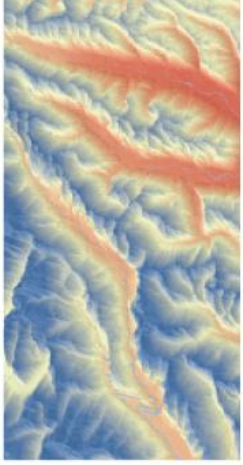
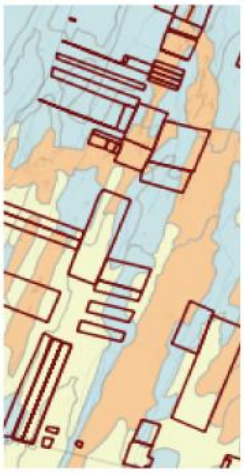
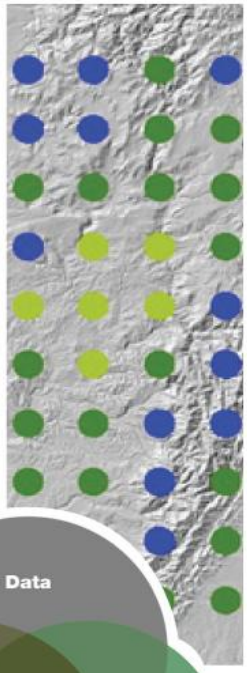
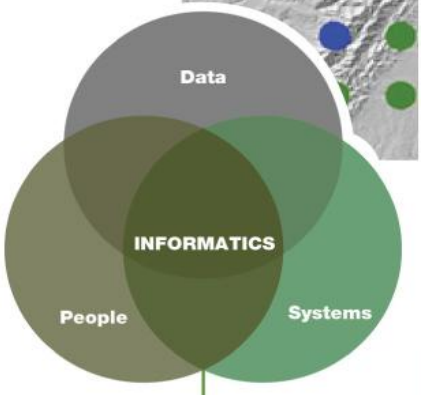


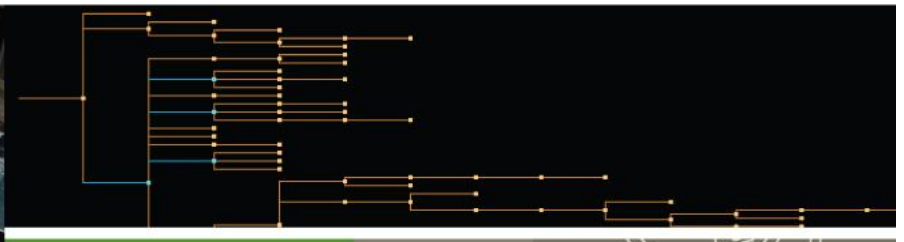




Spatial model and decision support tool directory metadata review

Envirolink Tools Project: R7-3





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Spatial model and decision support tool directory metadata review

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Summary

Project and Client

- Landcare Research was asked to provide expert advice on a directory of spatial model and decision support tools for regional councils and other key users. This work was a subcontract to an Envirolink Tools Project managed by Alchemists Ltd for Massey University.

Objectives

- Provide advice on a list of spatial models and spatial decision support systems that had been compiled.
- Review the draft directory, its structure, functionality, and content.
- Make recommendations for the ongoing maintenance and management of the directory.

Methods

The directory of spatial model and decision support tools was reviewed against:

- Existing approaches to describing metadata for data, spatial models and applications defined by the Dublin Core Initiative, and jointly by the International Standards Organisation and the Open Geospatial Consortium (ISO/OGC).
- The geospatial information strategy for open spatial data infrastructure developed by the New Zealand Geospatial Office.

Results and conclusions

- The proposed metadata properties were comprehensive and there were no significant omissions.
- There was difficulty mapping the defined Use Case properties defined to the metadata standards. As they can be considered to be describing something distinct (albeit related) to the descriptions of the models and decision support tools themselves, it is best that they are treated separately.
- A combination of the Dublin Core and ISO/OGC standards could be used as starting model for a new directory; however, they do not meet all requirements.

Recommendations

- The use of existing standards as the basis for the underlying system is recommended. We understand that the client felt this was not appropriate as the system was already in an advanced state of implementation and is focused on the provision of a human-readable web user interface, not a machine-readable registry of tools. Nonetheless, Landcare Research recommends that the long-term maintenance and exposure of the directory will be best achieved by considering the use of existing standards.

