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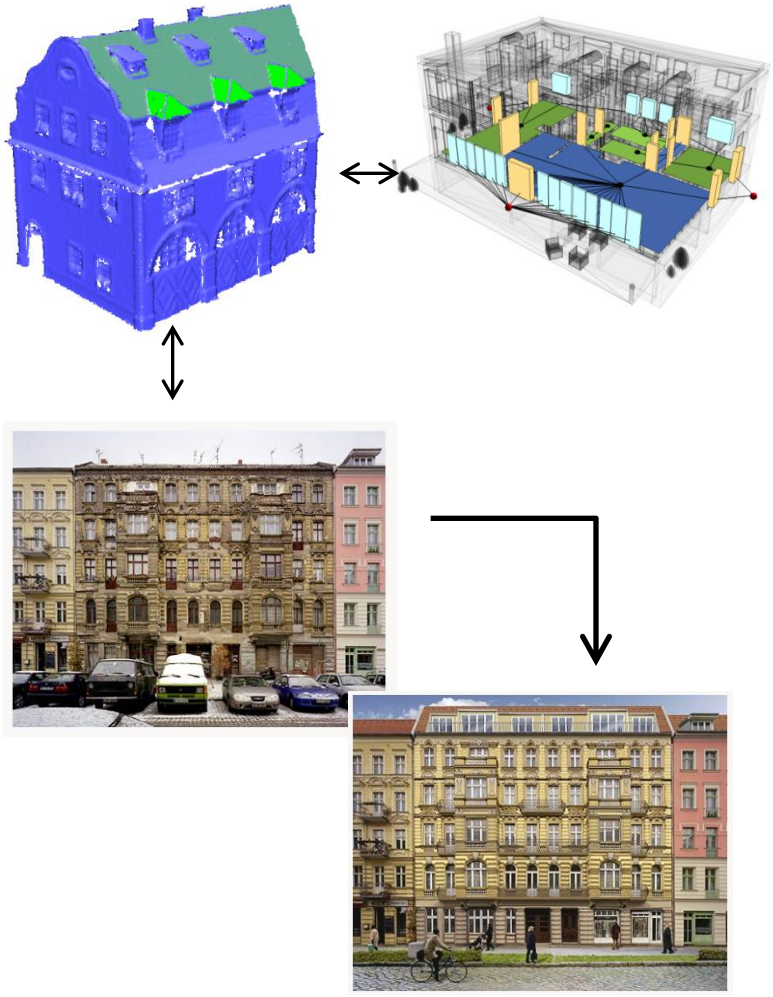
Forschungszentrum · Research Center
L3S

Towards Preservation of semantically enriched Architectural Knowledge

Stefan Dietze, Jakob Beetz, Ujwal Gadiraju, Georgios Katsimpras, Raoul Wessel, René Berndt

Goal

- Methods and tools for **sustainable** long-term **preservation** of **architectural knowledge**



Challenges

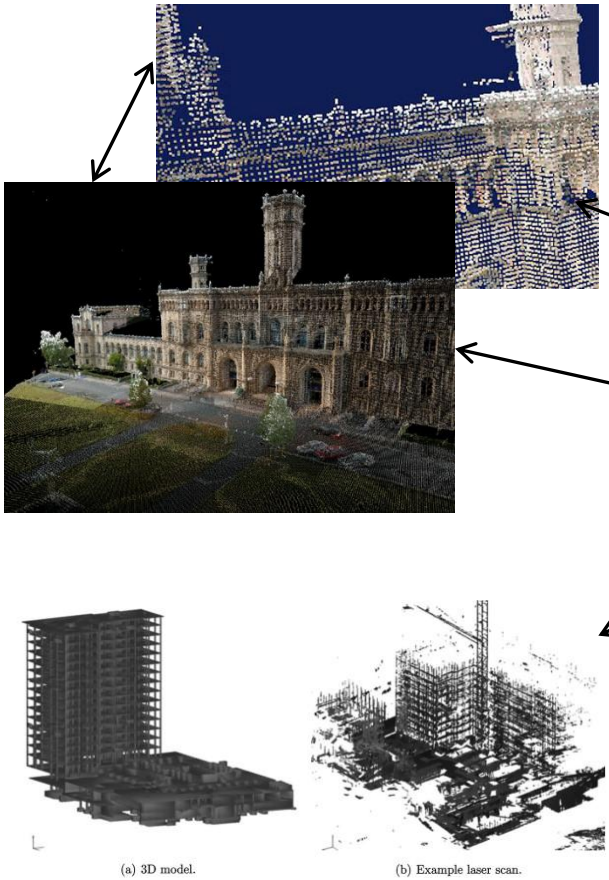
- **Diversity of data - interoperability**: low-level point clouds & legacy 3D models up to enriched Building Information Models (BIM), higher-level semantics and Web data / knowledge
- **Diverse stakeholders:** architects, building operators, urban planners, archivists, …
- **Building, model and data evolution**: document temporal evolution to prevent information loss

Goals and Challenges (1/2)

Challenges

- **“Semantic” enrichment of architectural knowledge**: exploiting Web data and knowledge to enrich low-level architectural data.
- **Inconsistent vocabularies**: adopting state of the art (LD) vocabularies and schemas towards sustainability
- **Long-term readability / renderability of architectural models:** addressing digital decay (eg due to deprecated file formats) and model evolution

Architectural Archives | **Architectural Web Data**



(a) 3D model. (b) Example laser scan.

Goals and Challenges (2/2)

UBO: Universität Bonn
- Technical Coordinator
- WP4/WP5: change management, shape recognition

