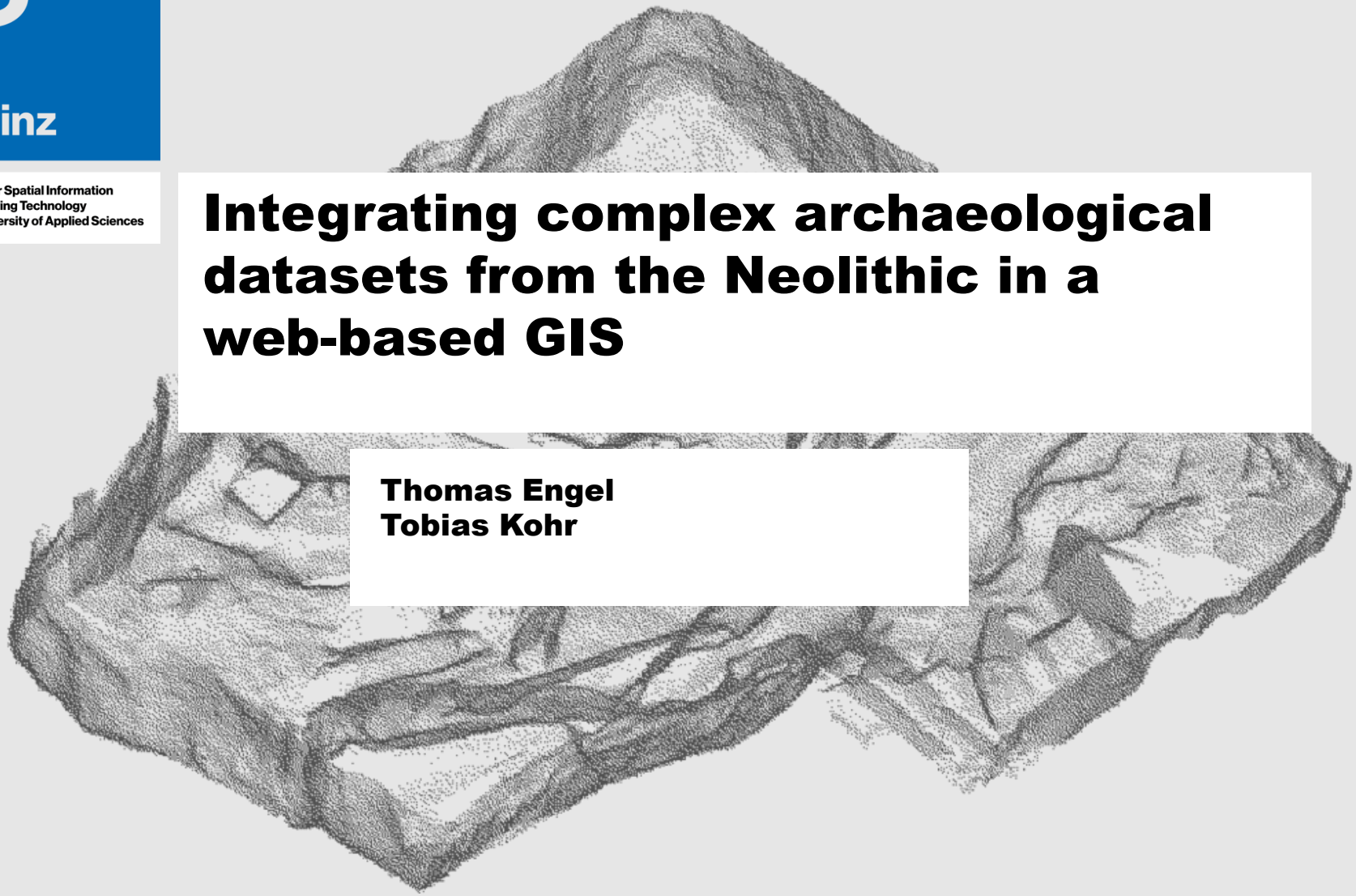
Institute for Spatial Information
and Surveying Technology
Mainz University of Applied Sciences

Integrating complex archaeological datasets from the Neolithic in a web-based GIS



Thomas Engel
Tobias Kohr

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1. Motivation
2. Earlier Research
3. Archaeological Background
4. Potential Frameworks
5. Implementation
6. Outlook and Conclusion

