TECHNISCHE UNIVERSITÄT DRESDEN

Center for Information Services and High Performance Computing (ZIH)

The MASi Research Data Management Service

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ZIH
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Data Challenge

- Scientific knowledge gain increasingly based on data
- Amount of data and number of files continuously growing
- Limits in current approaches
- Towards FAIR principles [datafairport.org]
  - **F**indable
  - **A**ccessible
  - **I**nteroperable
  - **R**e-usable
- Novel methods needed

Metadata as Solution

- Data Management via metadata (“Data about data”)

  → Access data via content instead of name/location

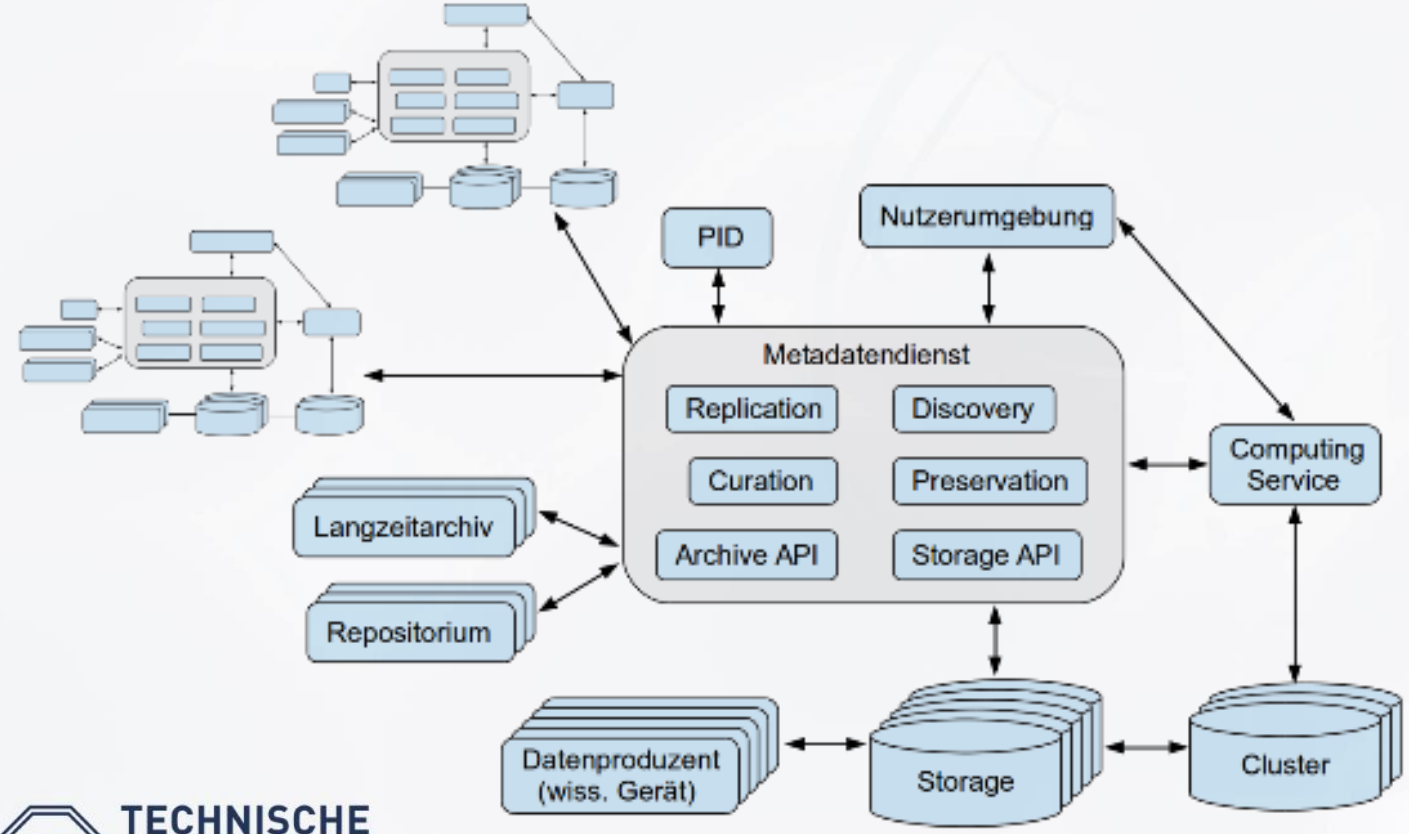
  → Find specific files in data set of millions of files
- Automatically extract, store and index metadata
- Metadata significantly improves usefulness of data

