

# Building and exploring Knowledge Graphs with eccenca Corporate Memory

Dr. Natanael Arndt  
Senior Linked Data Expert @ eccenca GmbH

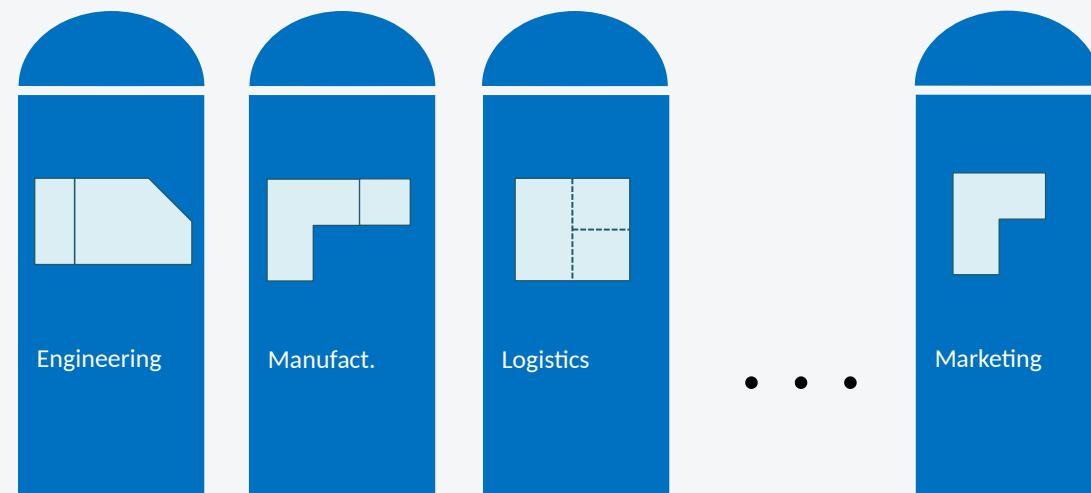
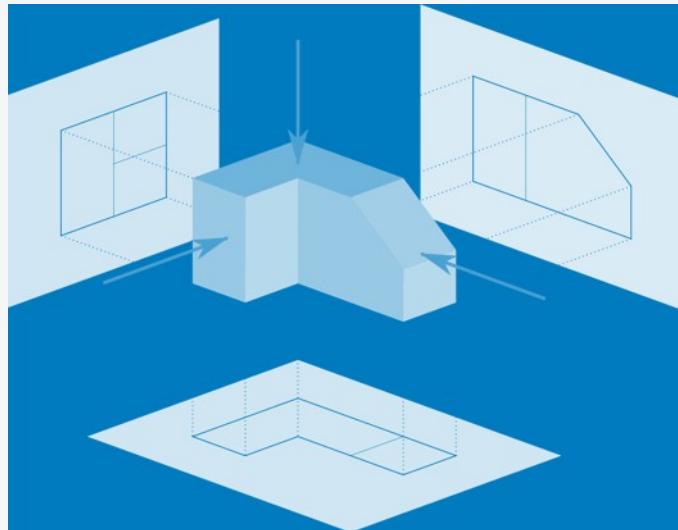
**Leipzig** ASCM - APICS  
Business Digital Twin      BOSCH  
EDM Daimler **BERLIN**  
Council Innovate with Data  
**>100% Growth** NOKIA  
**Volkswagen** 60 FTE  
Knowledge Graph      VOITH  
DBpedia      DaaS/Cloud