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1. Motivation

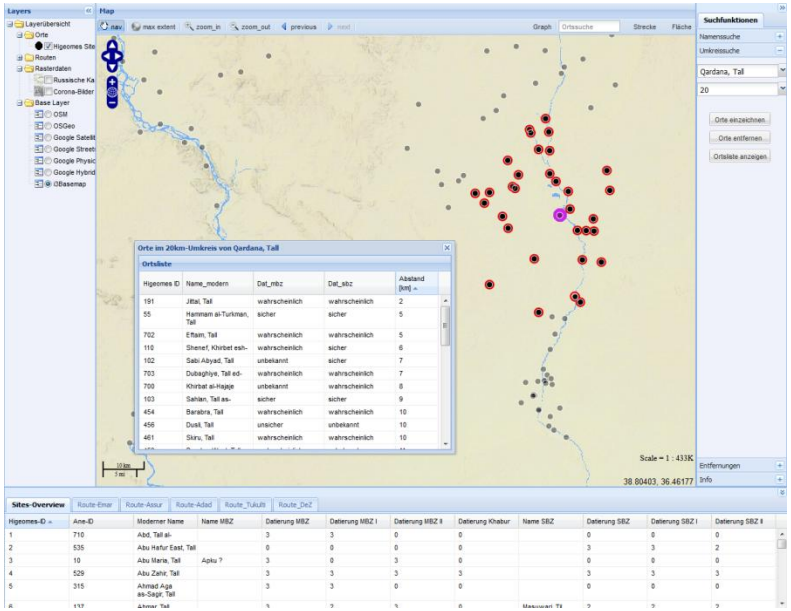
- **Projects have generated heterogeneous datasets of the West-Central European Neolithic**
- **Complex project-specific data models**
- **(Spatial) access on data for further analysis**

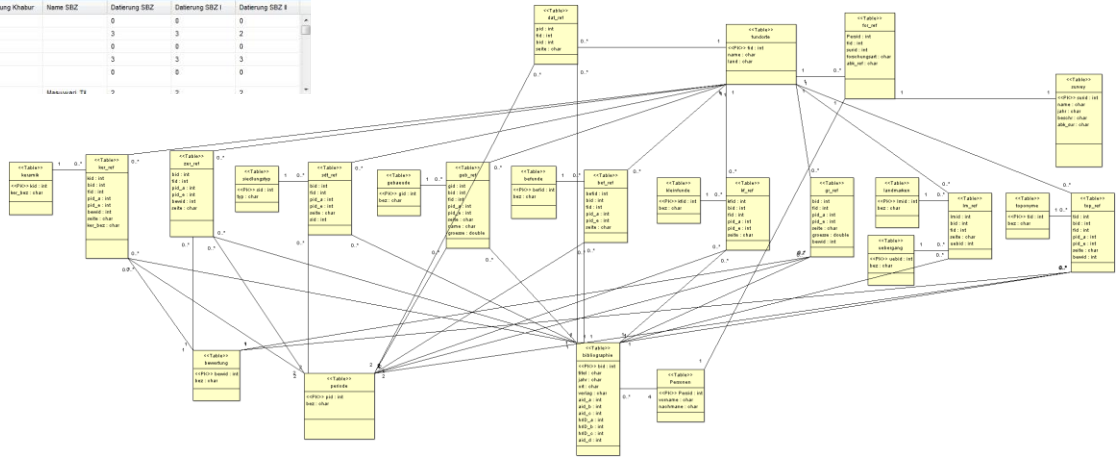
⇒ **Prototypical problems that lack general solution**

Main goal: Integration into an open, extensible WebGIS

1. Motivation

Web GIS vs. complex data models





2. Earlier Research

Web based archaeological information systems

CAA 2001

- **Breaking Down National Barriers: ARENA – A Portal to European Heritage Information (Dam et al., 2001)**
- **Developing an Information System for Archaeological Site and Monuments – Data Model and Construction (Haskiya, 2001)**
- **The Archaeological Map of Egypt. Archaeological Heritage Resource Management System (Seleh at al., 2001)**

CAA 2006

- **Using a GIS-based Database as a Platform for Cultural Heritage Management of Sites and Monuments in Norway (Berg, 2006)**
- **Towards a Web-based Enviroment for Italian Prehistory and Protohistory (Mantegary et al., 2006)**

CAA 2007

- **A Virtual Research Enviroment (VRE) for Archaeological Data Management, Visualization and Documentation (Meyer et al., 2007)**
- **Thinking Outside the Search Box. The Common Information Enviroment and Archaeobrowser (Jeffrey et al., 2007)**
- **A Web-GIS Approach to Cultural Resources Management in Crete (Sarris et al., 2007)**