MASi – Project Facts

- Metadata Management for Applied Sciences
- Build-up metadata-driven research data repository for highly diverse communities
- Computer science partners:
  - ZIH at Technische Universität Dresden (lead)
  - IPE at Karlsruhe Institute of Technology
- Community partners
  - Geography - IÖR Dresden
  - Chemistry - RWTH Aachen University
  - Digital humanities - TU Darmstadt
    - Academy of Sciences and Literature Mainz
- DFG funding, 03/2015 – 02/2018

MASi – Overarching Goals

- Use and extend KIT DM framework - no development from scratch
  - Generic API – support arbitrary metadata models
  - Generic GUI – easily adaptable to community needs



MASi – Overarching Goals

- Create best practice integration guide
- Support further communities
- Collaborate within RDA
- Work towards sustainable service offer

MASi – Background – KIT Data Manager

- KIT Data Manager (KIT DM)
  - A metadata-driven repository framework
- Core development at IPE/KIT (Group of Rainer Stotzka)
- Basis for MASi service
- Generic, customizable, open source
- First public version in 2014, now version 1.3
- Well documented & open to contributions
- Used and extended in several projects
- http://datamanager.kit.edu/

MASi – Background – KIT Data Manager

- Organized into high-level services
  - Data and metadata management
  - Sharing
  - Administration
  - Data transfer
  - Data workflows
- Java and REST APIs
- Far reaching automation capabilities

MASi – Generic Metadata API

- Metadata to cover whole data life cycle
- Single point of access for all data
- High extensibility via REST interface
- PIDs to uniquely reference data
- Support widely used standards