Building and exploring Knowledge Graphs with  
**eccenca Corporate Memory**

# Perspectives on data turn into silos

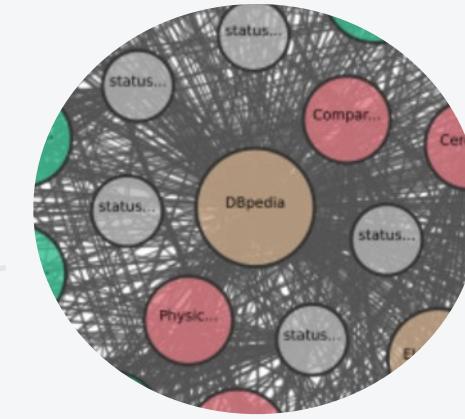
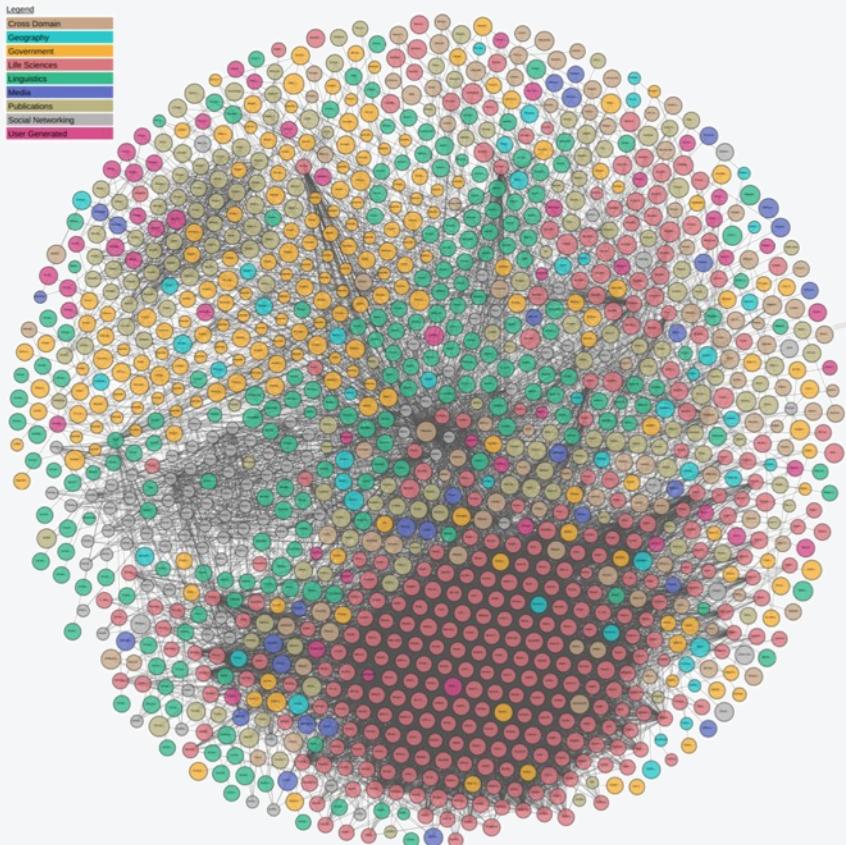
Parts of data are being curated, duplicated, annotated and simply changed over time, making reconciliation and interpretation a challenge



