The Data CaTalog metadata standard

The ODI Athens Node

Bank of Greece

Athens 08-11-2017

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WELCOME!

WE ARE.. GIANNIS & GIANNIS

..YOU ARE..?

Session 1: Introduction to open data and metadata

Hopefully by the end of this session you will be able to

- **Define** Open Data
- **Define** metadata and dataset
- **Explain** how metadata standard can be used

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OPEN DATA

Why now?

- policy mandates 

- data and technical standar 

- best practices and guidelines

what I need to know?

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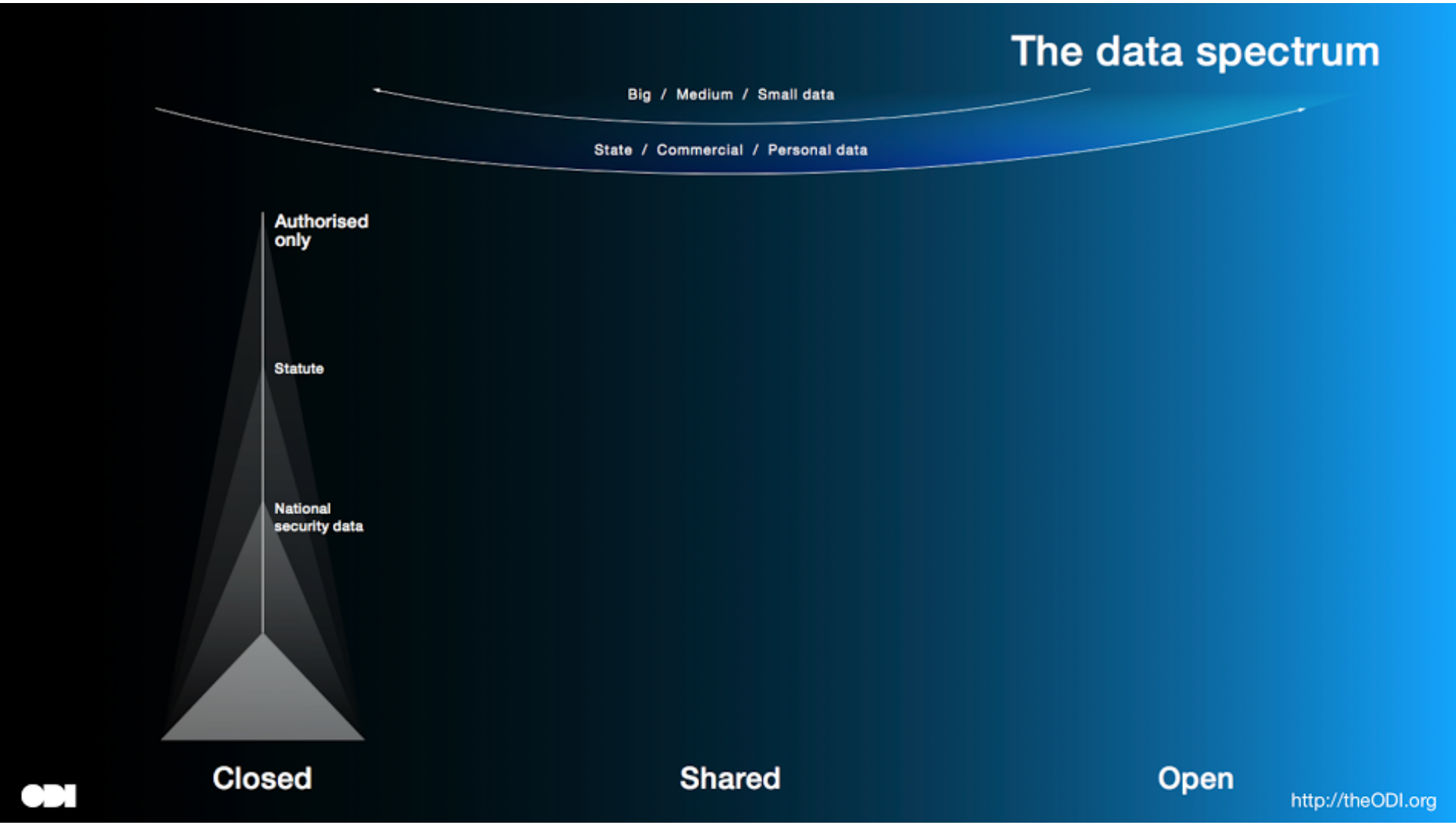

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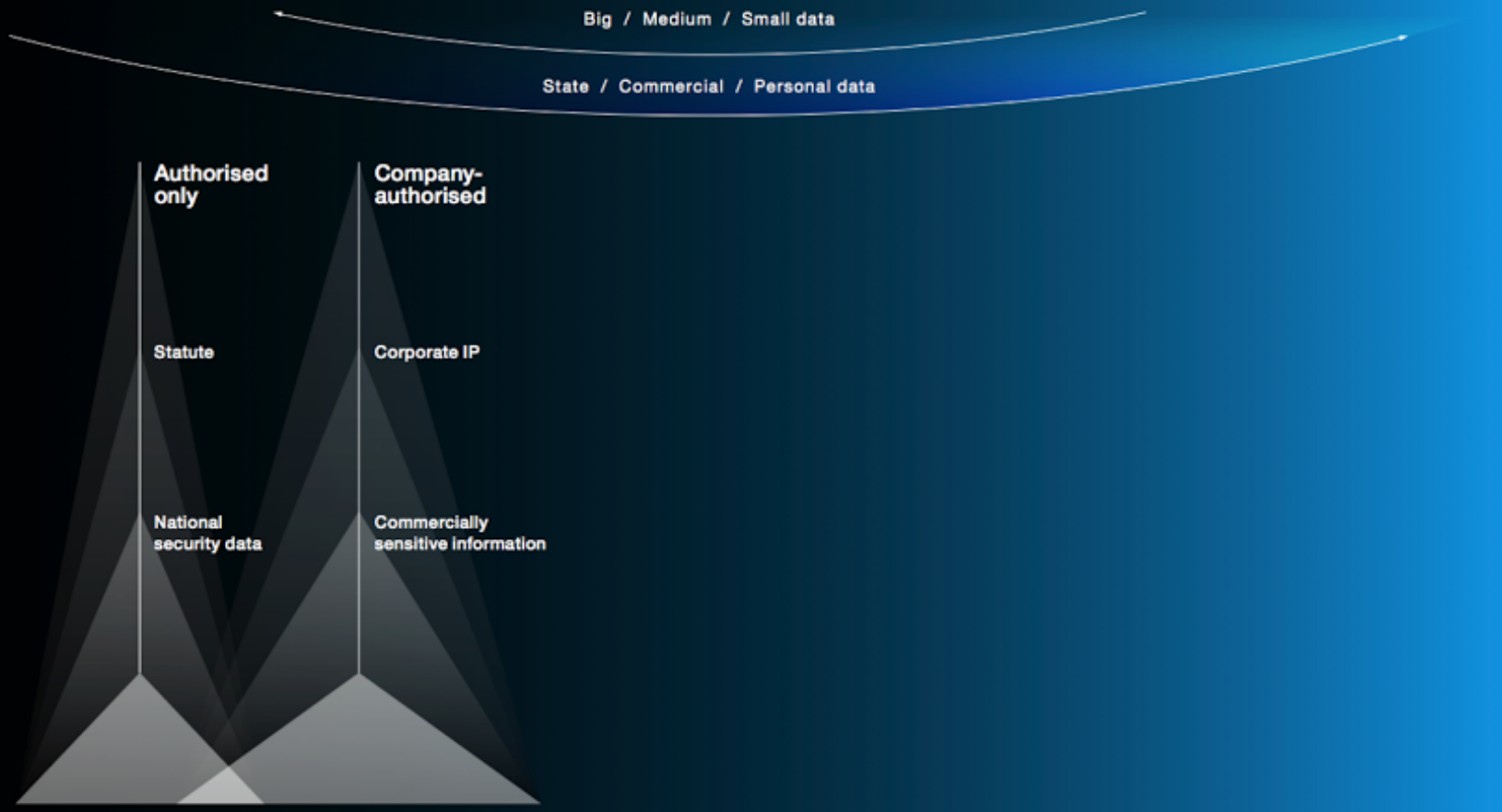
The data spectrum