CAA 2008

- **Free and Open Source WebGIS Solutions for the PO-BASyN Project (Mantegari et al., 2008)**
- **Heurist. A Web 2.0 Approach to Integrating Research, Teaching and Web Publishing (Johnson, 2008)**

CAA 2010

- **The Integrated Archaeological Management System in Cascais Portugal. From Management to Public Access (Almeida et al., 2010)**
- **Spatial Data Infrastructures and Archaeological Excavation Data. SILEX the SDI of the Neolithic Flint Mine of Casa Montero (Fraguas et al., 2010)**

CAA 2012

- **SEAD. The Strategic Environmental Archaeology Database, Inter-linking Multiproxy Environmental Data with Archaeological Investigations and Ecology (Buckland, 2012)**

2. Earlier Research

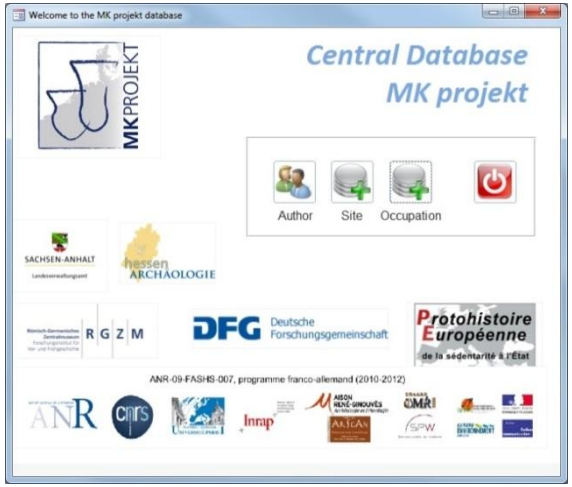
Common issues of prior projects

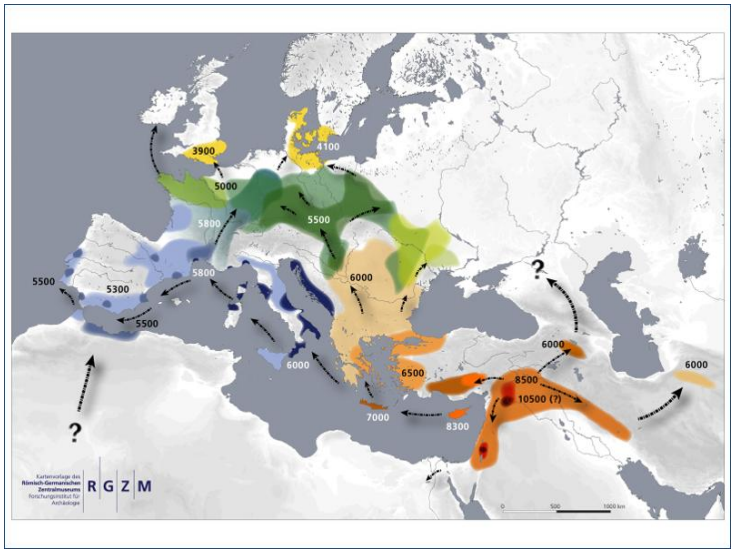
- Organizational
  - Temporary limited project-funding
    - Problematic migration into institutional environment
  - Absence of community
- Technical
  - Non-openness
    - Closed systems without interfaces
    - Non standard based
    - Restricted licensing
  - Rapid technological progress

3. Archaeological Background

Origin of heterogeneous archaeological datasets:

- RGZM research initiatives
  - MK Projekt
  - nlDynamics
- Various theses
- Offical state crm databases