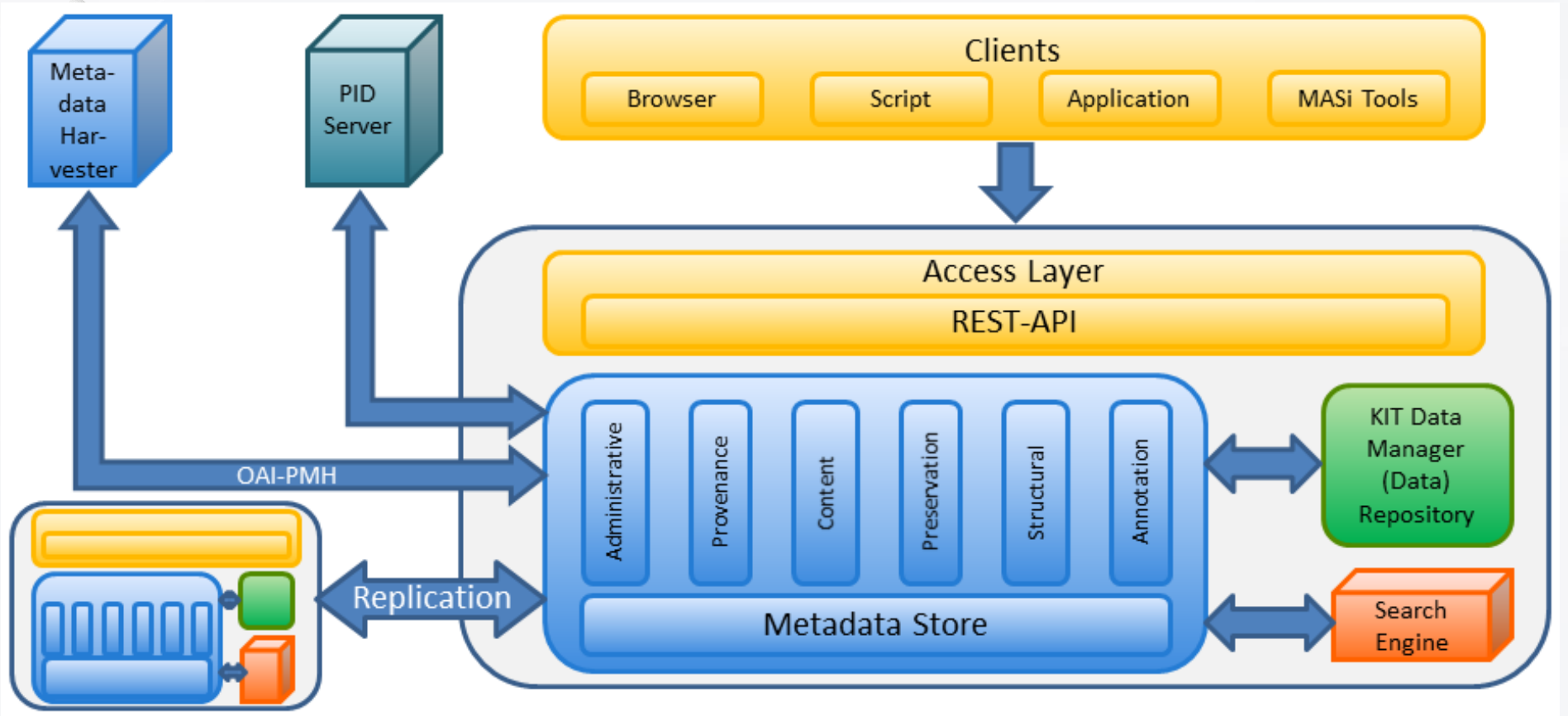
MASi – Generic Metadata API

- Metadata available as METS documents
  - “Metadata Encoding and Transmission Standard”
- METS defines various sections for different purposes
- Metadata in MASi split in packages similar to METS
  - Administrative, structural, content, provenance and annotation
- Appropriate combination of packages for specific community
- For each package possibly specialized database

MASi – Generic Metadata API

- Example for provenance package functionality
- Many workflow engines use separate workflow formats
- Many support Open Provenance Model (OPM) and ProvOne
- Graphs stored in graph database
  - Sophisticated queries such as “similar workflows”
- METS has pre-defined provenance section