1 Introduction

Landcare Research was asked to provide expert advice on a directory of spatial model and decision support tools for regional councils and other key users. The work was a subcontract to an Envirolink Tools Project managed by Alchemists Ltd for Massey University.

The Envirolink Tools project aimed to minimise impediments to the discovery of these models and tools 'by producing a searchable web-based directory of existing computer spatial simulation models and other non-spatial DSS that can be used in environmental and resource management strategic or policy decision-making by regional councils' (Fenton 2013).

Landcare Research considered the use of existing standards as a basis for the review, specifically the Dublin Core metadata model, and the set of spatial data and infrastructure standards developed by the International Standards Organisation and Open Geospatial Consortium. These were selected because they are the most commonly used standards for environmental metadata. They also form the basis for the New Zealand government strategy for designing and implementing a national geospatial data infrastructure (NZGO 2007).

2 Objectives

Landcare Research was to:

1. Provide advice on a list of spatial models and spatial decision support systems that had been compiled.

2. Review the draft directory, its structure, functionality, and content.

3. Make recommendations for the ongoing maintenance and management of the directory.

Points 2 and 3 are addressed here, and considered from the perspective of appropriate data structures and content – the design and functionality of the website was beyond the scope of this report.

3 Methods

This review assumes that the directory was public and would provide metadata to a variety of communities. As such, it would benefit from alignment with existing approaches to describing metadata for data, spatial models, and applications. It would also be desirable to align the directory with the geospatial information strategy for an open spatial data infrastructure developed by the New Zealand Geospatial Office. Two commonly used approaches – documented as formal standards for metadata information – were selected as a

basis for comparison with the directory: Dublin Core[1]; and the closely aligned specifications of the International Standards Organisation (ISO)[2] and Open Geospatial Consortium (OGC)[3].

Wikipedia[4] describes Dublin Core as an initiative to define a set of core 'metadata terms [as] a set of vocabulary terms which can be used to describe resources for the purposes of discovery. The terms can be used to describe a full range of web resources (video, images, web pages, etc.), [and] physical resources such as books and objects like artworks. […] The original set of 15 classic metadata terms [is] known as the Dublin Core Metadata Element Set.' The core elements are summarised at: http://dublincore.org/documents/dcmi-terms/.

The ISO/OGC standards are broader in scope than Dublin Core vocabulary. They describe not only the documents but also the systems used to access, distribute and operate on them (e.g. web services), and the exact temporal and spatial nature of data. They are part of a series of standards to support spatial data infrastructures and have been widely adopted or recommended – for example by the New Zealand Spatial Data Infrastructure (the implementation of the New Zealand Geospatial Strategy).

This review assumed that the spatial models and decision support systems being described could be considered a form of OGC Web Processing Service (WPS) – defined as 'any algorithm, calculation or model that operates on spatially referenced data' (OGC 2005). The WPS specification incorporates the ISO19115 for metadata about spatial information (ISO/TC211 2003).

In this context these standards could be used in several ways:

- As a basis for a review of the metadata properties defined for the directory
- As a constraint on the design of the full directory and its underlying implementation (e.g. as a data model for the underlying database)
- As a specification for the provision of the data – using structured file formats to end-users.

[1] Dublin Core® Metadata Initiative: http://dublincore.org/

[2] ISO/TC (Technical Committee) 211 Geographic Information/Geomatics: http://www.isotc211.org/

[3] Open Geospatial Consortium: http://www.opengeospatial.org

[4] http://en.wikipedia.org/wiki/Dublin_Core

4 Results

4.1 Review of metadata properties

The metadata properties identified for the directory were compared with properties defined in the Dublin Core and ISO/OGC standards to identify common ground, and to expose any missing properties. The results of this mapping are tabled in Appendix 1.

The review showed that the proposed metadata properties were comprehensive and there were no significant omissions.

There was, however, difficulty mapping the Use Case properties, defined at the end of the table, to the metadata standards. This is not surprising since they can be considered to be describing something distinct (albeit related) to the descriptions of the models and decision support tools themselves. It is therefore best that they are treated separately.

4.2 Application of metadata standards

The review also considered how the standards could be used to inform the design of the system underlying the directory, and the subsequent provision of structured data to end-users. It is the experience of the author that the application of existing standards can accelerate the development of new systems.

Application of Dublin Core

The Dublin Core elements and terms provided good, but not complete, coverage of the fields specified in the metadata model. It did not map well onto the user information (Software/Client) section, but this could possibly be addressed by describing each model with three entities/resources: a model entity, a user/client entity and a use case entity. Each could be linked using the Dublin Core 'relation' property and individually described using the Dublin Core properties. Also, the use of ontologies such as Friend of a Friend (FOAF) and the Vocabulary of Interlinked Datasets (VIOD) could provide descriptions of parties and datasets related to each model.