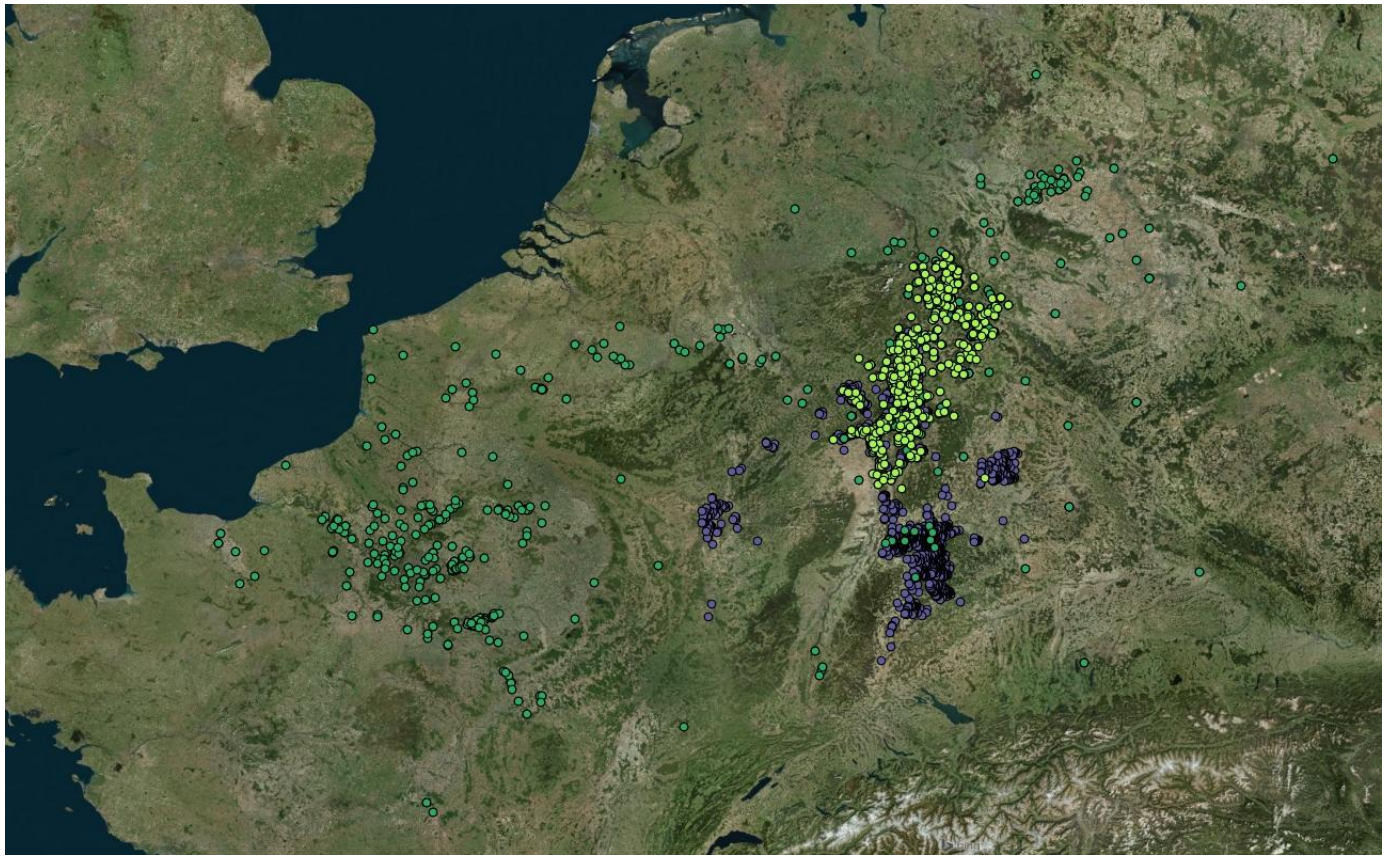




3. Archaeological Background

Spatial extent:

- Central & southwest Germany
- Northern France



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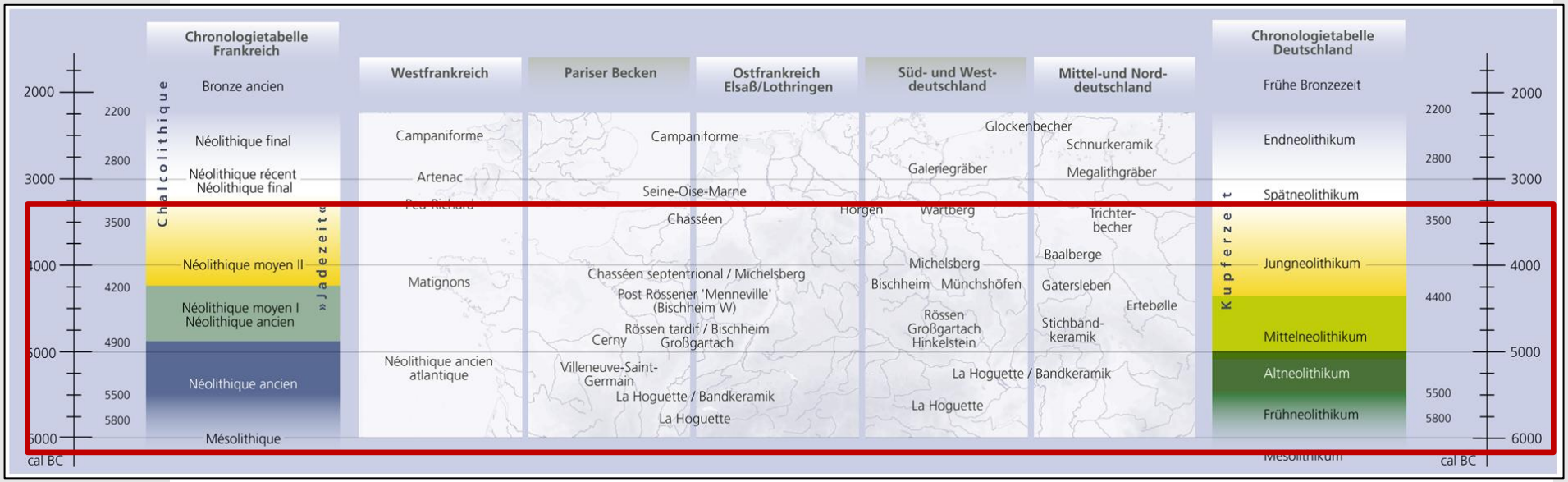
3. Archaeological Background