MASi – Generic Metadata API



MASi – Generic GUI

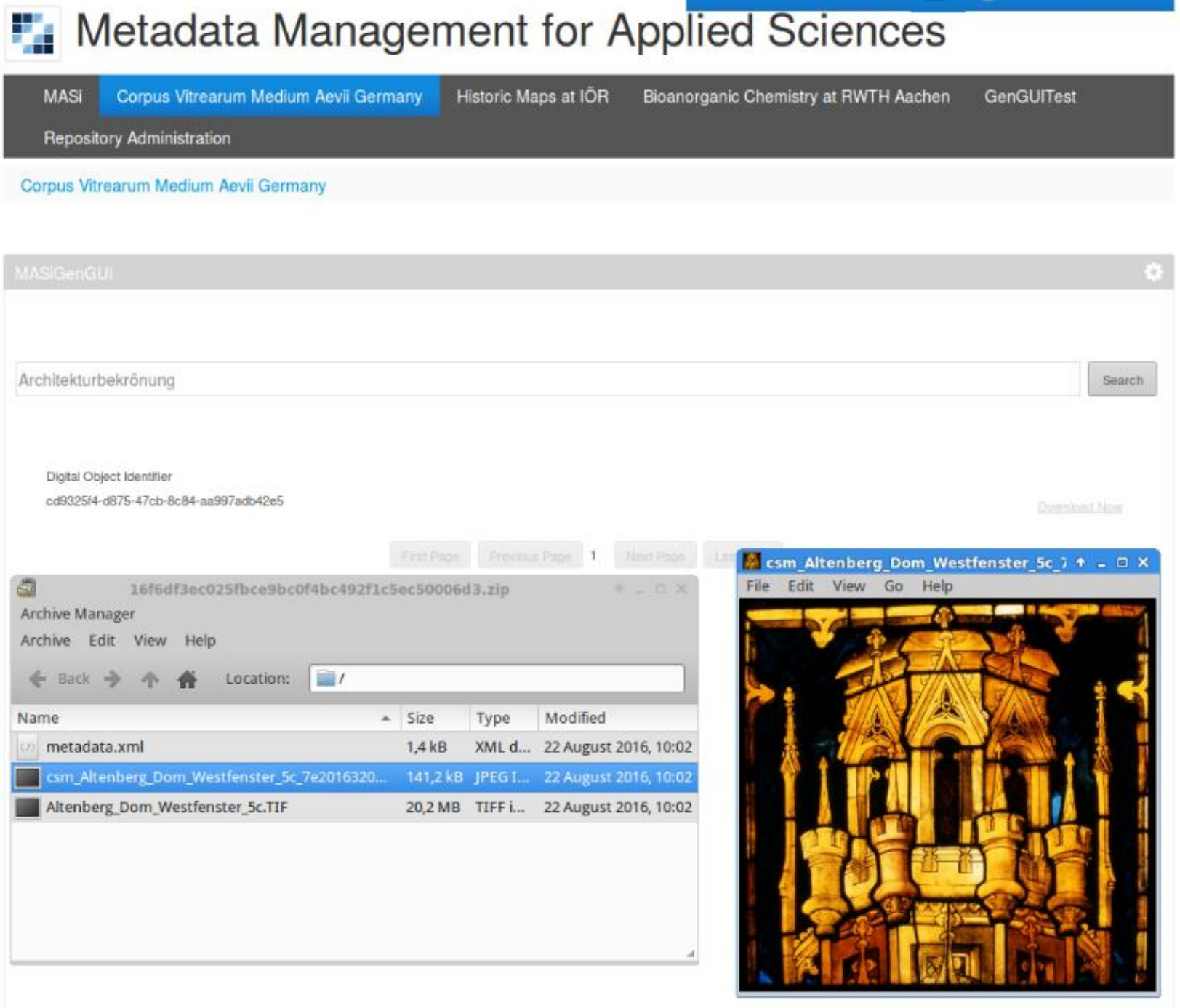
- Generic user interface to be specifically adapted
- Motivation to lower effort to adapt MASi to further use cases
- Time-saving for developers familiar with the technology
- Fundamentally enabling for developers unfamiliar with it
- Convenient access for users, specific to their use case

MASi – Generic GUI

- Built on basis of Liferay portal framework
- Development of plugin for KIT DM integration
  - Consistent user management between Liferay and KIT DM
- Liferay as ground truth
- Automatic syncing users and groups to MASi KIT DM instance
- MASi then transparently supports AAI methods that Liferay does