Luleå University of Technology
- WP8: dissemination/exploitation

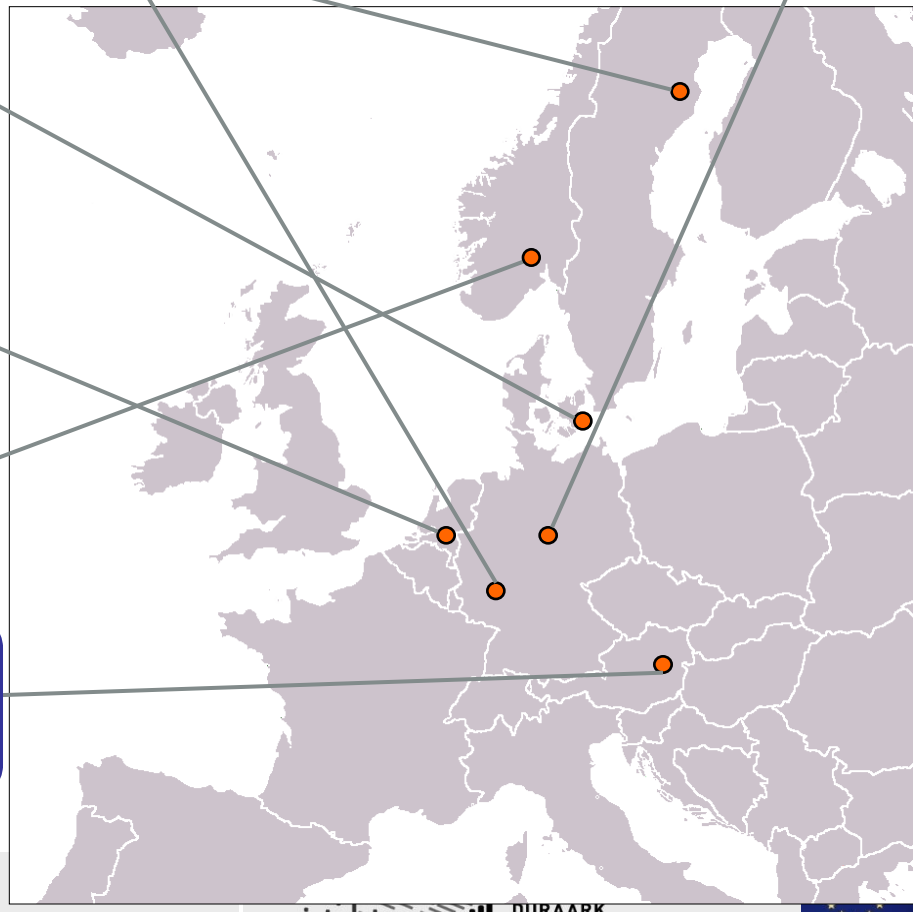
CITA, Center for Information Technology and Architecture Copenhagen
- WP7: data, evaluation, test

TUE, Department of the Built Environment, Eindhoven University of Technology
- WP3:,semantics & metadata

Catenda, SME
- User perspective, market requirements, evaluation

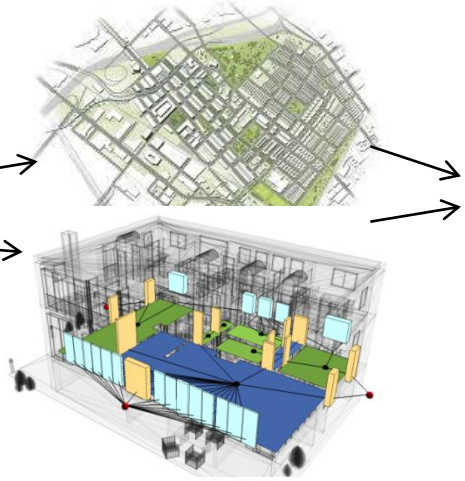
Fraunhofer Austria
- WP2: system specification & integration

LUH: German National Library of Science and Technology (TIB) & L3S Research Center Hannover
-Coordinator
- WP3 Semantic Enrichment
- WP6 leader, long-term preservation



Consortium

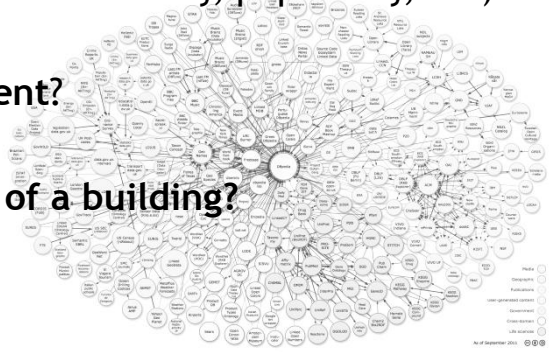
A very simplistic view on urban planning/architectural lifecycle today



1. research 2. design 3. monitoring (over time)

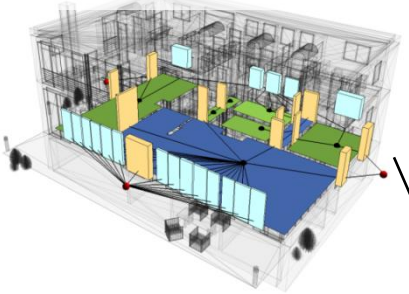
DURAARK approach - exploiting Web data to help architects and urban planners to answer questions like:

- What‘s the **legal, social and environmental context** of a structure (sustainability policies etc)?
- How did **buildings and their contexts** (traffic, surroundings, usage and functionality, popularity, etc) **evolve over time**?
- How did an architectural change impact **surrounding traffic/environment**? (examples: bridges, airports)
- How did an architectural change impact **popularity and attractiveness of a building?**
- ….

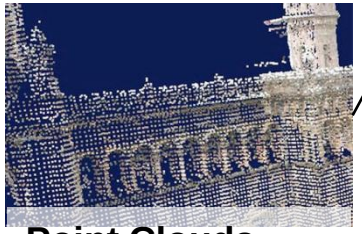


Why interlinking & semantic enrichment?