Temporal extent:

- **Early – middle neolithic**
- **Focus on Linear Band Pottery and Michelsberg Culture**



Gronenborn 2011

3. Archaeological Background

Domain specific data concepts

- **Various complexity levels**
  - **Based on prior research focus**

- **Numerical vs. descriptive**

3			
4	Pit(s)	one pit	1
5		more than one pit	2
6		possibly one or more pits	3
7	Ditch(es)	one ditch	1
8		more than one ditch	2
9		possible one or more ditches	3

Ref.: Dataset Fetsch

3. Archaeological Background

Representation of spatial dimension:

- **“incompatible” accuracy levels**

3	coordinate quality	Does not apply (e.g. secondary findspot)	0
4		Taken from literature / official state archive	1
5		More than one point (area) - interpolated	2
6		About - value	3
7		Defined after distinct value (e.g. field name)	4
8		Coordinates unknown / set to district	5

Ref.: Dataset Fetsch

vs

12	coordinate quality	exact (not checked if precise values were available in literature; In Neckarland defined myself or set after the cartographic mapping of collector)	1
13		Defined after other information / accuracy ~300m	2
14		About - value	3
15		only district / subdistrict	4

Ref.: Dataset Strien

3. Archaeological Background

Representation of temporal concepts:

- **Depending on archaeological phase**
  - **Varying isochronic complexity levels**
  - **E.g. LBK / Michelsberg Culture**

- **Descriptions of uncertainty (interpretations)**

2	Michelsberg Culture	
3		
4	possibly MC	yes=1 / no=0
5	perhaps MC	yes=1 / no=0
6	MC	yes=1 / no=0
7	indifferent	yes=1 / no=0
8	earliest MC	yes=1 / no=0
9	middle MC	yes=1 / no=0

Ref.: Dataset Fetsch

4. Potential Frameworks

Major objectives

- **Find** a generic framework
- **Deploy** the framework in a prototypical use case
- Provide a **pattern** for similar projects

http://crybit.com/wp-content/uploads/2013/09/find.jpg

http://www.metaltoad.com/sites/default/files/deploy-button.jpg

http://www.metaltoad.com/sites/default/files/deploy-button.jpg

4. Potential Frameworks

Main requirements (functional):

- IM(A)P
  - Input
  - Management
  - (Analysis)
  - Presentation
- Flexible data model
- Spatial & temporal reference models
- Role based data management
- Standardized interfaces (including metadata)

4. Potential Frameworks

Important aspects for evaluation

- Defined **requirements** (functional)
- Non-functional
  - **Community**
  - **ISO/IEC 25000**

http://joshlinkner.com/images/2012/05/SAN.jpg

http://www.autism-community.com/wp-content/uploads/2010/07/community.jpg

http://www.iso.org/iso/2012_iso-logo_print.png

4. Potential Frameworks

At a glance

	Heurist	GeoNode	arches heritage inventory & management system
Primary audience	Researchers	General public	Public authorities
Data focus	Knowledge management	Spatial data management	Cultural heritage inventory
System type	Single instance / Framework	Framework	Framework
Key feature	Knowledge representation	Collaboration	Data modelling