# Data on the web & WikiData & DBpedia

## Global and Unified Access to Knowledge

### The [Linked Open Data Cloud](#)



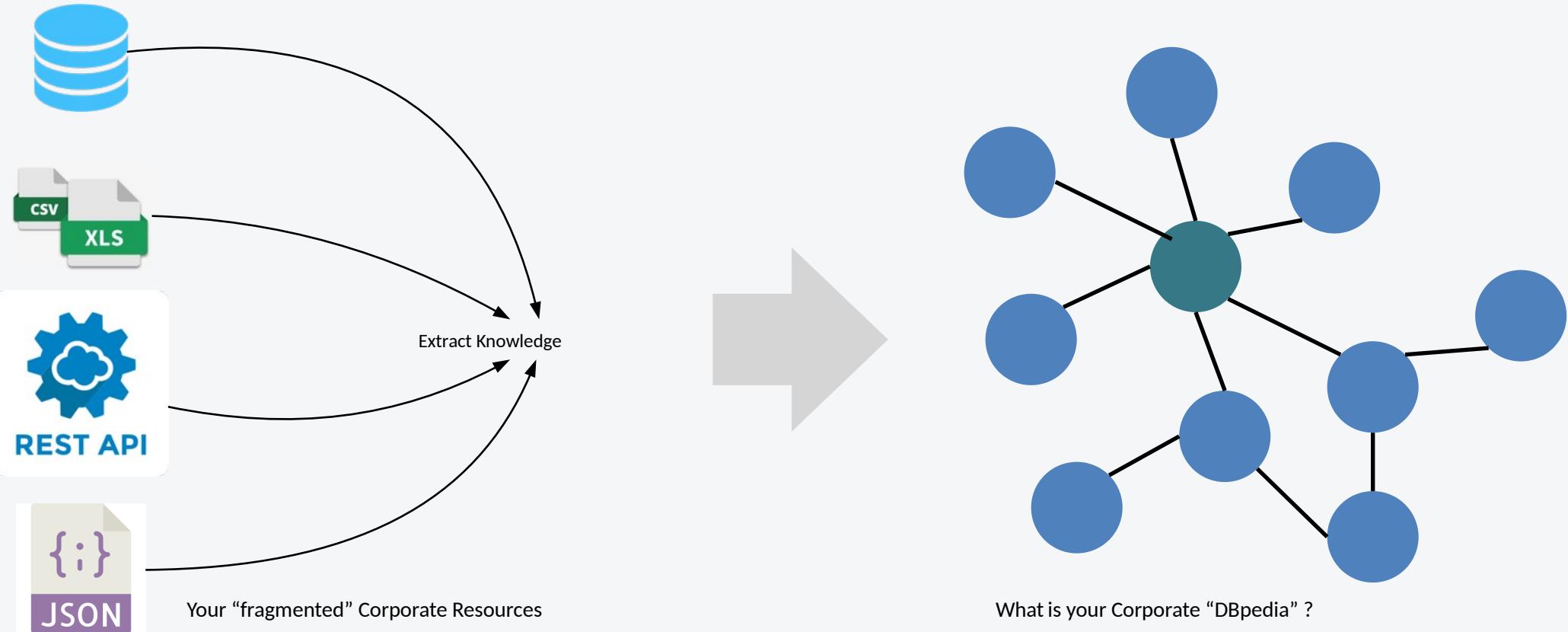
DBpedia extracts structured content from Wikipedia.

This structured information is made available on the World Wide Web.