3D Models

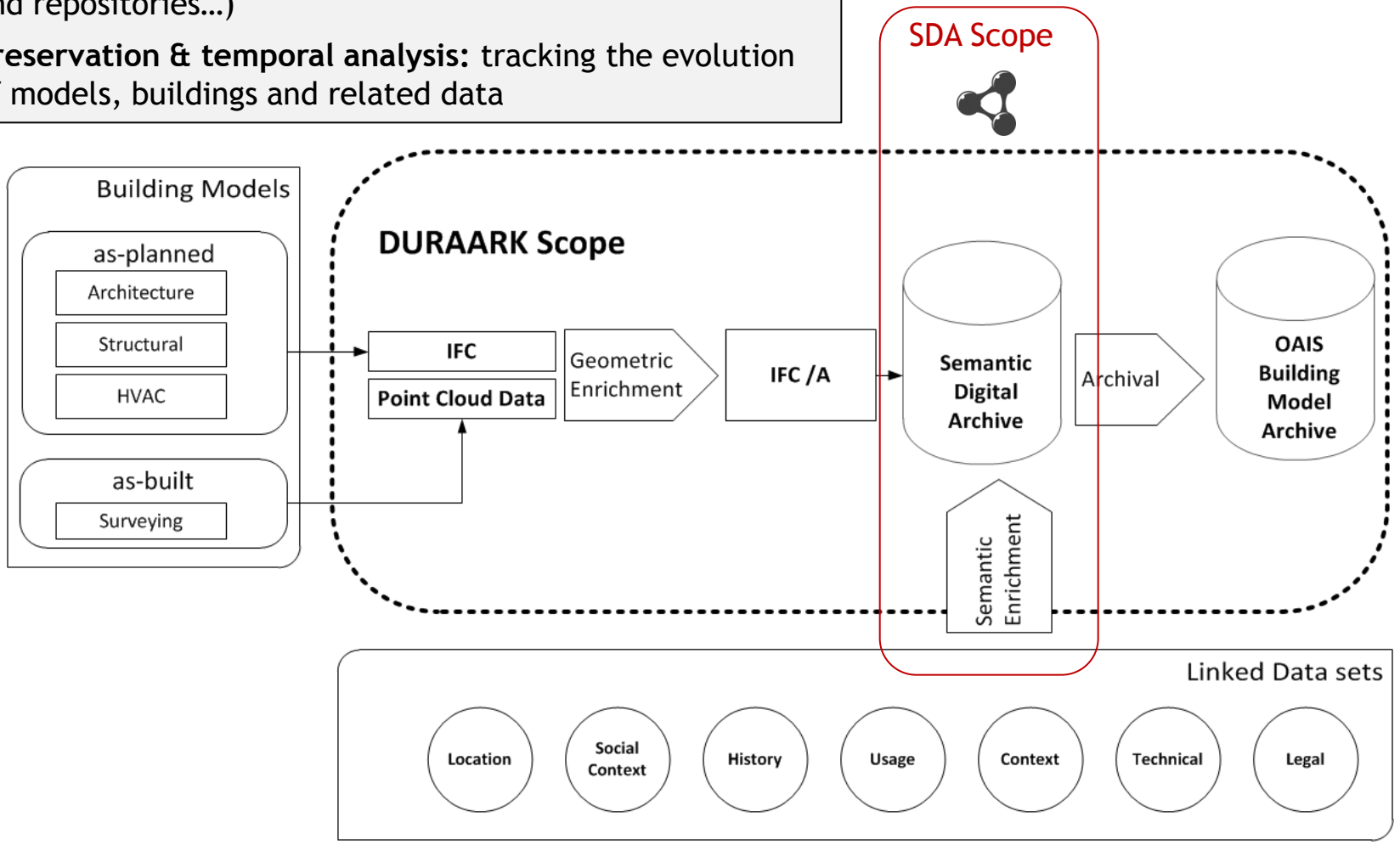


Building Information Models (BIM)
= structured „Building Model Metadata“

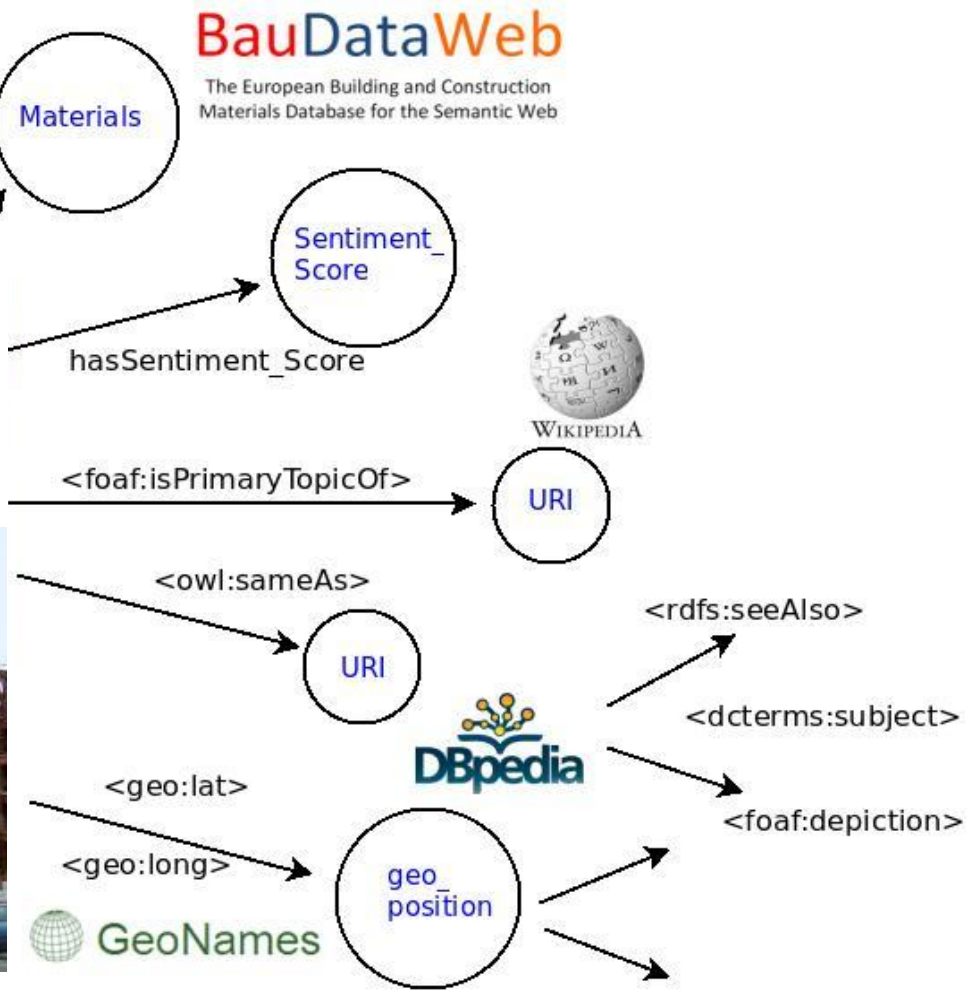


Point Clouds

- **Semantic enrichment** of low-level architectural models (gradual process)
- **Interlinking** of related models/data (across different abstraction levels, model types, datasets and repositories…)
- **Preservation & temporal analysis:** tracking the evolution of models, buildings and related data