4. Potential Frameworks

Major development efforts

Heurist

- Not primarily a framework with open interfaces

GeoNode

- Increase complexity of data model

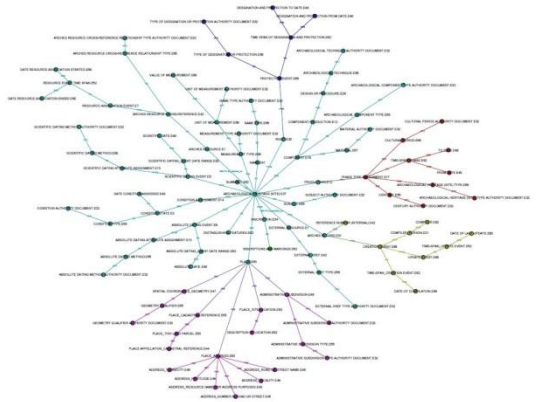
Arches

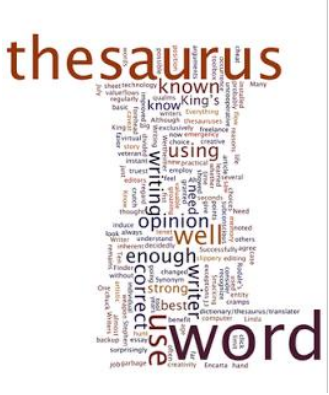
- Role based data management

5. Implementation

Deploying Arches in a prototypical use case

- Installing the software
- Adapting data model(s), vocabularies and GUI
- Mapping legacy data
- Import





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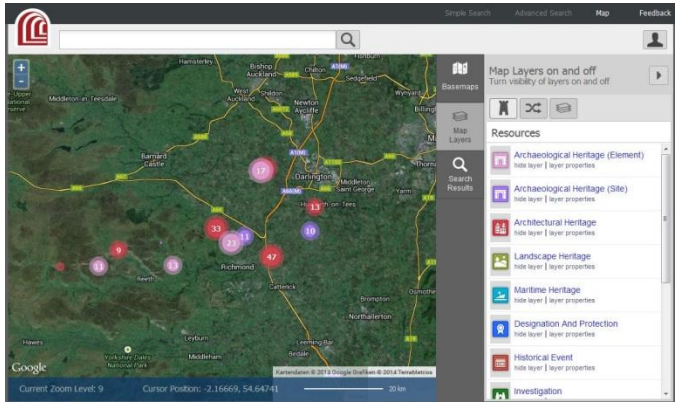


5. Implementation

Data model (the Arches graphs)

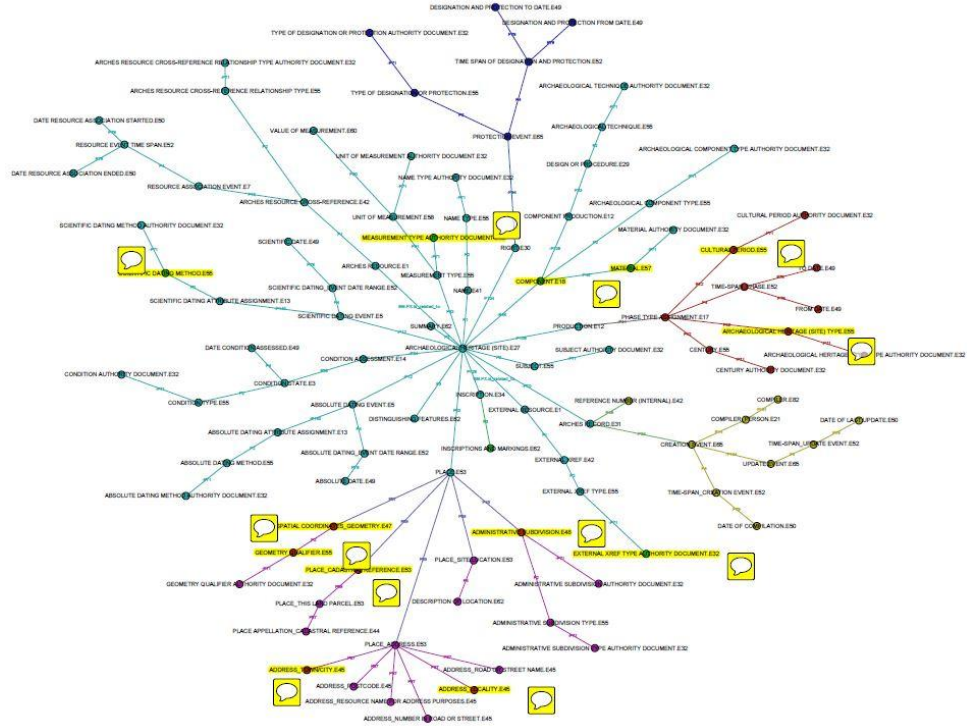
- Identify graphs / Resource Type
  - ARCHAEOLOGICAL HERITAGE (SITE).E27
- Identify entities in graph