MASi – Generic GUI

- Development of generic portlet based on Vaadin library
- Continuous extension of functionality
  - For increasingly advanced generic capabilities
- Enables quick community adaptations
- Extensive documentation
- Open source and upstreaming to KIT DM framework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Richard Grunzke
Metadata Management for Applied Sciences
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Corpus Vitrearum Medium Aevii Germany
Historic Maps at IÖR
Bioanorganic Chemistry at RWTH Aachen
GenGUITest
Repository Administration
Corpus Vitrearum Medium Aevii Germany
MASiGenGUI
Architekturbekrönung
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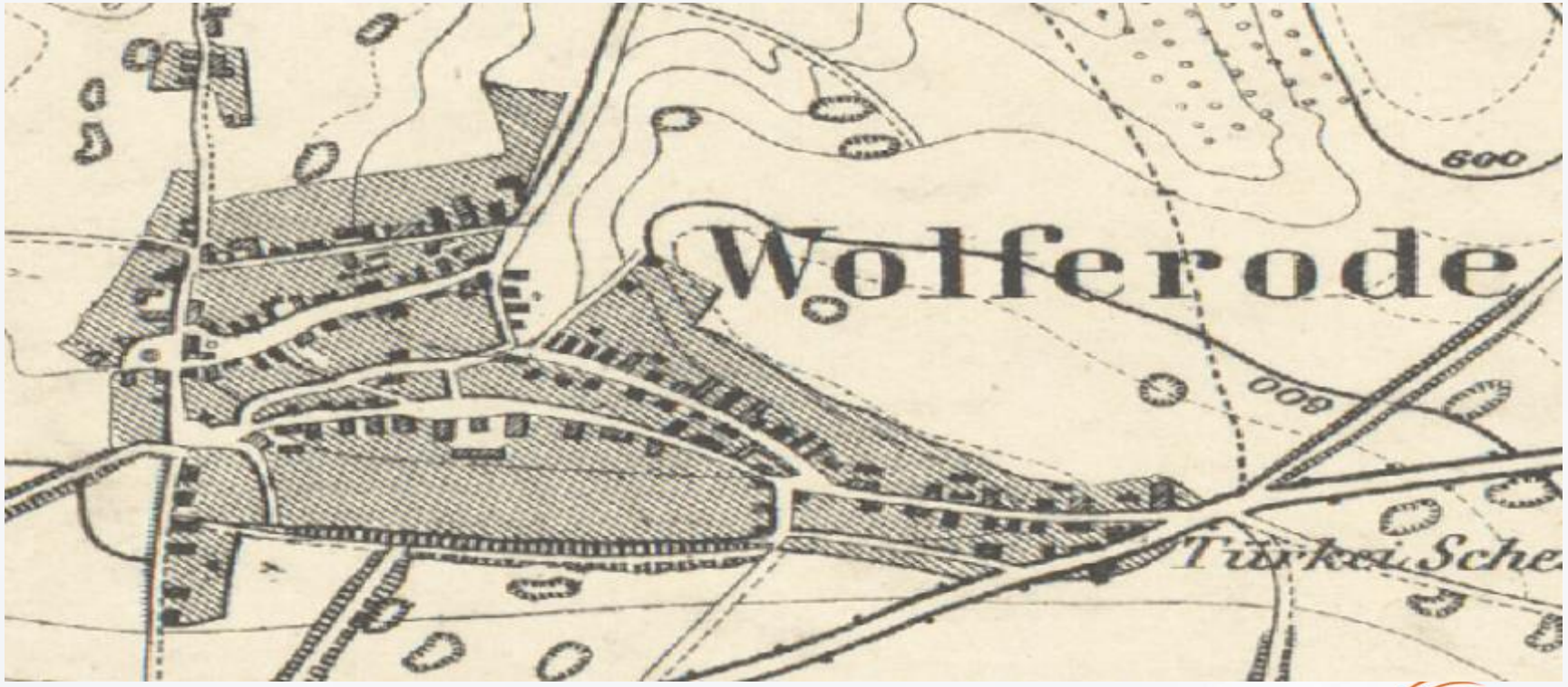
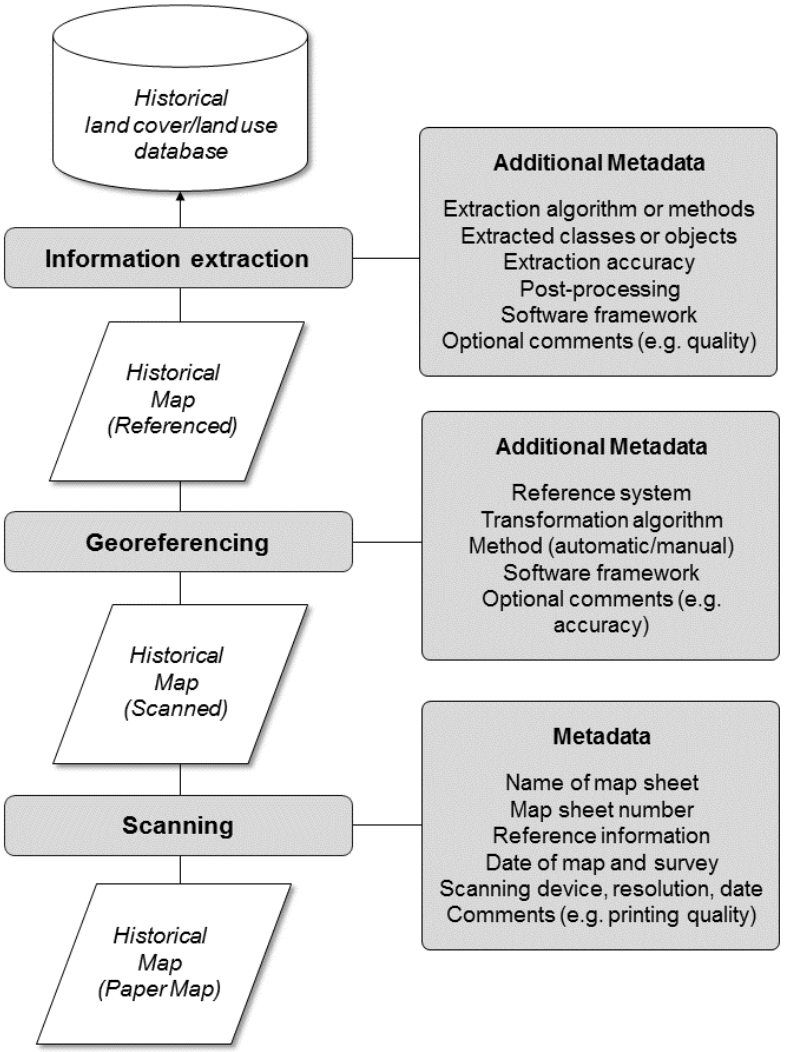
MASi – Use Cases – Historical Maps