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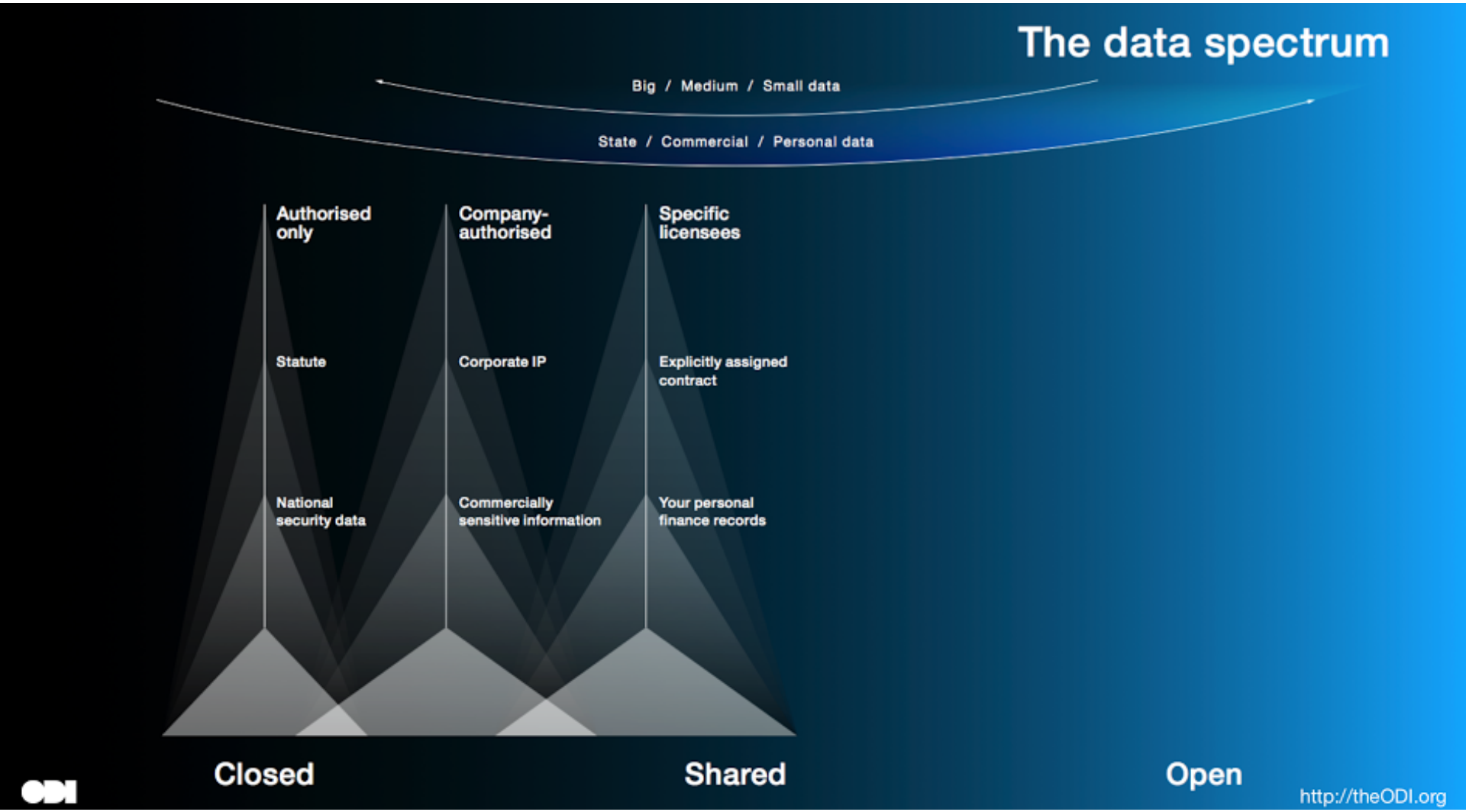

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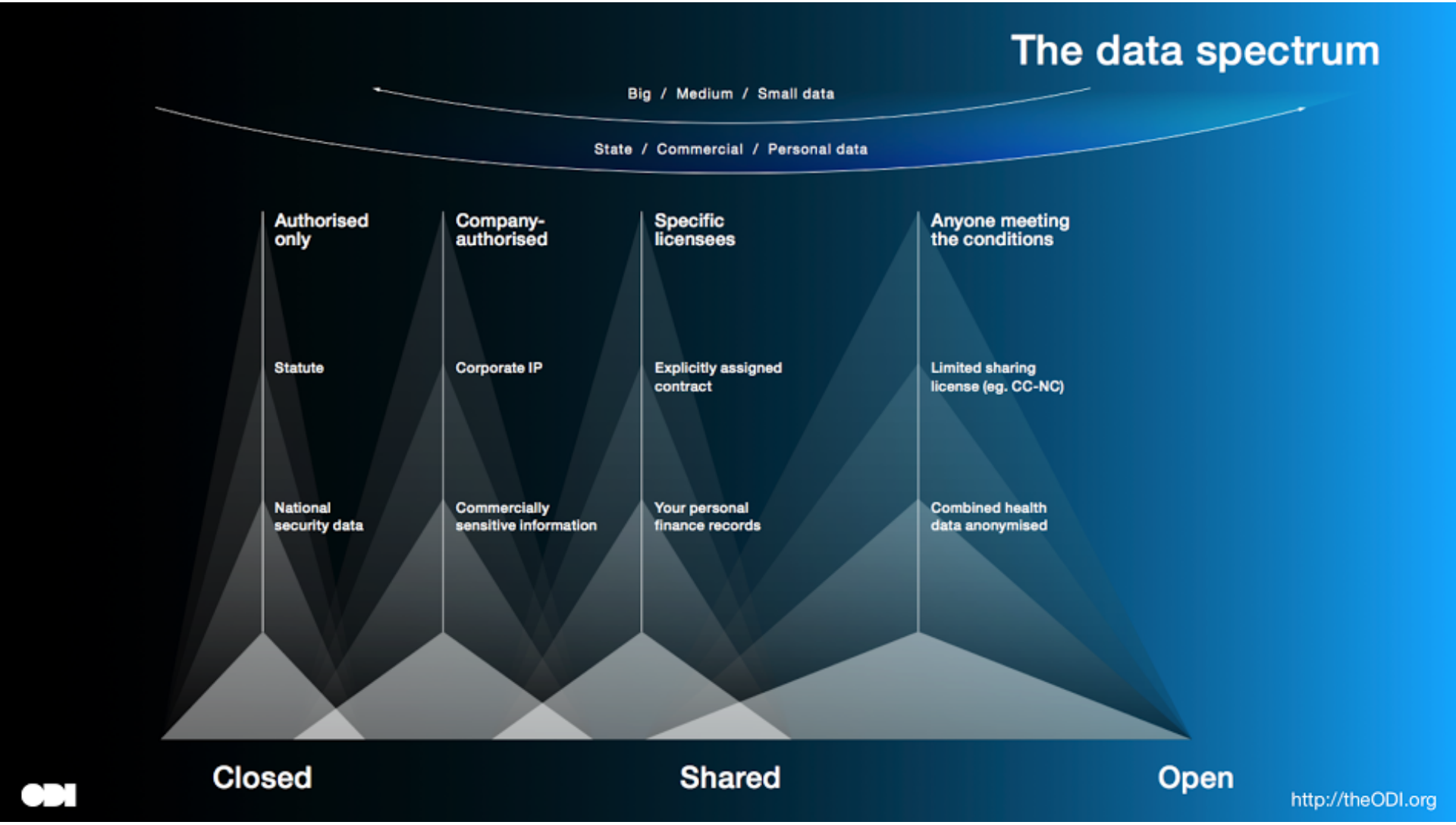