- Extend graph
  - Certainty (period)
  - Certainty (find / feature)
  - Quantity (finds / features)
  - Investigation Type

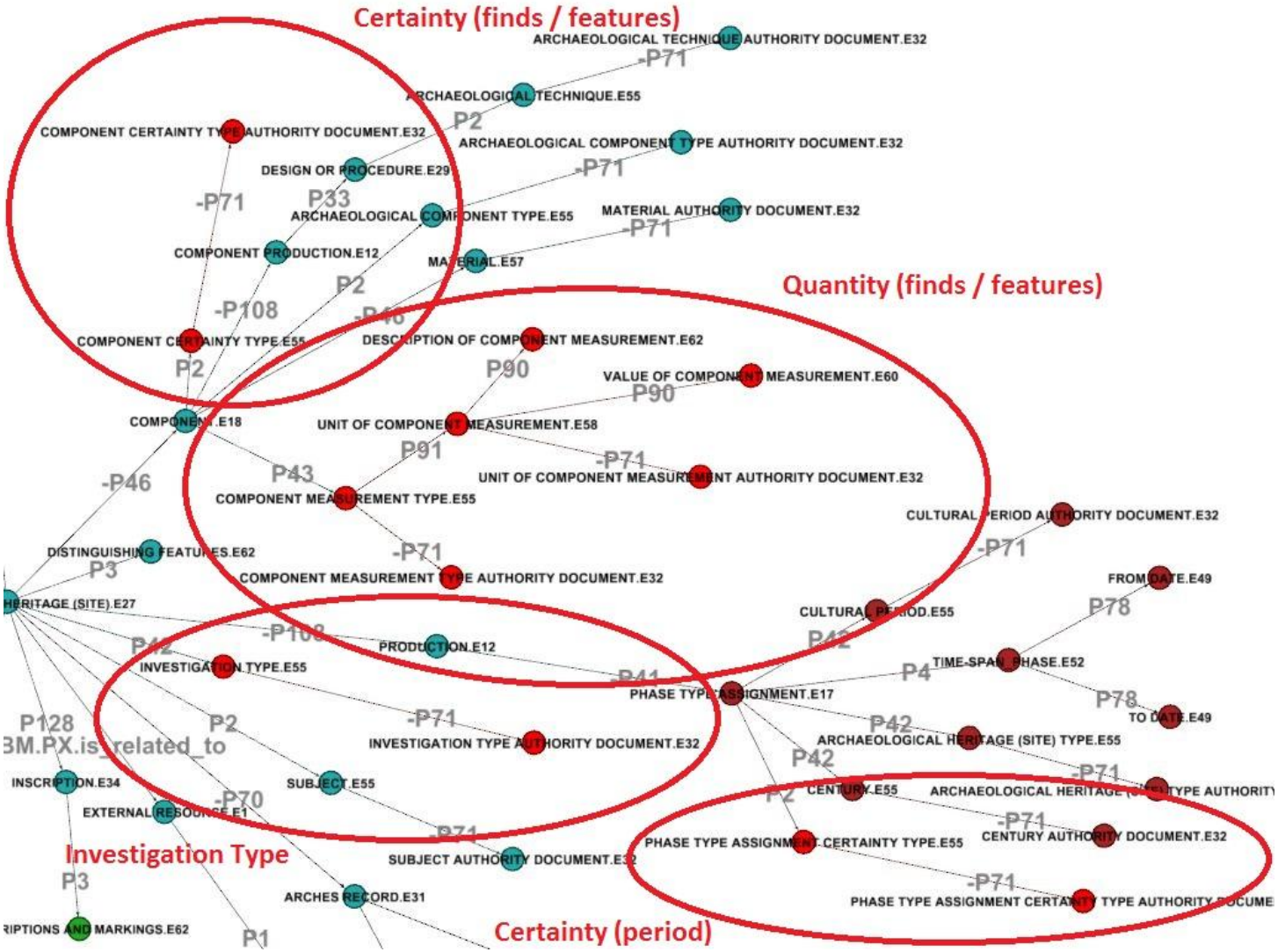
5. Implementation

Data model (the Arches graphs)

- **Identify graphs / Resource Type**
  - **ARCHAEOLOGICAL HERITAGE (SITE).E27**
- **Identify entities in graph**
-



5. Implementation



5. Implementation

Controlled vocabularies (Authority Files)

- Define terms for all entities
- Global vocabularies
  - are interoperable with other datasets
  - might be too general / detailed for a project
- Project specific vocabularies
  - Linking to SKOS concepts should be feasible