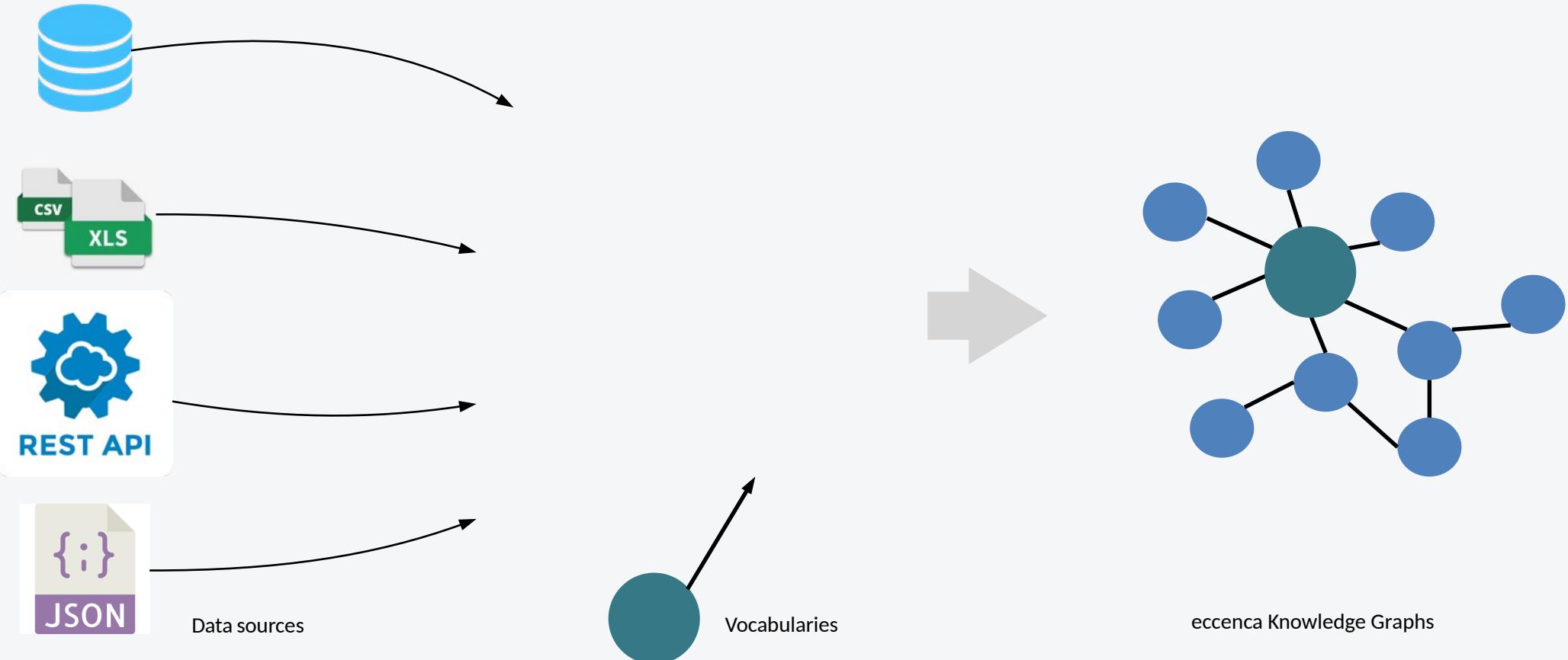
Leipzig University - Prof. Dr. Sören  
Auer, co-founder of Eccenza