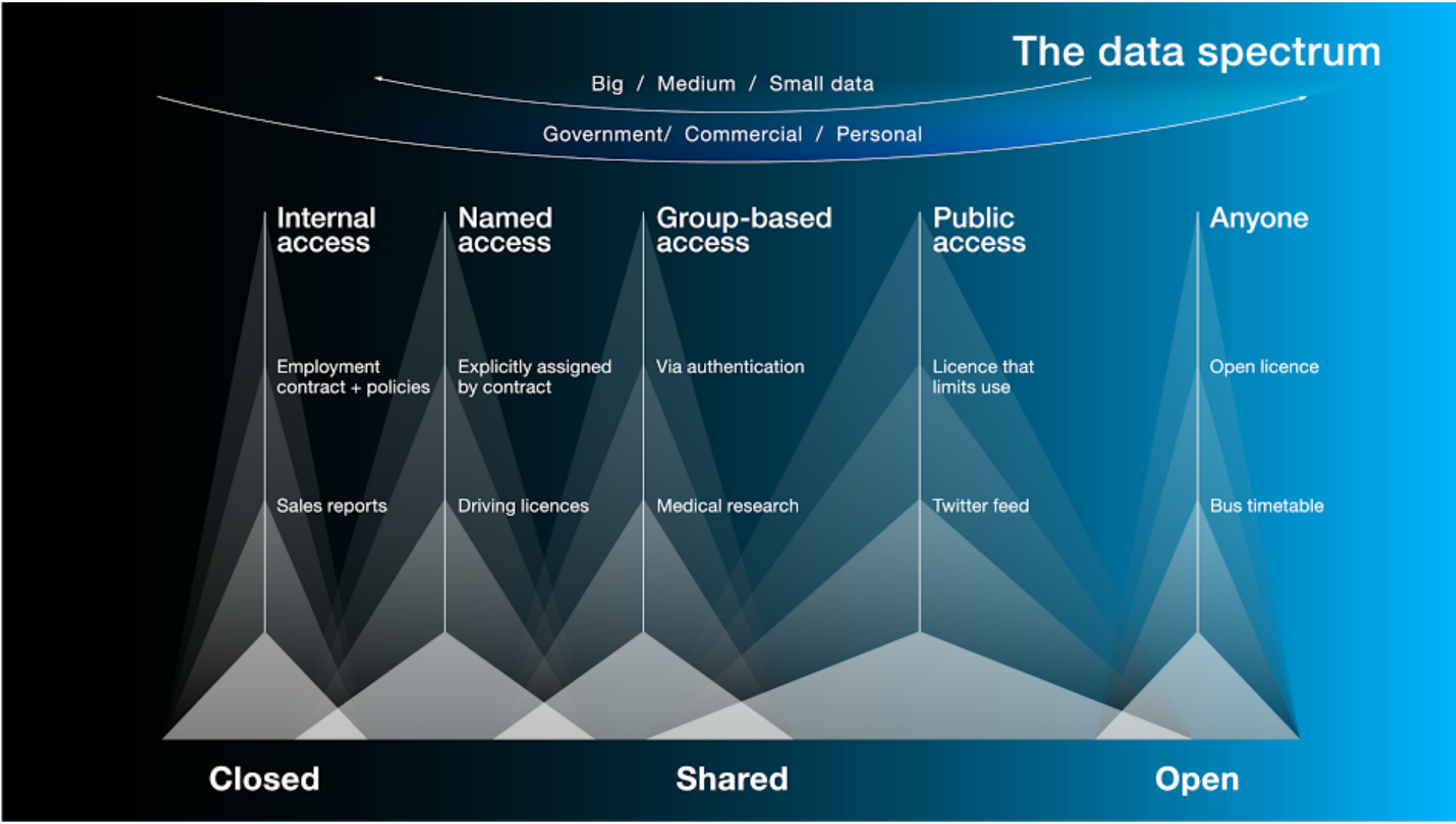
The data spectrum
Big / Medium / Small data
Government/ Commercial / Personal
Internal access
Named access
Group-based access
Public access
Anyone
Employment contract + policies
Explicitly assigned by contract
Via authentication
Licence that limits use
Open licence
Sales reports
Driving licences
Medical research
Twitter feed
Bus timetable
Closed
Shared
Open

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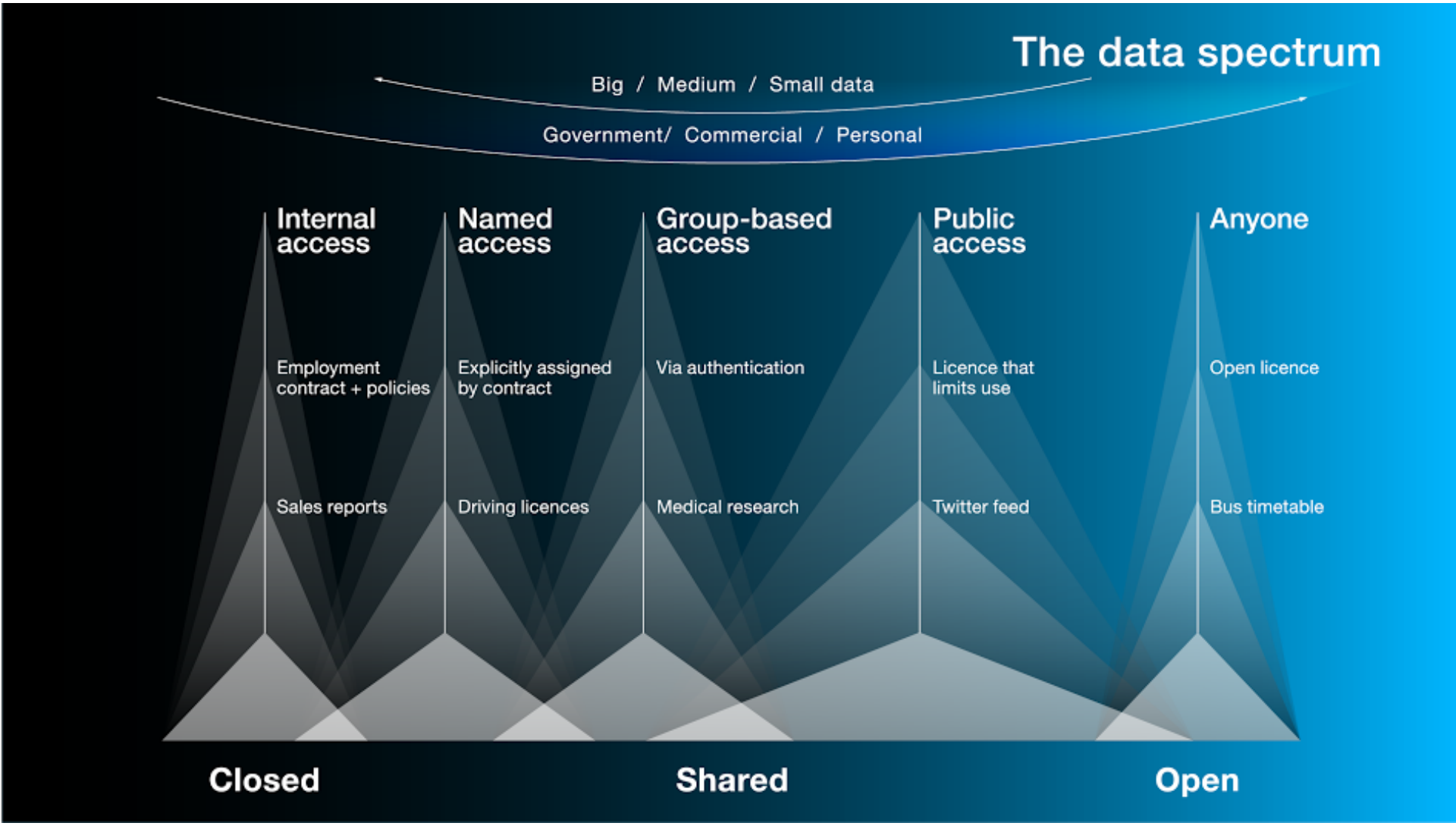
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Sales reports
Driving licences
Medical research
Twitter feed
Bus timetable
Closed
Shared
Open

Δι@υγεια Anonymized Health Records

Instagram Feed

Athens Temperatures

BUS Timetables (KTEL)