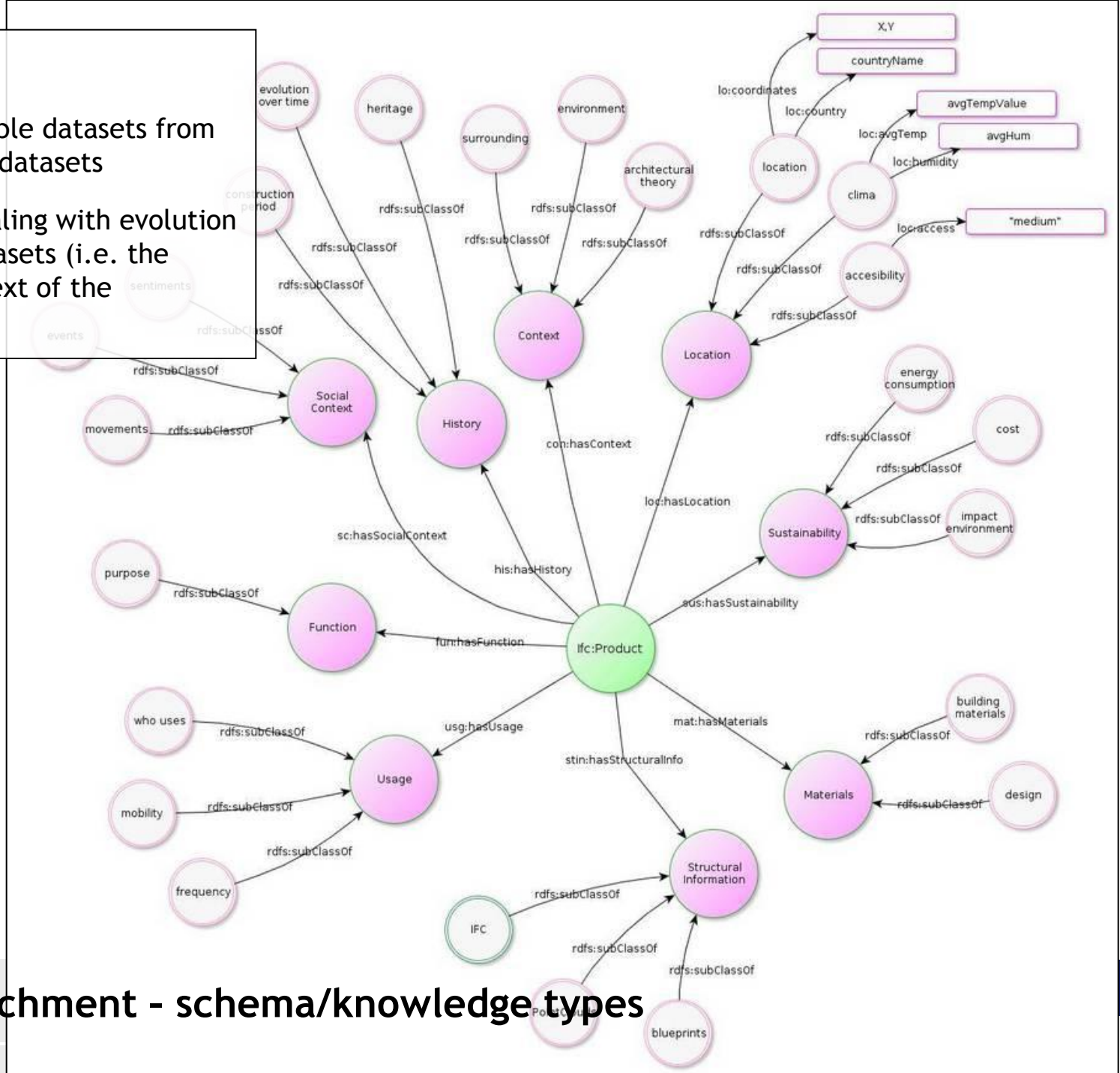
Example: GDR's People's Palace - static vs evolving data/links



Social & Semantic Web for enrichment

Challenges

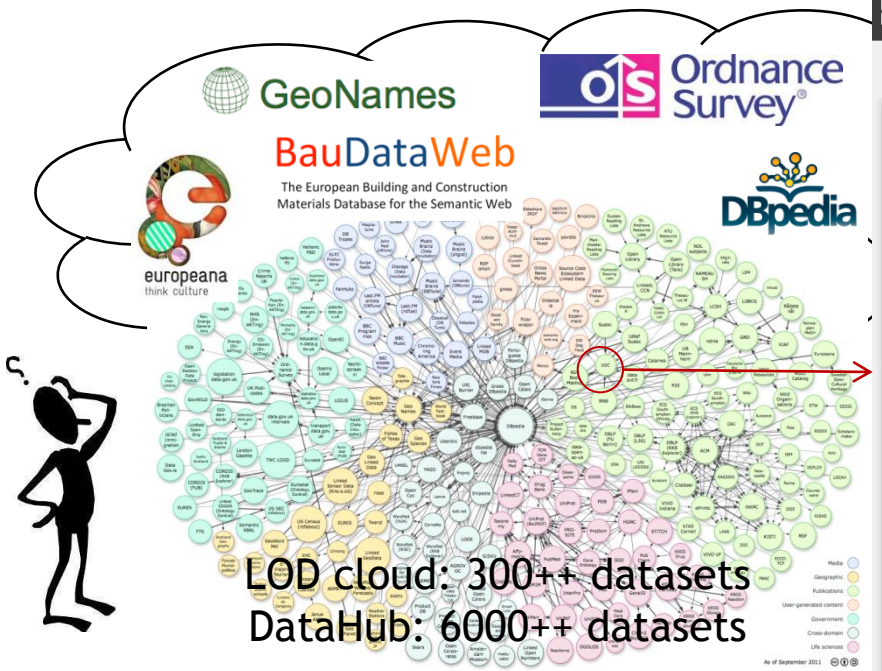
- **Selection** of suitable datasets from wealth of diverse datasets
- **Preservation:** dealing with evolution of distributed datasets (i.e. the semantics & context of the structure/models)



Semantic enrichment – schema/knowledge types

Data selection: too few information about too many datasets

- Lack of reliable dataset metadata but wide diversity (eg, DBpedia vs traffic stats London vs …)
  - Spatial and temporal coverage ?
  - Dynamics ? (evolution, frequency of changes…)
  - Resource types & topics ? (policy documents vs traffic statistics)
  - Currentness, availability, provenance, ….



http://datahub.io/dataset/transport-data-gov-uk

datahub
The easy way to get, use and share data

Datasets Groups About Search

/ Datasets / **transport.data.gov.uk**

Groups
Linking Open Data Cloud
Social
Google+
Twitter
Facebook

Dataset | Activity Stream | Related

transport.data.gov.uk

data.gov.uk
Working with UK Public Sector information and data

Transport-related linked data from data.gov.uk.

- Namespace for roads
- Namespace for stations
- Namespace for airports
- Road traffic statistics (SCOVO)

329.527.661 triples

Additional Info

Field	Value
Source	http://transport.data.gov.uk/
Author	data.gov.uk
Version	1.0
links:data-gov-uk-time-intervals	795669
links:dbpedia	3768
links:statistics-data-gov-uk	109708
namespace	http://transport.data.gov.uk/id/
triples	329527661

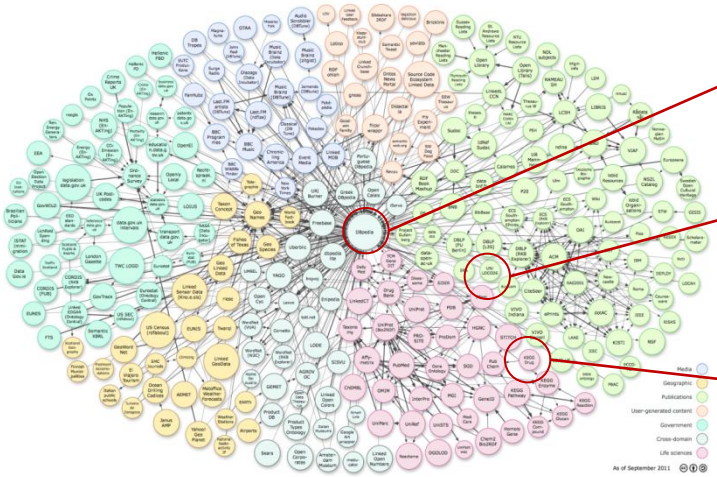
metadata

airports broken_link bus-stops country-uk deref-vocab format-dc
format-foaf format-geo format-skos government lod motorways
naptan no-license-metadata no-provenance-metadata no-vocab-mappings
ports published-by-producer roads stations traffic transport uk