Application of OGC and ISO19100 series standards

The mapping treated each model as a Process exposed by a Web Processing Service and then mapped the proposed properties to those available from a response to a WPS DescribeProcess request. Most properties could be populated in this way; however, they do not describe the client or user experience well. As with the Dublin Core standards, this means the user information and use case sections are not well covered.

Application of a combined set of standards

It is possible to combine the two standards sets by using the Dublin Core implementation in the OGC Web Catalogue Service (CS/W) specification (OGC 1999) by considering a model as a WPS Process registered with a CS/W. The CS/W Record that describes the Process would use the Dublin Core properties, and the results of the WPS DescribeProcess could fill in the gaps (or provide more detail – e.g. with the input/output data section, or explicit representations of spatio-temporal extent).

5 Conclusions and recommendations

An initial review concluded that the Dublin Core and ISO/OGC standards could be used as starting model for a new directory, but did not meet all requirements. The OGC/ISO standards are comprehensive while Dublin Core provides a smaller, but widely accepted and understood set of core metadata properties. A combined approach therefore provides the most comprehensive solution: Dublin Core would provide a basic, but very usable, set of information that can be provided as digital data (structured using the Dublin Core model), meanwhile a much more comprehensive set of metadata can be exposed using the additional WPS descriptions.

Neither approach satisfactorily addresses the user information and use case requirements. The directory Use Cases section should be separated from the spatial model and decision support tool metadata, but still be tightly linked to the metadata.

The review of the model – including the recommendation to separate the Use Cases from the metadata – was accepted by the client. The proposal to use the existing standards as the basis for the underlying system was, however, not considered to be appropriate, as:

- The system was already in an advanced state of implementation and adopting the recommendations would be expensive (in terms of redevelopment time).
- The project is focused on the provision of a human-readable web user interface, not a machine-readable registry of tools.

The long-term maintenance and exposure of the directory may be best achieved by considering the recommendations. Time saved by implementing existing models can be invested in the user interface and related tools. It was therefore decided to ensure that the alignment of the implementation of the directory with the standards was recorded, thereby facilitating their use in the future.

Future use does not necessarily involve reengineering the directory, and the approach is therefore consistent with a common use of web services: they provide an alternative view of an existing implementation according to a more widely known set of standards. This allows implementers of specific systems the freedom to design their own tools, while conforming to external standards through an overarching service layer.

There was insufficient time to complete a full mapping onto the ISO/OGC suite of standards, but the Dublin Core term mappings were accommodated by the directory developers for future use. These have been recorded in Appendix 1.

6 Acknowledgements

The author thanks the following for their support and feedback: Tony Fenton (Alchemists Ltd); Robert Gibb and Stella Belliss (Informatics Team, Landcare Research).

7 References

Fenton A 2013. Decision Support System Web Directory Project – Final report. http://tools.envirolink.govt.nz/assets/Uploads/DSS-Directory-Project-Final-Report.pdf

ISO/TC211 2003. ISO19115 (Geographic Information – Metadata). http://www.iso.org/iso/catalogue_detail.htm?csnumber=26020

NZGO 2007. New Zealand Geospatial Strategy. http://www.geospatial.govt.nz/sites/default/files/assets/Geospatial-Strategy/nz-geospatial-strategy-2007.pdf

OGC 1999. OGC Web Catalogue Service. http://www.opengeospatial.org/standards/specifications/catalog

OGC 2005. OGC Web Processing Service. http://www.opengeospatial.org/standards/wps

Appendix 1 – SDSS Web Directory metadata field mapping

This table is a reproduction of a spread sheet that maps the SDSS Web Directory metadata fields onto equivalent Dublin Core terms and ISO/OGC standards properties and the content has not been changed for this report. The Dublin Core Term mappings shown as hyperlinks and without italics have been accommodated by the developers of the directory. Dublin Core Terms shown in italics indicate an equivocal mapping – they show a clear conceptual match, but cannot be easily implemented. These have not been considered for use at this stage.