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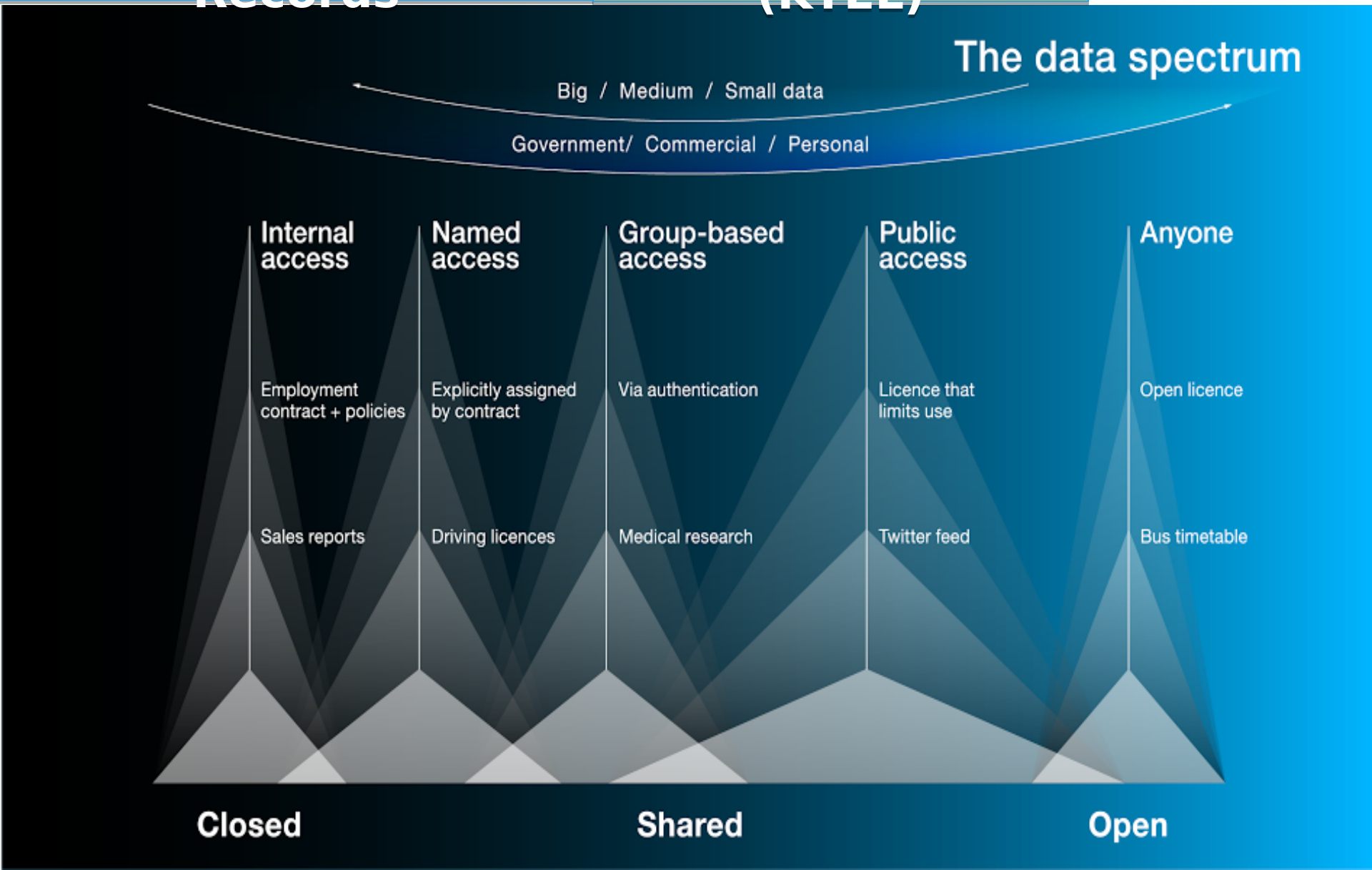

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CAN YOU GIVE AN OPEN DATA DEFINITION ?

Open ?

Open means **anyone** can **freely access**, **use**, **modify**, and **share** for **any purpose**

(*subject, at most, to requirements that preserve provenance and openness*)/ **http://opendefinition.org**

Definition ?

Open data is information that is available for **anyone** to **use**,

for **any purpose**,

at **no cost**

- **Open Data Institute**

Definition

Open Data is Data that **anyone** can **access**, **use** and **share**

- **Open Data Institute**
- ***http://theodi.org/guide/what-open-data***
  Introduced in 2015

Is That All ?

There is something missing..

OPEN DATA

must be explicitly licensed

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What is metadata, dataset and data distribution

What is metadata?

“Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is often called data about data or information about information.”

-- National Information Standards Organization

http://www.niso.org/publications/press/UnderstandingMetadata.pdf

Metadata provides information enabling to make sense of **data** (e.g. documents, images, datasets), **concepts** (e.g. classification schemes) and **real-world entities** (e.g. people, organisations, places, paintings, products).

Do we really need a metadata standard?

When you manage a single or few datasets and you share them with colleagues you may not need a common metadata standard and you may use a common agreed schema

BUT when you want to share your heterogeneous datasets and contribute them to a data catalog then **the dataset metadata (machine readable data description) becomes important**

Why machine readable descriptions?

Data can be reused by applications: other can search and make use of your data

- **Datasets have to be found by applications**
- **Datasets have to be understood by applications**

Datasets should be managed in data repositories/data catalogs

- **Data catalogs have to provide enough dataset metadata to applications to allow them to find and understand datasets**

Types of metadata

Descriptive: describe a resource for discovery and identification

Structural: e.g. data models and reference data

Administrative: information to help resource management

Metadata schema

It is a standard set of data elements that is used for describing records. It establishes data elements and rules for their use.

What is important when creating a metadata schema for your data

Reuse properties from standard well accepted vocabularies. Some examples

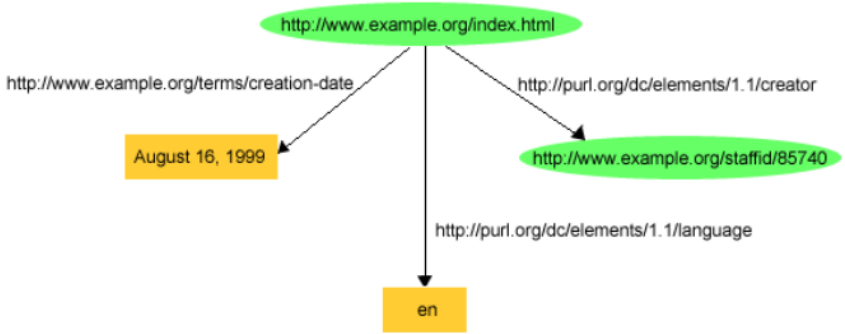
- **Dublin Core** for published material (text, images), http://dublincore.org/documents/dcmi-terms/
- **FOAF** for people and organisations, http://xmlns.com/foaf/spec/
- **SKOS** for concept collections, http://www.w3.org/TR/skos-reference
- **ADMS** for interoperability assets, http://www.w3.org/TR/vocab-adms/
- Specific standard for datasets:
- **Data Catalog Vocabulary DCAT**, http://www.w3.org/TR/vocab-dcat/
- Specific usage of DCAT and other vocabularies to support interoperability of data portals across Europe:

How to provide metadata on the web?

Two approaches

```
<?xml version="1.0"?>
<!DOCTYPE user SYSTEM "users.dtd">
<user>
 <student>
    <name>
       <firstname>Joe</firstname>
       <surname>Smith</surname>
       <title>Mr.</title>
       <username>smithj</username>
    </name>

    <contact>
       <address>
          <street>54 Maple Rise, Santry</street>
          <county>Dublin</county>
          <country>Ireland</country>
       </address>
       <email>smithj@dcu.ie</email>
    </contact>

    <programme active="true">
       <progname>M.Eng in Electronic Systems</progname>
       <code>MEN</code>
       <year>1</year>
    </programme>

    <module semester="2">
       <modid>EE557</modid>
    </module>

    <module semester="1">
       <modid>EE553</modid>
    </module>
 </student>
```

XML




```
ex:index.html  dc:creator             exstaff:85740 .
ex:index.html  exterms:creation-date  "August 16, 1999" .
ex:index.html  dc:language            "en" .
```

RDF (Triple-based approach)

What is a dataset?

According to W3C

Dataset is a collection of data, published or curated by a single agent, and available for access or download in one or more formats.

From: https://www.w3.org/TR/vocab-dcat/#class-distribution

What is a data distribution?

Represents a specific available form of a dataset. Each dataset might be available in different forms, these forms might represent different formats of the dataset or different endpoints. Examples of distributions include a downloadable CSV file, an API or an RSS feed

From: https://www.w3.org/TR/vocab-dcat/#class-distribution

Dataset description vocabularies

- **DCAT** Vocabulary
  - RDF vocabulary for describing any dataset
  - Dataset can be stand alone or part of a catalog
  - Metadata about dataset (collection) and related distributions

- **DataCube** Vocabulary
  - RDF Vocabulary for describing statistical datasets
  - Useful for attaching metadata about the “data structure” of a dataset

- **VOID** vocabulary
  - RDF vocabulary for expressing metadata about RDF datasets
  - Useful especially for metadata related to RDF data services

Controlled vocabularies

What is a controlled vocabulary?