Enrichment & Preservation

Data preservation: handling evolution of distributed data

- Preservation needs to address evolution of distributed datasets / semantics of links
  - In RDF graphs (such as the LOD Cloud), „all“ nodes are connected:
    - Which datasets to preserve (only direct links or also more distant neighbours)? (semantic relatedness, see [ESWC2013])
    - Propagation of changes in LOD graph => measuring relevance of changes for specific entities



DBpedia <dbp:Berlin> <dbp:Berlin(east)>

GeoNames <geoLatLong:52/13>

<dura:GDR Peoples Palace>

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Enrichment & Preservation

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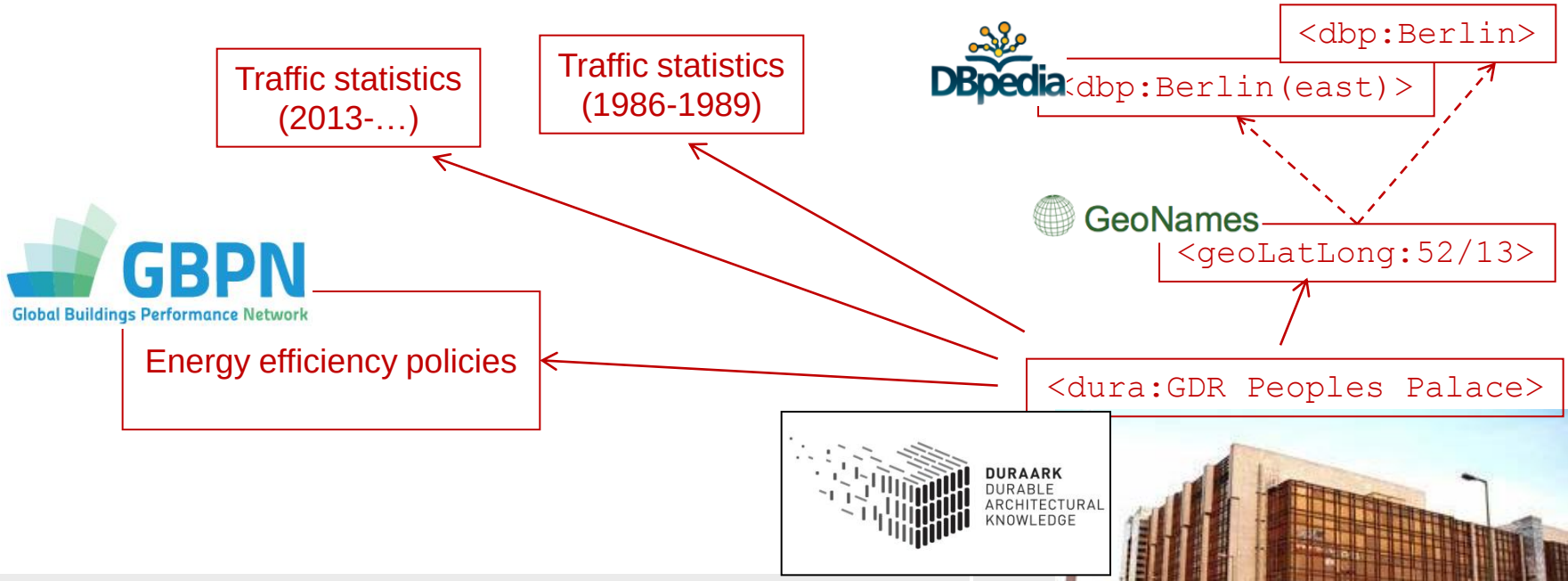
    - Propagation of changes in LOD graph => measuring relevance of changes for specific entities
  - Preservation strategies dependent on dataset dynamics
    - Simple linking (archiving) for static datasets (eg statistics over past periods in data.gov.uk)
    - Recurring link computation and graph archival for dynamic datasets (frequency?)



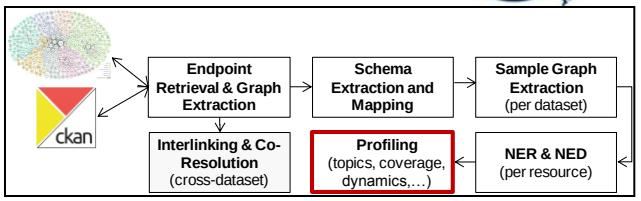
Enrichment & Preservation

Approach: dataset profiling

- Enrichment & preservation = intertwined process!
- Dataset selection & cataloging: via DataHub.io (similar to LOD cloud)

  http://datahub.io/group/linked-building-data

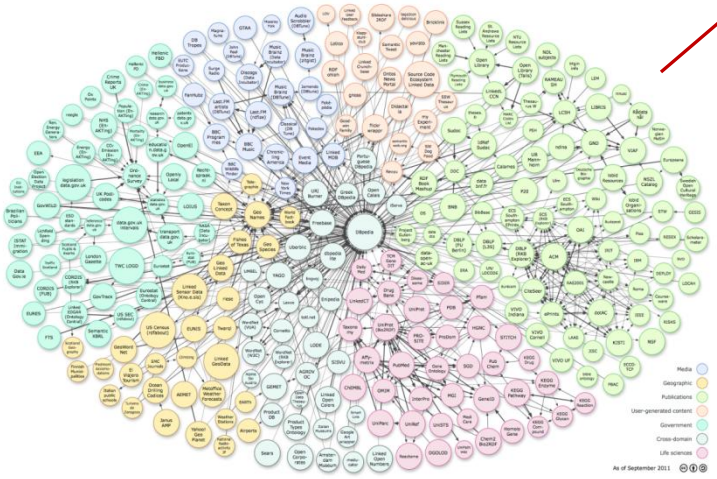
- Dataset profiling: metadata about dataset dynamics, size, types, topics, evolution, temporal/spatial coverage etc
  => Data observatory (see also [ESWC2013], [ISWC2013])
- Vocabulary curation (expert-based)