# From the web to linked enterprise data

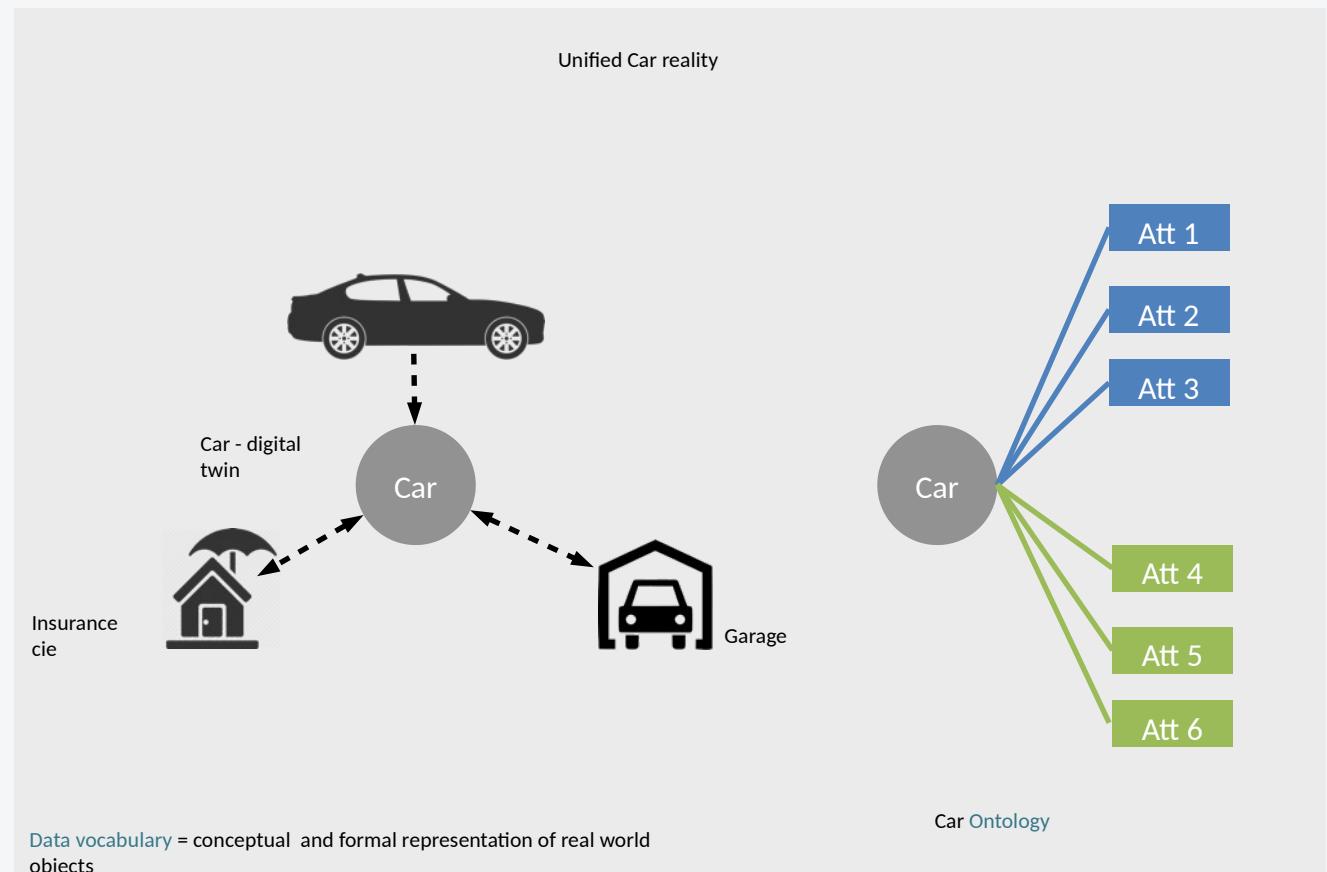
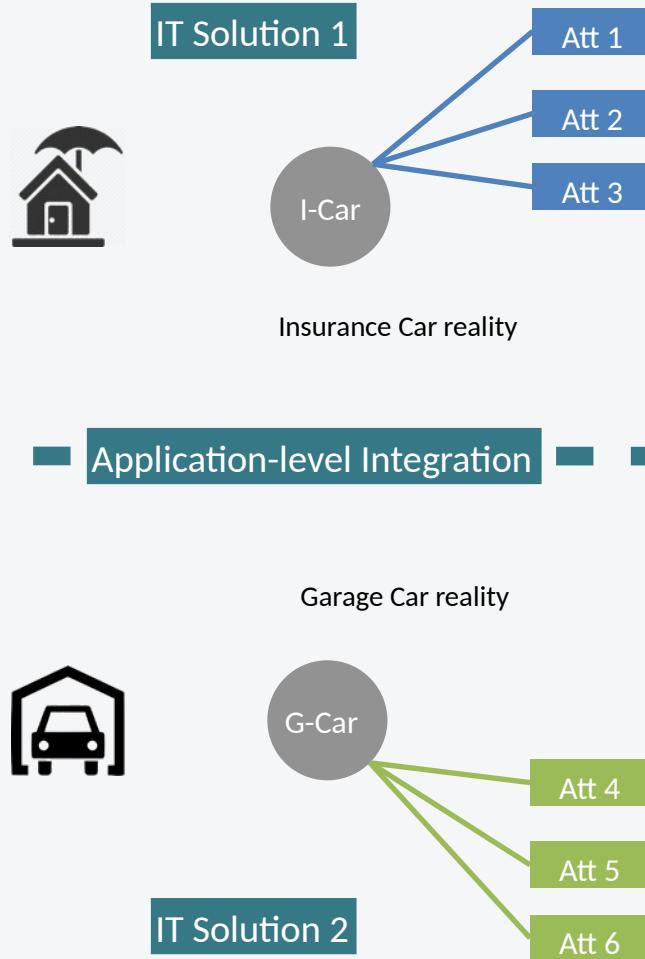
## Global & unified access to corporate knowledge