A controlled vocabulary is a predefined list of values to be used as values for a specific property in your metadata schema.

- In addition to careful design of schemas, the value spaces of metadata properties are important for the exchange of information, and thus interoperability.
- Common controlled vocabularies for value spaces make metadata understandable across systems.

How to use controlled vocabularies (1/3)

In element describing the *topics*: use a multilingual vocabulary with public URI for each term

Example: Use Eurovoc

```
<rdf:Description rdf:about="http://eurovoc.europa.eu/300">
        <xl:altLabel rdf:resource="http://eurovoc.europa.eu/415040"/>
        <s04:prefLabel xml:lang="da">international kredit</s04:prefLabel>
        <s04:prefLabel xml:lang="sv">internationell kredit</s04:prefLabel>
        <s04:prefLabel xml:lang="en">international credit</s04:prefLabel>
        <s04:prefLabel xml:lang="de">internationaler Kredit</s04:prefLabel>
        <s04:prefLabel xml:lang="nl">internationaal krediet</s04:prefLabel>
</rdf:Description>
```

How to use controlled vocabularies (2/3)

In a *Language* element: use a standard code list

Example: Using ISO 639-1

```
<madsrdf:hasVariant>
        <madsrdf:Language>
          <rdf:type rdf:resource="http://www.loc.gov/mads/rdf/v1#Variant"/>
          <madsrdf:variantLabel xml:lang="en">English</madsrdf:variantLabel>
        </madsrdf:Language>
      </madsrdf:hasVariant>
  <madsrdf:hasVariant>
```

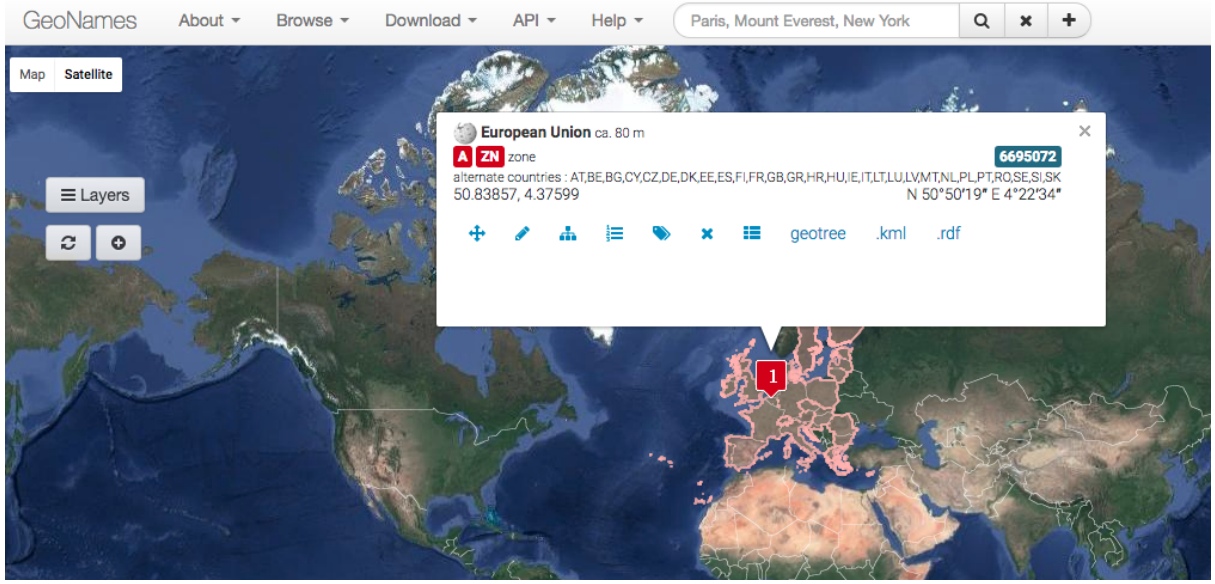
How to use controlled vocabularies (3/3)

In an element for Country: use a standard ontology with public URIs for each value

Example: use Geonames ontology

dct:spatial <http://www.geonames.org/6695072> ;

http://www.geonames.org/6695072/european-union.html



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LET’S TAKE A BREAK

Session 2: How to use DCAT

Hopefully by the end of this session you will be able to

- **Explain** the metadata lifecycle
- **Name** the main aspects of metadata quality
- **Define** DCAT and DCAT - AP
- **Explain** how DCAT-AP can be used

CREATING, MAINTAINING, UPDATING AND PUBLISHING YOUR METADATA

Creating metadata

Metadata creation can be supported by (semi-)automatic processes.

- Document properties generated in (office) tools, e.g. creation date.
- Spatial and temporal information captured by cameras, sensors...
- Information from publication workflow, e.g. file location or URL

But other characteristics require human intervention:

- What is the resource about (e.g. linking to a subject vocabulary)?
- How can the resource be used (e.g. linking to a licence)?
- Where can I find more information about this resource (e.g. linking to a Web site or documentation that describes the

Maintaining metadata

Approaches for maintaining metadata need to be appropriate for the type of data that is being published.

Data does not change

- e.g. dataset with prices of goods for an older year
- metadata can be relatively stable. Changes (bulk conversions) can take place off-line when needed.

Data changes frequently

- e.g. sensor data
- metadata needs to be closely coupled to the data workflow and changes need to be practically instantaneous.

Updating metadata

Metadata operates in a global context that is subject to change!

- Organisation – new departments are established, merge with others, responsibilities are handed over.
- Usage of the data – new applications emerge around data.
- Reference data – controlled vocabularies evolve and get linked.
- Data standards and technologies – technology lifecycle is getting shorter all the time; what will tomorrow's Web look like?
- Tools and systems – evolution of storage, bandwidth, mobile…

Metadata needs to be kept up-to-date to the extent possible, taking into account the available time and budget.

Storing metadata

Options for storing metadata

Depending on operational requirements, metadata can be embedded with the data or stored separately from the data.

- Embedding the metadata in the data (e.g. office documents, MP3, JPG, RDF data) embedding makes data exchange easier.
- Separating metadata from data (e.g. in a database), with links to corresponding data files makes management easier.

Depending on the availability of tools and requirements on performance and capacity, metadata can be stored in a ‘classic’ relational database or an RDF triple store.

Deleting metadata

Decommissioning or deletion of data happens, for example:

- When data is no longer necessary.
- When data is no longer valid.
- When data is wrong.
- When data is withdrawn by the owner/publisher

In that case the metadata should, contain information that the data was deleted, and if it was archived, how and where an archival copy can be requested.

Publishing metadata

‘Open’ publication: direct access on URIs

- This is the option most in line with the vision of Linked Open Data and allows the ‘follow-your-nose’ principle.

Make your metadata available through a SPARQL endpoint

- This allows external systems to send queries to an RDF triple store.
- Requires knowledge about the schema used in the triple store.

Make your data available through a web service (REST based or SOAP)

- Can be used by software developers
- Requires good documentation including mappings to metadata standards
- Collaboration with metadata consumer

Deferred publication: access to exported file in RDF

- Produced by converting non-RDF data to RDF.
- Allows off-line bulk harvesting and caching of data collections.
- Allows implementation of access control.

Metadata quality

Why metadata quality is important

The quality and completeness of the description metadata of your datasets, directly affects their searchability and reuse.

From:
https://www.europeandataportal.eu/sites/default/files/d2.1.2_training_module_1.4_introduction_to_metadata_management_en_edp.pdf

Metadata quality is about (1/3)

- **Accuracy**: are the characteristics of the resource correctly reflected?
- **Completeness**: are all relevant characteristics of the resource captured (as far as practically and economically feasible and necessary for the application)?
- **Availability**: can the metadata be accessed now and over time into the future?

Metadata quality is about (2/3)

- **Conformance**: is the metadata conforming to a specific metadata standard or an Application Profile?
- **Consistency**: does the data not contain contradictions?
- **Credibility and provenance:** is the metadata based on trustworthy sources?

Metadata quality is about (3/3)

- **Processability**: is the metadata properly machine-readable?
- **Relevance**: does the metadata contain the right amount of information for the task at hand?
- **Timeliness:** is the metadata corresponding to the actual (current) characteristics of the resource and is it published soon enough?