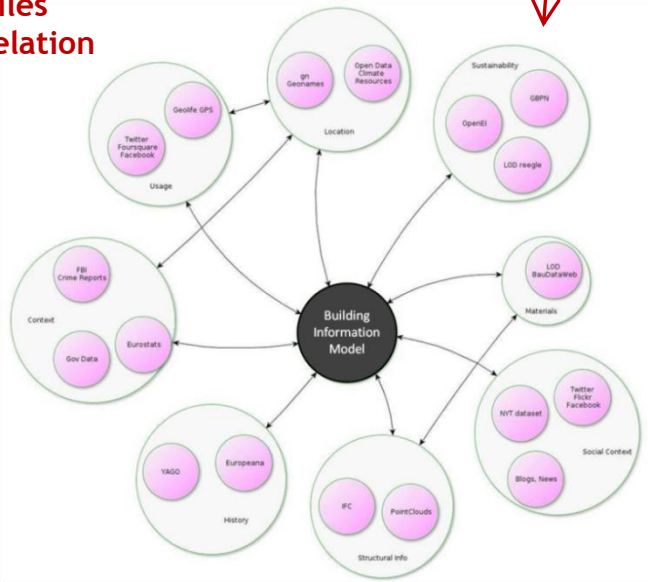


DURAARK Data Observatory

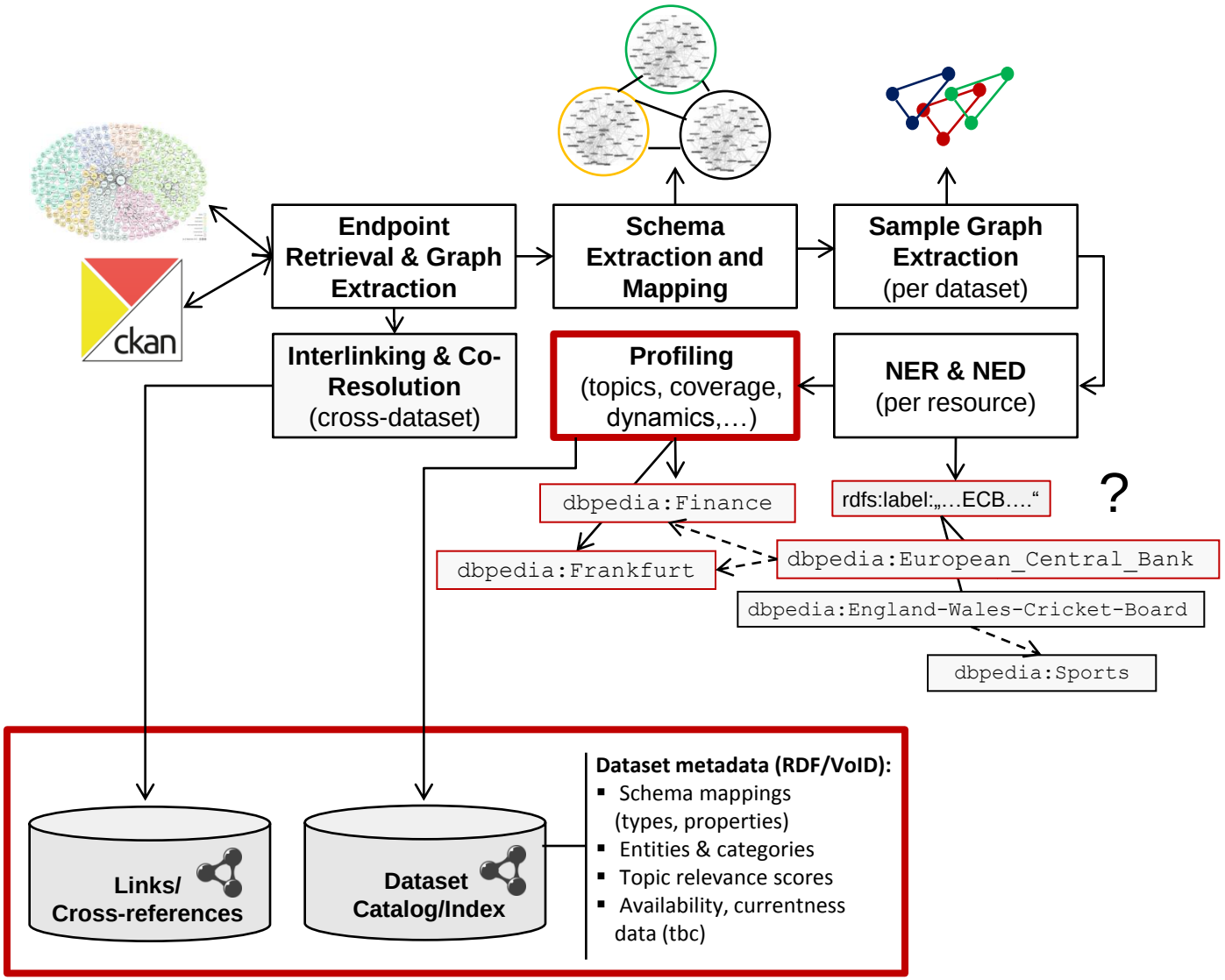
describes

Automated processing to generate:
- **Descriptive Dataset Profiles**
- **Data Interlinking & Correlation**