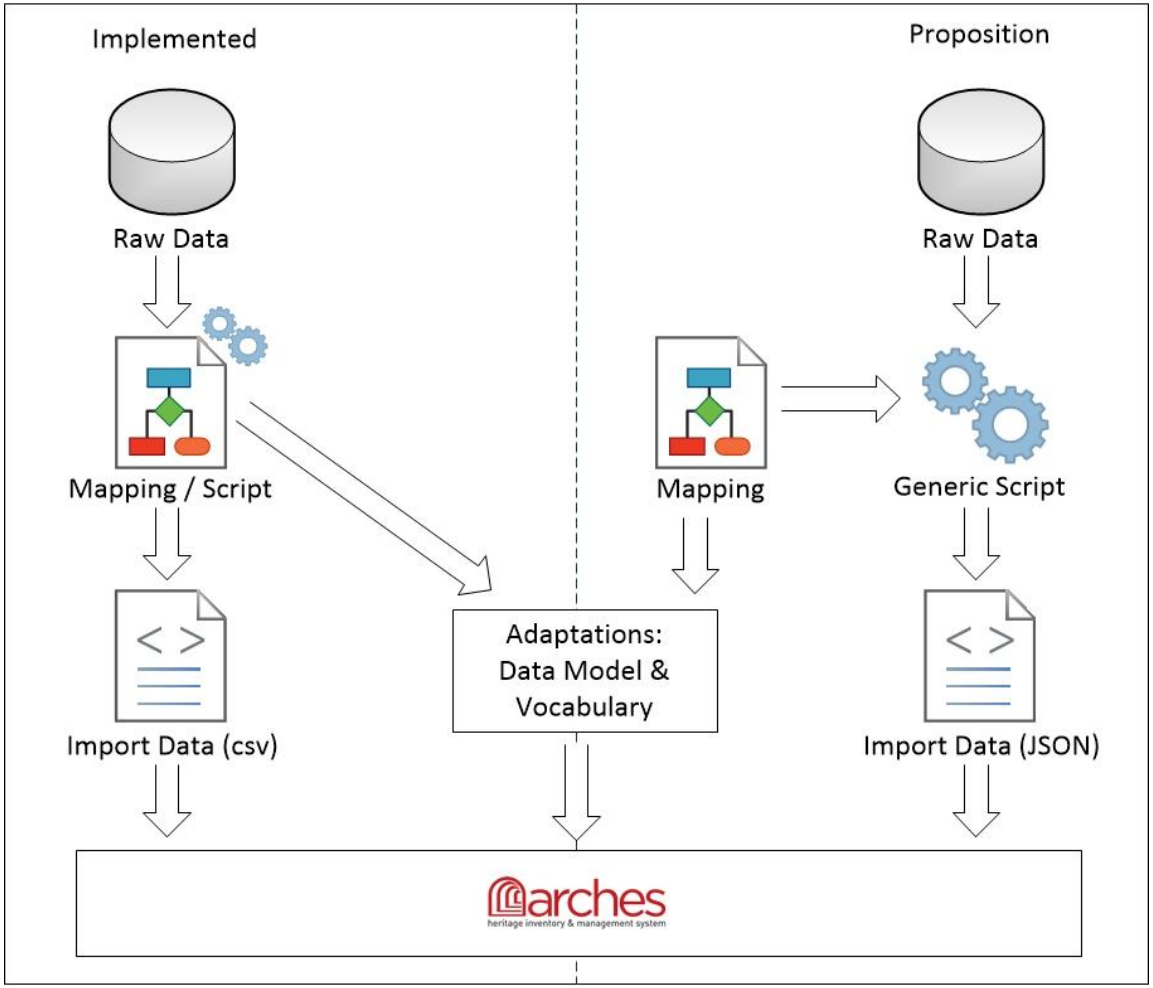
5. Implementation

A generic approach

- Predefined input format
- Mapping (configuration file incl. editing tool)
- Generic transformation script

5. Implementation

A generic approach



6. Outlook & Conclusion

Arches

- Flexible data model
  - Adaptable to any use case
  - Built on CIDOC standard
- Controlled vocabularies
  - Specific thesauruses can be defined
  - Linking to SKOS concepts planned
- Interoperable interfaces
  - OGC: Extendable via GeoServer
  - Linked Open Data: Long term vision
- Role based data management
  - Arches plans user management
  - i3mainz plans extension on data level

i3 mainz

Thanks for your attention!

Contact:

bruhn@fh-mainz.de

engel@fh-mainz.de

kohr@fh-mainz.de