- Historical maps for reconstructing land use changes
- Large scale spatial analyses and change detection
- Image analysis and pattern recognition algorithms on map scans



MASi – Use Cases – Historical Maps

- Metadata essential for change detection and interpretation
- Three major components
  - Scanning of paper maps
  - Georeferencing of scanned maps
  - Information extraction
- Automatic metadata extraction



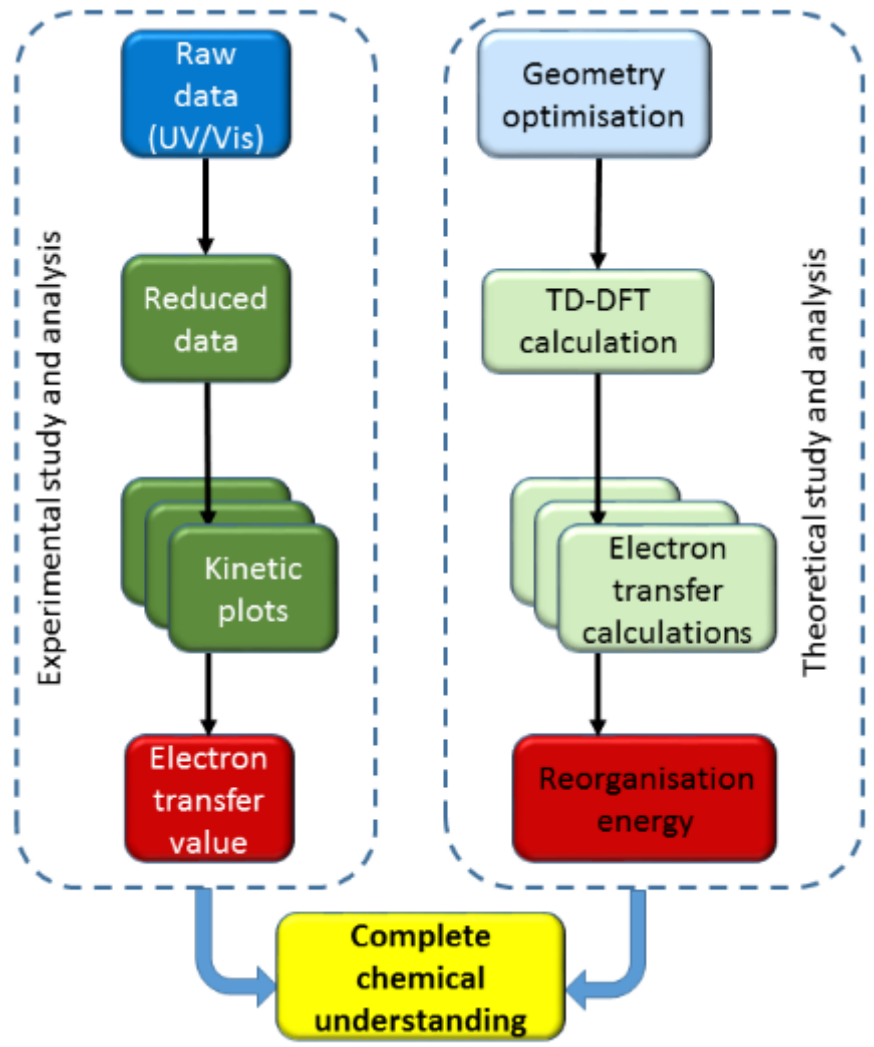
MASi – Use Cases – Spectroscopy in Chemistry