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THE DATA CATALOG VOCABULARY (DCAT)

Some history

International Conference on Electronic Government
EGOV 2010: Electronic Government pp 339-350 | Cite as

Enabling Interoperability of Government Data Catalogues

Authors | Authors and affiliations

Fadi Maali, Richard Cyganiak, Vassilios Peristeras

Conference paper

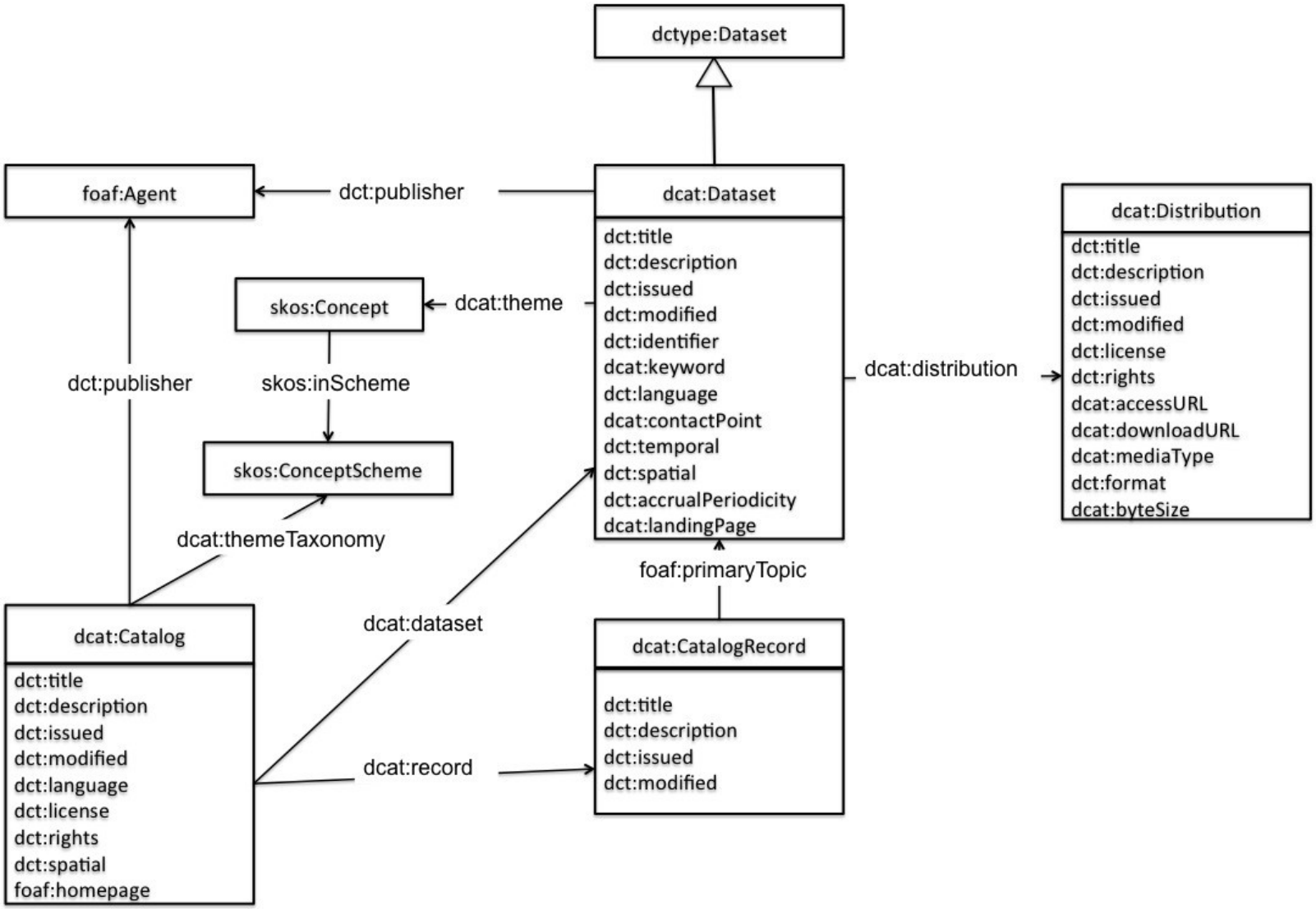
6 Citations | 125 Readers | 1.2k Downloads

Part of the Lecture Notes in Computer Science book series (LNCS, volume 6228)

Abstract

Opening public sector information has recently become a trend in many countries around the world. Online government data catalogues with national, regional or local scope act as one-stop data portals providing descriptions of available government datasets. These catalogues though remain isolated. Potential benefits from federating geographically overlapping or thematically complementary catalogues are not realized. We propose an RDF Schema vocabulary as an interchange format among data catalogues and as a way of bringing them into the Web of Linked Data, where they can enjoy interoperability among themselves and with other deployed

The DCAT Model



DCAT Vocabulary namespaces

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Prefix	Namespace
dcat	http://www.w3.org/ns/dcat#
dct	http://purl.org/dc/terms/
dctype	http://purl.org/dc/dcmitype/
foaf	http://xmlns.com/foaf/0.1/
rdf	http://www.w3.org/1999/02/22-rdf-syntax-ns#
rdfs	http://www.w3.org/2000/01/rdf-schema#
skos	http://www.w3.org/2004/02/skos/core#
vcard	http://www.w3.org/2006/vcard/ns#
xsd	http://www.w3.org/2001/XMLSchema#

DCAT makes extensive use of terms from other vocabularies

DCAT properties: catalog class

A data catalog is a curated collection of metadata about datasets.

Property	Usage
dcat: catalog	Typically, a web-based data catalog is represented as a single instance of this class.
dct: title	Name of the catalog
dct: description	Description about the catalog
dct: issued	Date of formal publication of the catalog
dct: modified	Most recent date on which the catalog was modified, updated
dct: language	Language used in textual metadata describing the datasets of the catalog
foaf: homepage	The homepage of the catalog
dct: publisher	Entity responsible for making the catalog online
dct: spatial	The geo coverage of the dataset e.g. Greece
dcat: themeTaxonomy	The KOS used to classify the datasets of the catalog e.g. Eurovoc
dct: license	License of the catalog and not of the dataset distribution
dct: rights	Rights under which the dataset can be used
dcat: dataset	A dataset that is part of the catalog
dcat: record	A catalog record that is part of the catalog

DCAT properties: Catalog record class

A record in a data catalog, describing a single dataset. (Optional)

Property	Usage
dct: title	Name of the given record
dct: description	Free text description of the record
dct: issued	The date of listing the corresponding dataset in the catalog.
dct: modified	Most recent date on which the catalog entry was changed, updated or modified.
dct: primarytopic	Links the catalog record to the dcat:Dataset resource described in the record.

DCAT properties: dataset class

Actual dataset as published by the dataset publisher

Property	Usage
dct: title	A name of the dataset
dct: description	Free text description of the dataset
dct: issued	The date of formal publication of the dataset
dct: modified	Most recent date on which the dataset was changed, updated or modified.
dct: language	The language of the dataset
dct: publisher	An entity responsible for making the dataset available.
dct: acrualPeriodicity	The frequency at which dataset is published.
dct: identifier	A unique identifier of the dataset
dct: spatial	Spatial coverage of the dataset
dct: temporal	Temporal period that the dataset covers
dcat: theme	The main category of the dataset. A dataset can have multiple themes.
dcat: keyword	A keyword or tag describing the dataset.
dcat: contactPoint	Link a dataset to relevant contact information which is provided using VCard
dcat: distribution	Connect a dataset to its distributions

DCAT properties: distribution class

Represents a specific available form of a dataset.