SDSS Web Directory – metadata fields	Dublin Core terms	OGC/ISO19100 Series properties
Title of model/DSS	DCMI Term - title	WPS Describe Process – title
Purpose	DCMI Term - description	WPS Describe Process – (part of?) abstract
Description	DCMI Term - description	WPS Describe Process – abstract
Type – computer model (spatial, non-spatial), non-computer model	DCMI Term - type	
Latest version	*Unclear*	WPS Describe Process – process version
State of development		WPS Describe Process – Metadata – metadata maintenance – Maintenance information
Current development activity		
Main developers	DCMI element - creator	WPS Describe Process – Metadata – contact
Contact	DCMI element - publisher	
Scope		
Outcome area	DCMI element -subject	WPS Describe Process – Metadata – contact (?) Described as part of the OGC profile? Processes can meet needs of multiple profiles … one for each of the outcome areas and management domains mentioned.
Management domain		
Sub domain		
Intended end-users	DCMI element - audience	
Spatial resolution	*DCMI element - coverage - spatial*	WPS Describe Process – Metadata – spatial representation – Dimension – resolution

SDSS Web Directory – metadata fields	Dublin Core terms	OGC/ISO19100 Series properties
Spatial extent		WPS Describe Process – Metadata – reference system info – Reference System – domain of validity
Spatial dimensions		*Implicit in the data models referred to in the input/output data section.*
Temporal resolution	*DCMI element - coverage - temporal*	WPS Describe Process – Metadata – data quality – temporal validity?
Temporal extent		WPS Describe Process – Metadata – reference system info – Reference System – domain of validity
Steady state or dynamic	*Unclear*	*Unclear*
Level of integration		*Unclear*
Input and output data		
Key input data	*Unclear*	WPS Describe Process – Data Inputs – Complex Data/Literal Data/Bounding Box Data
Input data formats	*DCMI element - format(.mediatype)*	WPS Describe Process – Data Inputs – Complex Data – Format
Key output data	*Unclear*	WPS Describe Process – Process Outputs – Complex Output/Literal Output/Bounding Box Output
Output data formats	*DCMI element - format(.MediaType)*	WPS Describe Process – Process Outputs – Complex Output – Format
Accessibility		
Open/Closed Source	*DCMI element - rights - access rights*	*Implicit in licence type?*
Licence type	*DCMI element - rights - license (LicenseDocument class)*	WPS Describe Process – Metadata – metadata constraints – Legal Constraints?
Licence cost for non-commercial use	*DCMI element – rights – license (?)*	WPS Capabilities – fees

SDSS Web Directory – metadata fields	Dublin Core terms	OGC/ISO19100 Series properties
Licence cost for commercial use	*DCMI element – rights – license (?)*	
Licence purchase contact	*DCMI element - rightsHolder*	
Other IP constraints on use	*DCMI element – rights*	WPS Describe Process – Metadata – metadata constraints – Constraints
User information		
Operating system / platforms	*Unclear*	*Tricky – OGC/ISO19100 standards tend to focus on services and information structures. They assume there could be any number of clients that can invoke their services. As a result client metadata standards aren't defined (to my knowledge …).* *That said, some OGC/ISO types could be used to structure values for these properties – e.g.* *CI_Citation for documentation/manuals and* *CI_ResponsibleParty for available support.*
Software needed		
Prerequisites for use		
User Interface		
Ease of use	*DCMI element - audience - education level*	
Use in Policy process	*Unclear*	
User documentation/manuals		
Available support	DCMI element - audience - mediator	
Users Forum		
Technical considerations		
Language used	*DCMI element - language*	WPS Describe Process – Metadata – language
~~Techniques/methods for user control~~	*Unclear*	~~*As stated elsewhere - not aware of much meta info about clients in the ISO/OGC spec.*~~
Methods included for calibration and validation		WPS Describe Process – Metadata – data quality – {data quality type}
Methods included for managing uncertainty		
Analytical techniques		WPS Describe Process – Metadata – data quality –

SDSS Web Directory – metadata fields	Dublin Core terms	OGC/ISO19100 Series properties
		{lineage type}
Model Structure (diagram)		*Unclear* – Citation/URL?
Other information		
Keywords	DC element - subject	WPS Describe Process – metadata – (xlink) title
Linkages to other models	DC element - relation	*Unclear*
Links	*DC element - relation*	*What does this mean?*
Key References	*DC element - identifier - bibliographic citation*	WPS Describe Process – Metadata – data quality – {lineage}
Applications – Case Studies	*DC element - relation*	
Location		*Tricky – as per user information above … not much in the specs about application of models/data (that I'm aware of … it's a big set of specs). As with the above, some data types could be used to structure values for these properties.*
Organisations		
Management domain		
Sub domain		
Description		
Links		
Key References		