- Multitude of information by instruments
  - UV/Vis, IR, Raman, EPR and XAS spectroscopy
- Monitoring every 1.5 ms via instrument

  → Large amount of raw data
- Data currently manually reduced by choosing suitable characteristics
- Combination with theoretical simulation data highly fruitful

MASi – Use Cases – Spectroscopy in Chemistry

- Different levels of data production
- Metadata annotation in all steps
- Manually attaching metadata that is only known to users
- Handling of
  - Reduced data
  - Metadata for theoretical data



MASi – Use Cases – Church Windows

- Corpus Vitrearum Medii Aevi (CVMA) Germany
- Long-term research project for medieval stained glass windows
- Study each window's history such as iconography and religious context
- Curates image archive with set of XMP metadata for each TIFF file

MASi – Use Cases – Church Windows

- MASi to open up CVMA image archive to further interested parties
- E.g. providers of cultural heritage photography
- Use of upcoming OAI-PMH interface
- Automatic functionality
  - Matching of metadata records with other cultural repositories
  - Annotating of CVMA images with these records

MASi – Sustainability

- Further use cases
- Collaborations
- Towards service offer
- Further technology improvements

MASi – Sustainability – Further Use Cases

- Basis of and extensions in further use cases (up to 24 user groups each)
- DFG Collaborative Research Centre 940 - Volition and Cognitive Control
  - Psychology, neuroimaging
- DFG Collaborative Research Centre 980 - Episteme in Motion
  - History
- H2020 Nanoscience Foundries & Fine Analysis (NFFA)
  - Nanoscience
- DFG Generic Research Data Infrastructure (GeRDI)
  - Ocean, environment and life sciences, economy, digital humanities
- Further proposals underway

MASi – Sustainability – Collaborations

- Contribute to RDA and evaluate integration of RDA recommendations
- ScaDS Dresden/Leipzig Big Data competence center
  - MPI-CBG, UFZ, UKD
- Nanoscopy reference archive with KIP (Heidelberg) and IMB (Mainz)

ScaDS DRESDEN LEIPZIG

RDA Research Data Sharing without barriers
RESEARCH DATA ALLIANCE

MASi – Sustainability – Towards service Offer

- General service offer for arbitrary user communities
- Planning phase
- Aim at production mode
  - Support, bug fixes, new features, scheduled downtimes
- Utilization of IT infrastructure at ZIH / TU Dresden

MASi – Sustainability – What is missing?

- Better support arbitrary communities
  - Schema hierarchies
  - Controlled vocabularies
  - Extended automatic validation
  - Support definition of practical policies

MASi – Summary

- MASi enables
  - Metadata-driven management of large and complex data
  - Quick integration of highly diverse use cases
- Uses and extends open source framework KIT DM
- Work towards production-ready and sustainable service offer
- Need to even better support arbitrary community use cases

Thank you