Property	Usage
dct: title	Name of the distribution
dct: description	Free text description of the distribution
dct: issued	Date of formal publication
dct: modified	Most recent date on which the distribution was changed, updated or modified.
dct: license	This links to the license document under which the distribution is made available.
dct: rights	Information about rights held in and over the distribution.
dcat: accessURL	A landing page, feed, SPARQL endpoint or other type of resource that gives access to the distribution of the dataset
dcat: downloadURL	A file that contains the distribution of the dataset in a given format
dcat: byteSize	The size of a distribution in bytes.
dcat: mediaType	The media type of the distribution
dct: format	format of the distribution

DCAT Metadata Application Profile

A **DCAT application profile** is a specification for data catalogs that adds additional constraints to DCAT. A data catalog that conforms to the profile also conforms to DCAT. Additional constraints in a profile may include:

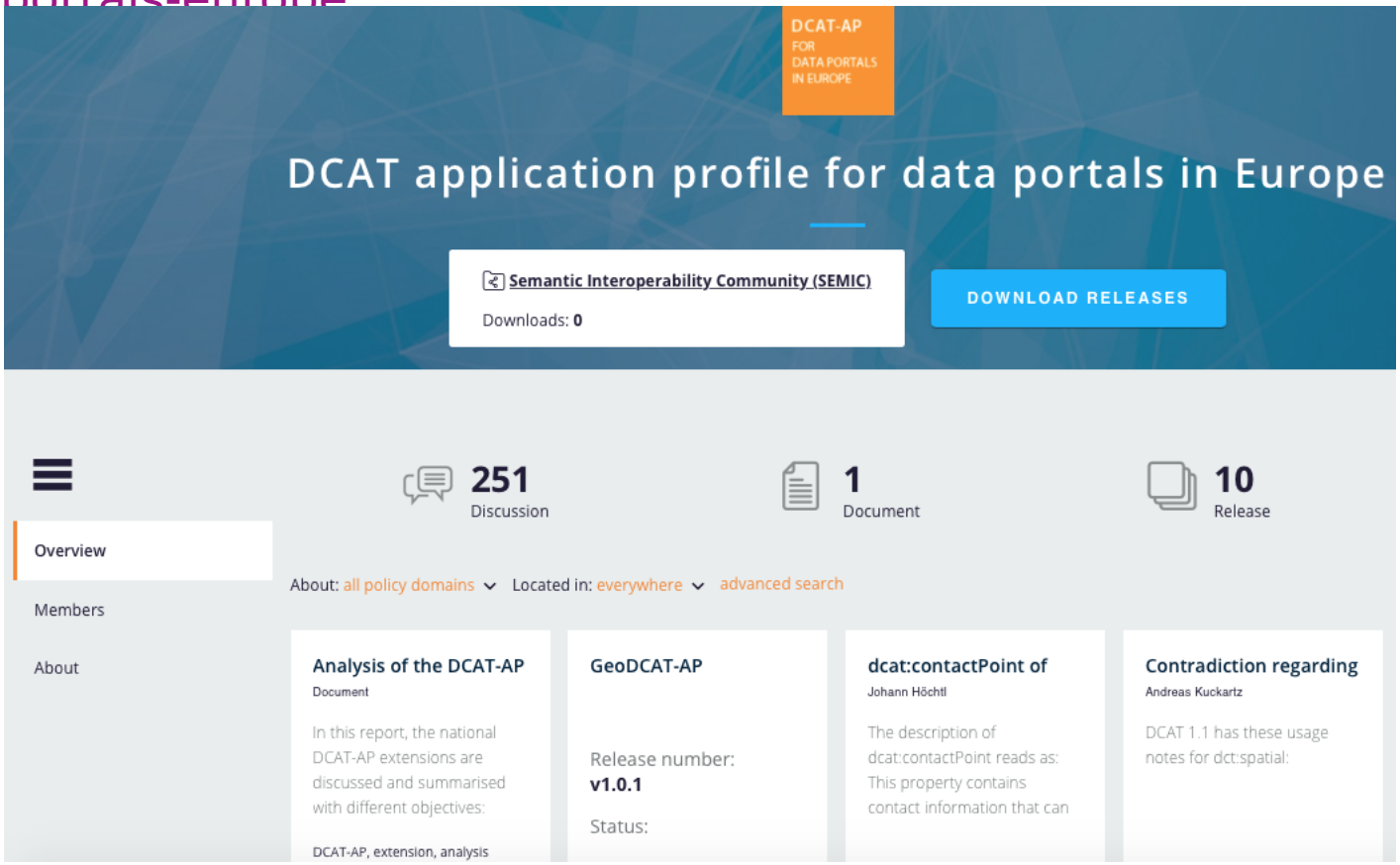
- A minimum set of required metadata fields
- Classes and properties for additional metadata fields not covered in DCAT
- Controlled vocabularies or URI sets as acceptable values for properties
- Requirements for specific access mechanisms (RDF syntaxes, protocols) to the catalog's RDF description

--- https://www.w3.org/TR/vocab-dcat/

Supported by a community

ISA² Programme

https://joinup.ec.europa.eu/solution/dcat-application-profile-data-portals-europe



DCAT – AP extensions

Examples of National extensions

- DCAT-AP Sweden
- DCAT-AP Belgium
- DCAT-AP Germany
- DCAT-AP Spain

Domain extensions

- **GEO/DCAT-AP** in collaboration with JRC team responsible for INSPIRE Directive
- **STAT/DCAT-AP** in collaboration with EUROSTAT
- recently some new extensions have been developed for transportation, agrifood, chatbots, scientific data

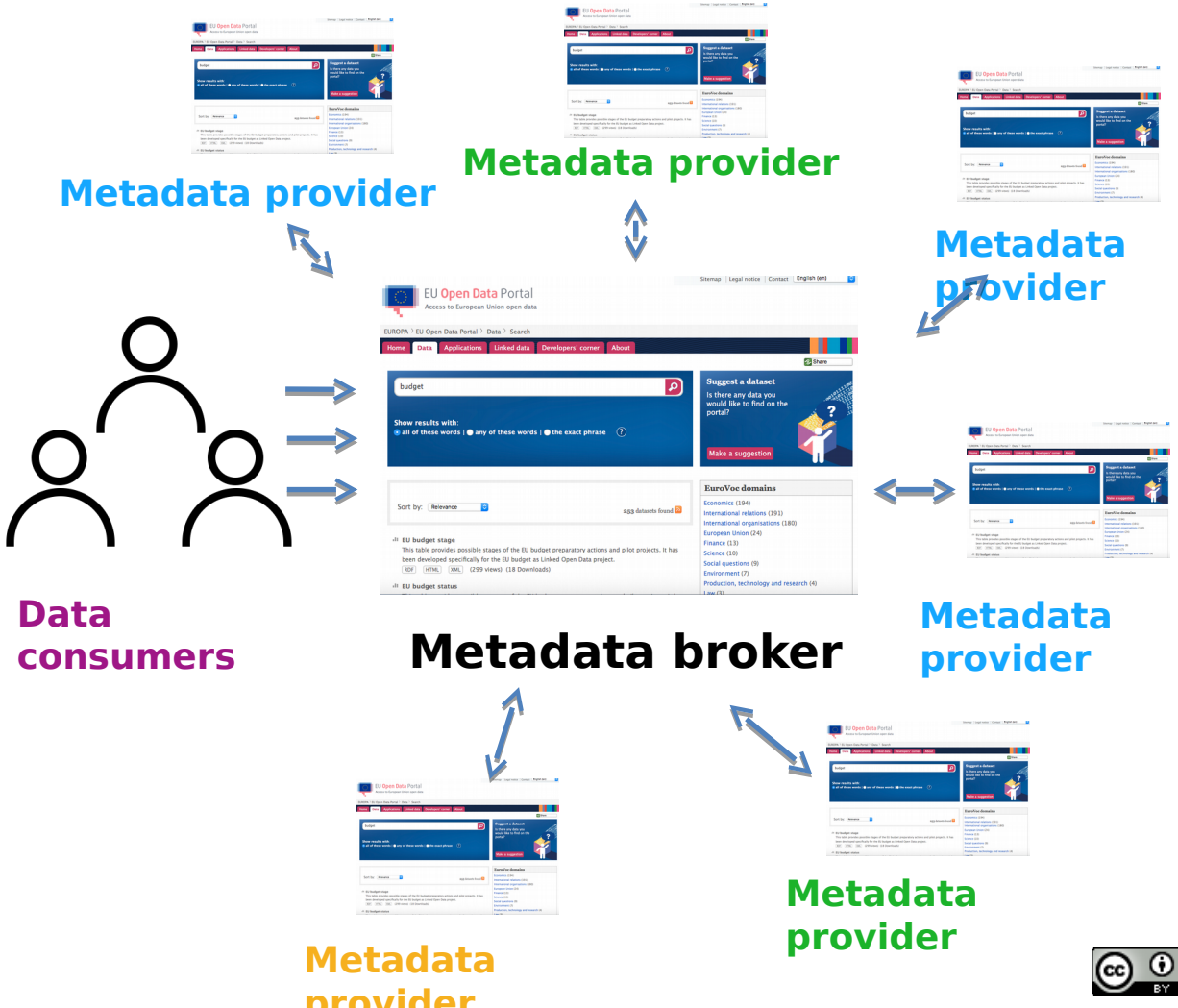
Exchanging your data descriptions (metadata)