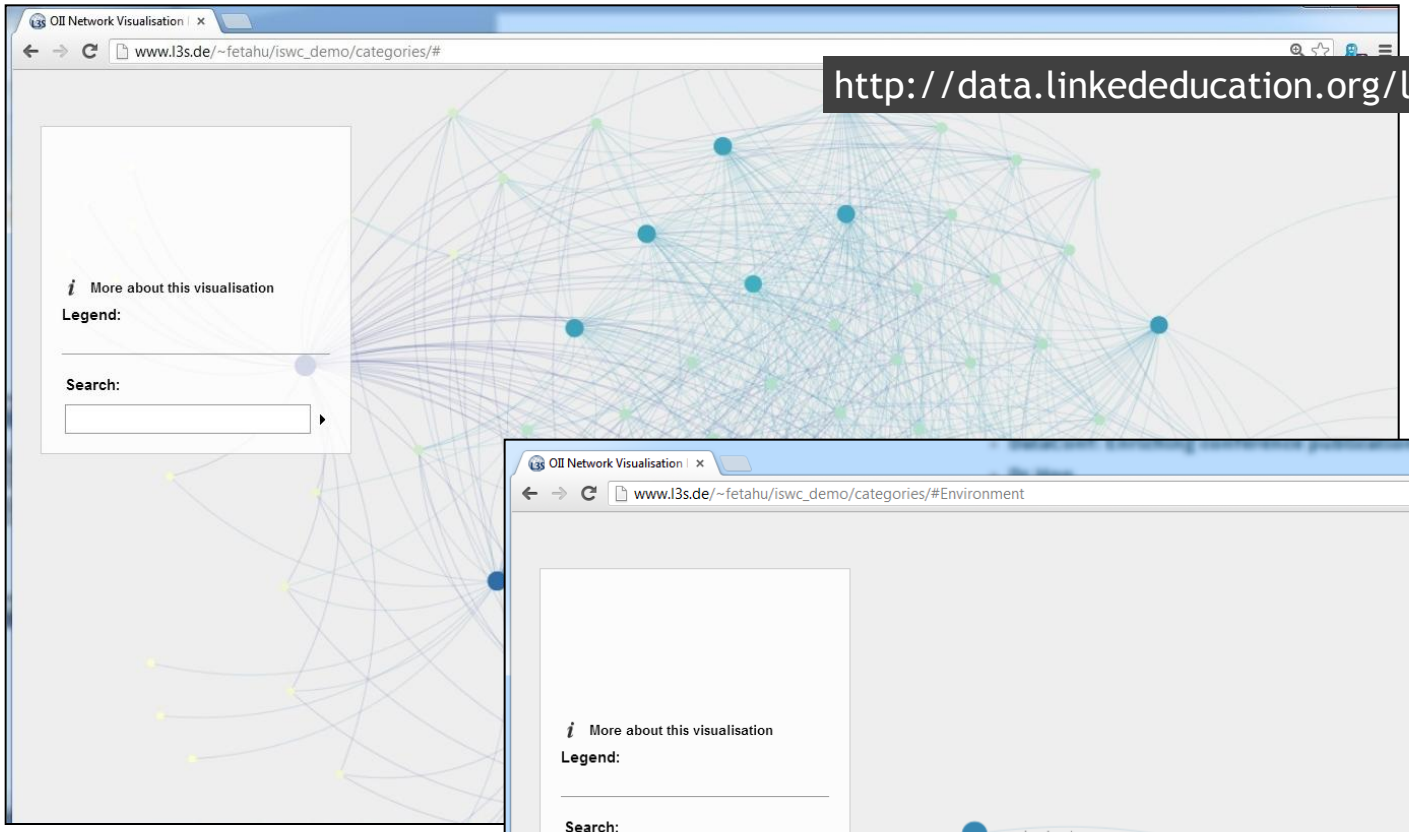
Dataset profiling: processing workflow



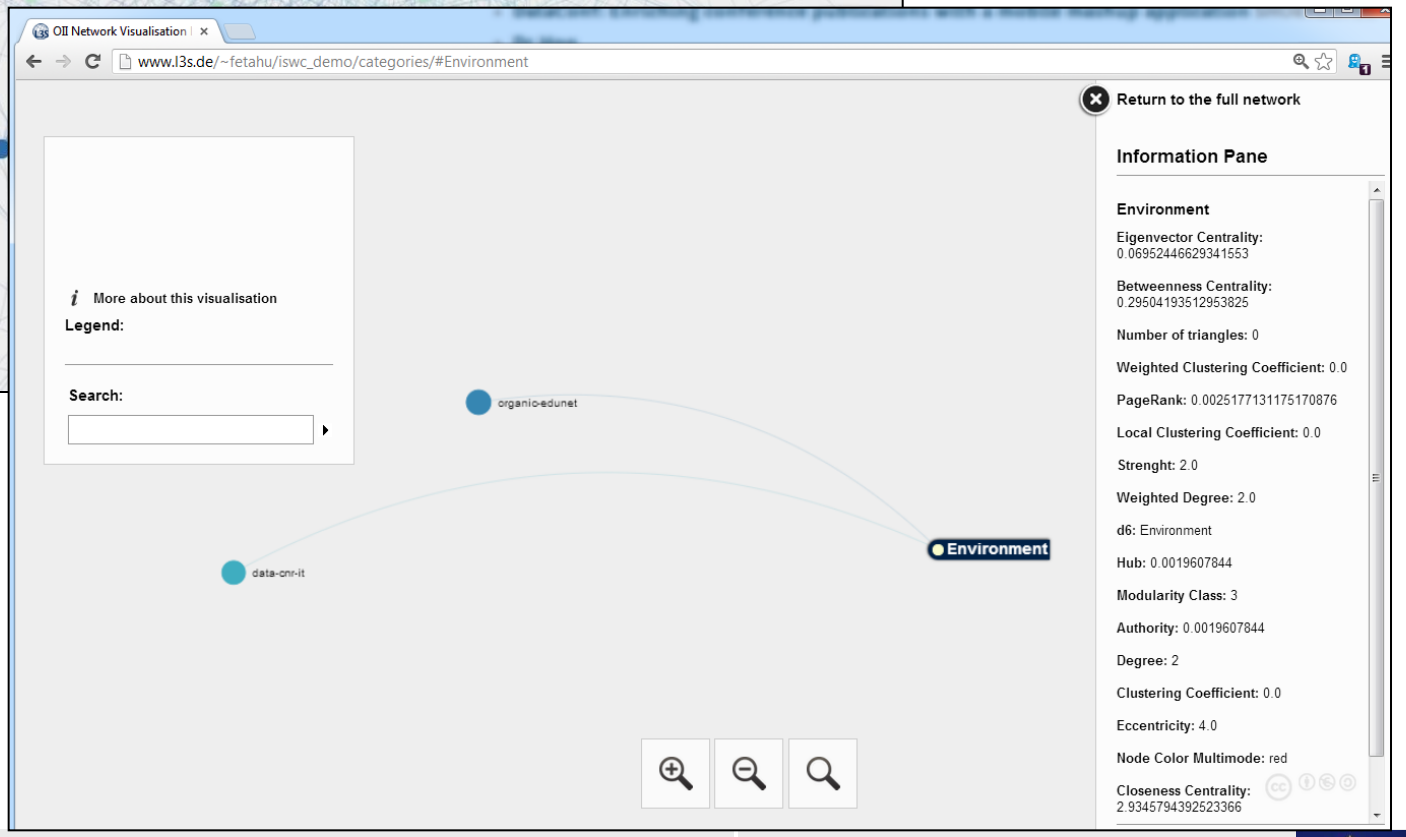
Goals:

- **RDF catalog of datasets**
- Tracking the **evolution of datasets** according to, eg, topics, dynamics, spatial coverage, accessability
- Links and coreferences => unified view on data => Linked Building Data Graph
- Infrastructure & APIs **for federated queries**

Towards a Web Data ”Observatory”



