFormat>
    <dc:hasFormat>
      <rdf:Description rdf:about="http://kartat.tampere.fi/uri/doc/1000358/6447/EPSG:3067.gml2">
        <rdf:type rdf:resource="http://paikkatiedot.fi/jhs-skeema#data"/>
        <dc:format>application/gml</dc:format>
        <jhs:CRS rdf:resource="http://www.opengis.net/def/crs/EPSG/0/3067"/>
      </rdf:Description>
    </dc:hasFormat>
    <dc:subject rdf:resource="http://www.yso.fi/onto/yso/p17892"/>
    <rdfs:seeAlso rdf:resource="http://paikkatiedot.fi/so/1000040/172353"/>
    <jhs:id rdf:resource="http://paikkatiedot.fi/id/1000040/172353"/>
    <jhs:so rdf:resource="http://paikkatiedot.fi/so/1000358/6447"/>
  </rdf:Description>
</rdf:RDF>
```