Mapping metadata to a common metadata vocabulary

- **Systems rarely** use a common metadata vocabulary: own internal model
- **Mapping of properties**: e.g. Dataset name DC Title, description
- **Mapping of controlled vocabularies:** e.g. Language, topics, format

DCAT–AP as the common metadata schema to exchange dataset information

The DCAT-AP can be used to collect (harvest) the metadata from all data portals enabling the Open Data Interoperabilit y



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LET’S TRY A MAPPING

Bank of Greece

Σύνδεσμοι | Συχνές Ερωτήσεις | Επικοινωνία | English | Εκτύπωση | Αναζήτηση | RSS

κινήτων | **Δείκτες Τιμών**

Δείκτες Τιμών Οικιστικών και Επαγγελματικών Ακινήτων και άλλοι Βραχυχρόνιοι Δείκτες

Με στόχο τη συστηματική παρακολούθηση, τεκμηρίωση και ανάλυση των εξελίξεων και των προοπτικών στην αγορά ακινήτων, η Τράπεζα της Ελλάδος έδωσε ιδιαίτερη έμφαση στη δημιουργία ενός μηχανισμού συγκέντρωσης και ανάλυσης πρωτογενών στοιχείων σχετικά με τη δραστηριότητα στην αγορά ακινήτων και ιδίως τις τιμές, τα μισθώματα καθώς και τα ποιοτικά χαρακτηριστικά των ακινήτων. Στο πλαίσιο αυτό, το Τμήμα Ανάλυσης Αγοράς Ακινήτων, προχώρησε στην κατασκευή Δεικτών Οικιστικών και Επαγγελματικών Ακινήτων, χρησιμοποιώντας την αναλυτική πληροφόρηση που συλλέγει από όλα τα πιστωτικά ιδρύματα καθώς και από τις Ανώνυμες Εταιρείες Επενδύσεων Ακίνητης Περιουσίας (ΑΕΕΑΠ) που δραστηριοποιούνται στην Ελλάδα. Οι δείκτες αυτοί διαθέτουν συγκεκριμένα πλεονεκτήματα και ποιοτικά χαρακτηριστικά και εκτιμάται ότι θα συμβάλουν σε μια πιο εμπεριστατωμένη αξιολόγηση των εξελίξεων και των προοπτικών της αγοράς ακινήτων στη χώρα μας, ενισχύοντας έτσι πρώτα από όλα την ίδια την αγορά. Ορισμένα από τα πλεονεκτήματα αυτά είναι: ο επίσημος φορέας υλοποίησης και η εφαρμογή σύγχρονης μεθοδολογίας, η έγκαιρη και τακτική δημοσιοποίηση (έκδοση Δελτίων Τύπου σε προκαθορισμένες ημερομηνίες), η τριμηνιαία περιοδικότητα των δεικτών οικιστικών ακινήτων και η εξαμηνιαία περιοδικότητα των δεικτών επαγγελματικών, η κάλυψη όλης της χώρας με δυνατότητα σημαντικής ανάλυσης (π.χ. κατά γεωγραφική περιοχή, είδος χρήσης, παλαιότητα,), κ.ά.

Σχετικά Θέματα

Δελτία Τύπου

Συναλλαγματικές Ισοτιμίες

Εκδόσεις

Δείκτες Οικιστικών Ακινήτων

- Δείκτες Τιμών Οικιστικών Ακινήτων (Νέοι Πίνακες)
- Δείκτες Τιμών Οικιστικών Ακινήτων (ιστορικές σειρές)
- Δείκτες εκτιμήσεων οικιστικών ακινήτων με τη διαμεσολάβηση των τραπεζών

Δείκτες Επαγγελματικών Ακινήτων

- Δείκτες Τιμών Γραφείων
- Δείκτες Μισθωμάτων Γραφείων
- Δείκτες Τιμών Καταστημάτων
- Δείκτες Μισθωμάτων Καταστημάτων
- Μεθοδολογία κατασκευής των δεικτών επαγγελματικών ακινήτων

Πίνακας Ι.6. ΝΕΟΣ ΔΕΙΚΤΗΣ ΤΙΜΩΝ ΔΙΑΜΕΡΙΣΜΑΤΩΝ ΚΑΤΑ ΠΑΛΑΙΟΤΗΤΑ

Table II.6. NEW INDEX OF APARTMENT PRICES BY AGE

Περίοδος		Σύνολο Total			Νέα (έως 5 ετών) New (up to 5 years old)			Παλαιά (άνω των 5 ετών) Old (over 5 years old)		
		Δείκτης Index 2007=100	(%) Μεταβολή / Change Προηγούμ. περιόδου Previous period	(%) Μεταβολή / Change Προηγούμ. έτους Previous year	Δείκτης Index 2007=100	(%) Μεταβολή / Change Προηγούμ. περιόδου Previous period	(%) Μεταβολή / Change Προηγούμ. έτους Previous year	Δείκτης Index 2007=100	(%) Μεταβολή / Change Προηγούμ. περιόδου Previous period	(%) Μεταβολή / Change Προηγούμ. έτους Previous year
2006		94,4	...	...	93,3	...	...	95,1	...	...
2007		100,0	5,9	5,9	100,0	7,2	7,2	100,0	5,2	5,2
2008		101,7	1,7	1,7	102,3	2,3	2,3	101,3	1,3	1,3
2009		97,9	-3,7	-3,7	100,2	-2,0	-2,0	96,5	-4,8	-4,8
2010		93,3	-4,7	-4,7	96,0	-4,2	-4,2	91,7	-5,0	-5,0
2011		88,2	-5,5	-5,5	91,2	-5,0	-5,0	86,4	-5,8	-5,8
2012		78,0	-11,7	-11,7	80,1	-12,1	-12,1	76,6	-11,4	-11,4
2013		69,5	-10,9	-10,9	71,4	-10,9	-10,9	68,3	-10,8	-10,8
2014		64,3	-7,5	-7,5	66,8	-6,5	-6,5	62,8	-8,1	-8,1
2015		61,1	-5,1	-5,1	63,0	-5,6	-5,6	59,8	-4,7	-4,7
2016*		59,6	-2,4	-2,4	61,1	-3,0	-3,0	58,7	-1,9	-1,9
2006	I	90,7	...	...	92,1	...	...	89,8	...	...
	II	93,3	2,9	...	92,3	0,2	...	93,9	4,6	...
	III	94,8	1,6	...	91,7	-0,6	...	96,7	2,9	...
	IV	98,8	4,2	...	97,0	5,7	...	99,9	3,3	...
2007	I	98,6	-0,2	8,7	98,0	1,1	6,4	98,9	-1,0	10,1
	II	99,6	1,1	6,8	100,1	2,2	8,5	99,3	0,4	5,7
	III	100,7	1,0	6,2	100,2	0,1	9,2	100,9	1,6	4,4
	IV	101,2	0,5	2,4	101,6	1,4	4,8	100,9	-0,1	1,0
2008	I	101,4	0,2	2,9	101,3	-0,3	3,4	101,5	0,6	2,6
	II	101,4	0,0	1,7	101,9	0,6	1,7	101,0	-0,4	1,7
	III	102,2	0,8	1,6	103,0	1,1	2,8	101,7	0,7	0,8
	IV	101,8	-0,4	0,6	103,0	0,0	1,3	101,0	-0,7	0,1

dataset url

http://www.bankofgreece.gr/BoGDocuments/Νέοι_Πίνακες_Τιμών_Κατοικιών_full.pdf

Issued?
Periodicity?
theme?
Publisher?

http://www.bankofgreece.gr/Pages/el/Statistics/realestate/indices.aspx

Outcomes

Define metadata standard, dataset and DCAT

Name the most important aspects of metadata quality

Describe how DCAT can be used to describe and exchange metadata for a dataset

References

- W3C, *The DCAT Specification*, https://www.w3.org/TR/vocab-dcat/
- Makx Dekkers, Michiel De Keyzer, Nikolaos Loutas and Stijn Goedertier, *Introduction to metadata management*
- Valeria Pesce, *Dataset description: DCAT and other vocabularies*, https://www.slideshare.net/valeriap/dataset-description-dcat-and-other-vocabularies

NODE ATHENS

LET’S TAKE A BREAK