http://data.linkededucation.org/linkedup/categories-explorer



Web Data Observatory - ongoing work

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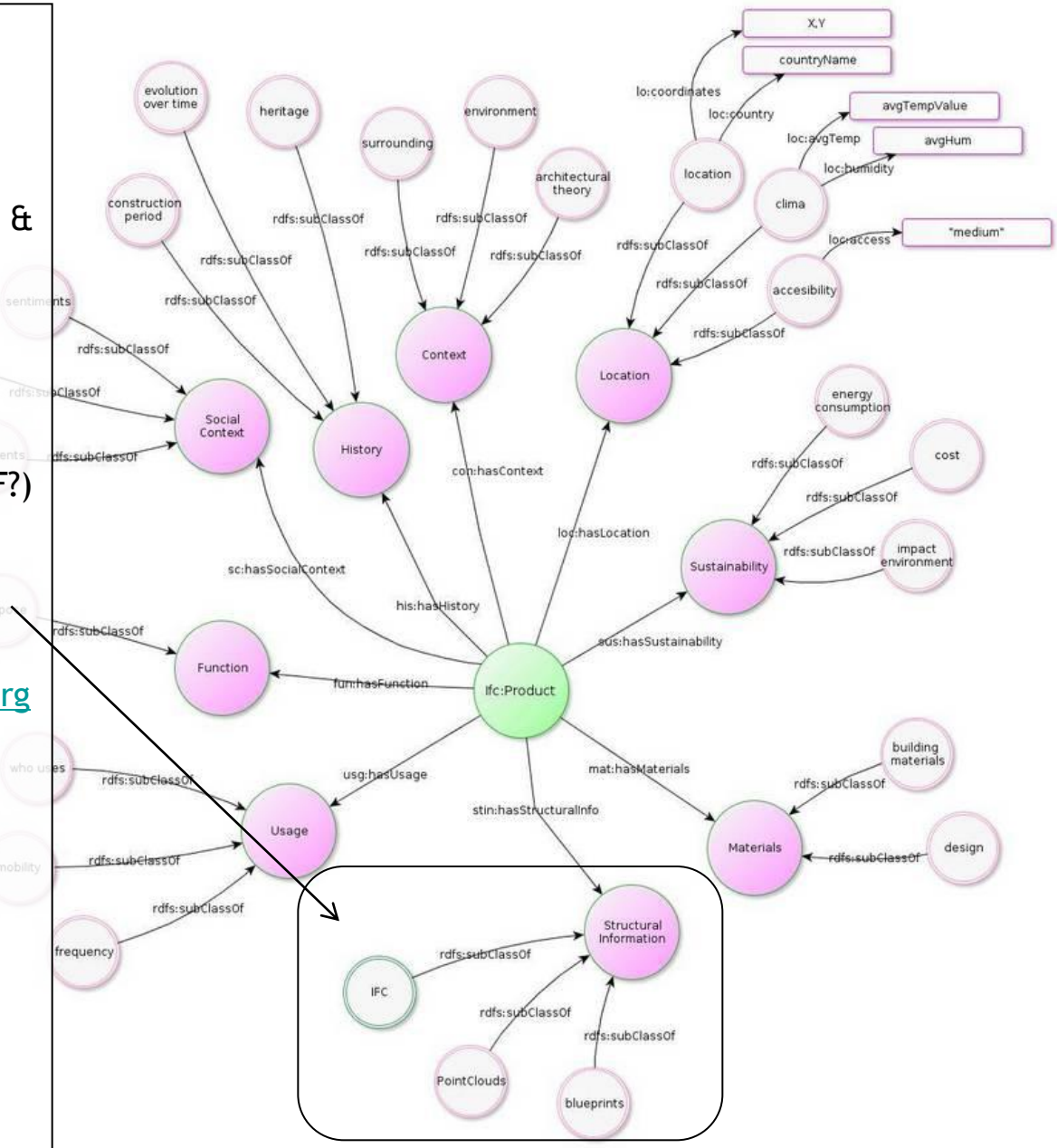
- Using dataset profiles for semi-automated data interlinking:
  - Manual alignment of schemas & vocabularies into unified RDF graph
  - Automated interlinking (and preservation) techniques
- Preservation metadata (PREMIS RDF?)
- Expert-based curation of building-related vocabularies
  - BuildingSmartDD (http://www.buildingsmart.org/standards/ifd)
  - OMNIClass, UNIClass
  - SFB-NL (http://nl-sfb.bk.tudelft.nl)
  - CROW Library for infrastructural objects (http://www.gww-ob.nl/)
  - …



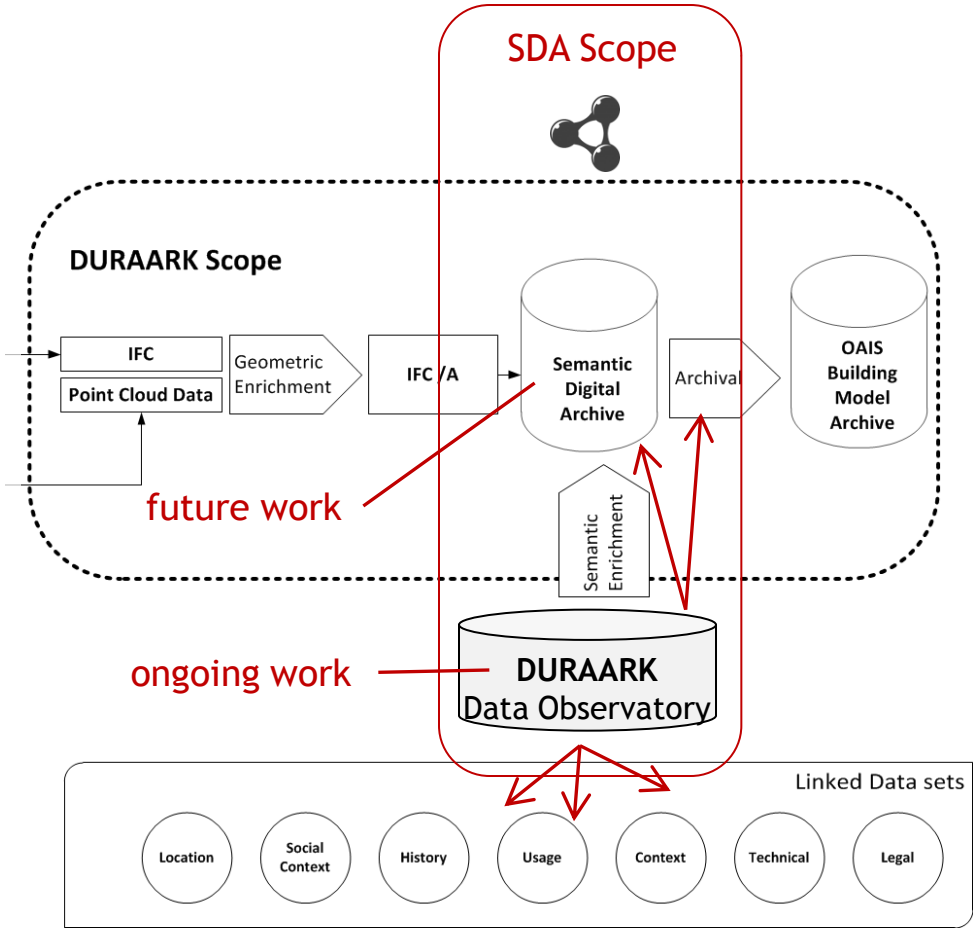
Vocabulary Curation & Data Interlinking

Summary

- "Data Observatory" as generic platform and domain-specific instantiation (profiling building-related dataset aspects in DURAARK)
- Preservation/linking strategies for SDA based on dataset profiles (eg dynamics, relevance)

Outlook

- Dataset selection: populating DataHub-group
- Schema and vocabulary curation and alignment
- Dataset profiling: establishing LDO, considering range of metadata aspects
- Building SDA: data interlinking & dataset preservation



Conclusions

Thank you!

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