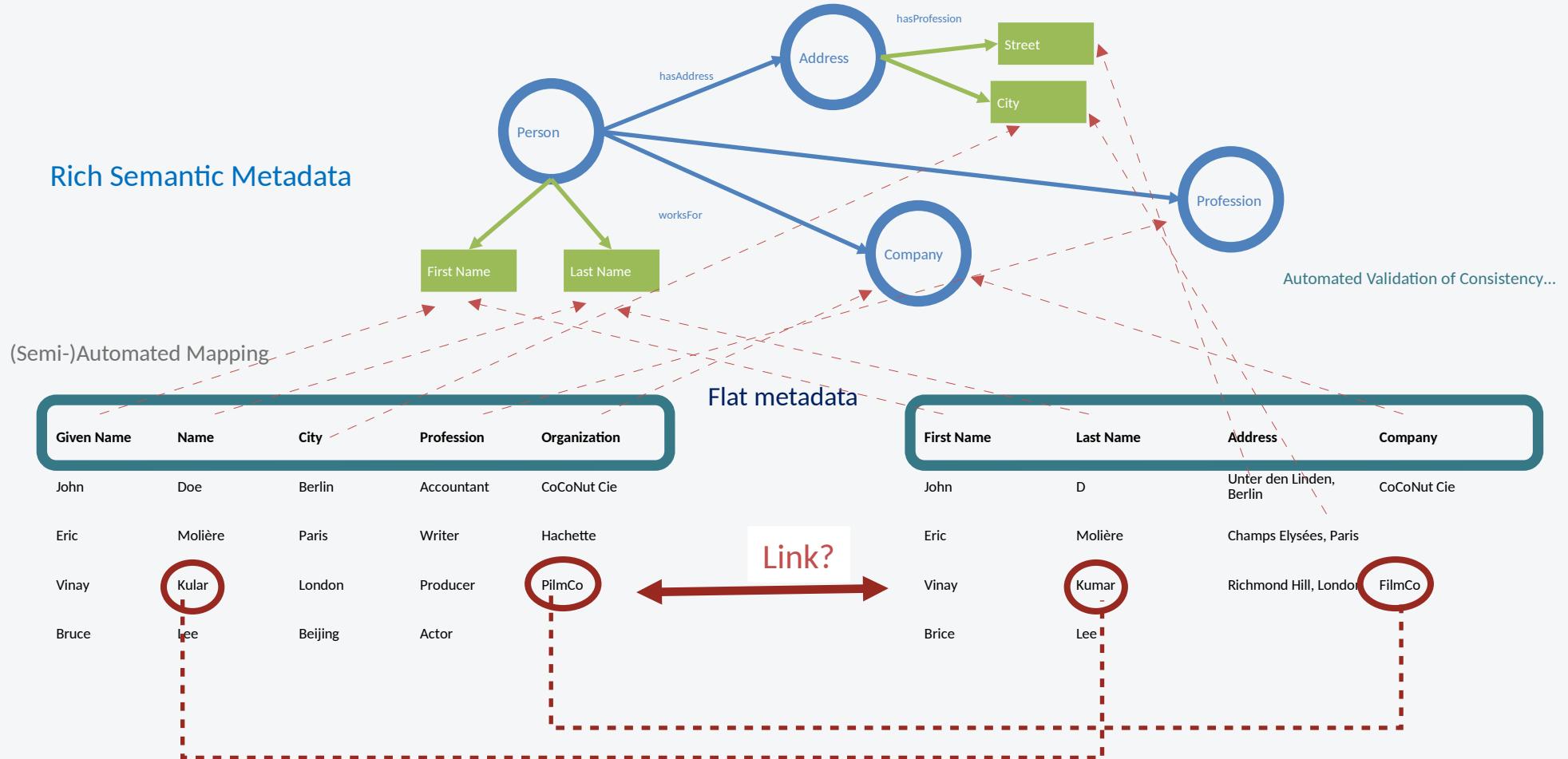
# eccenca Corporate Memory



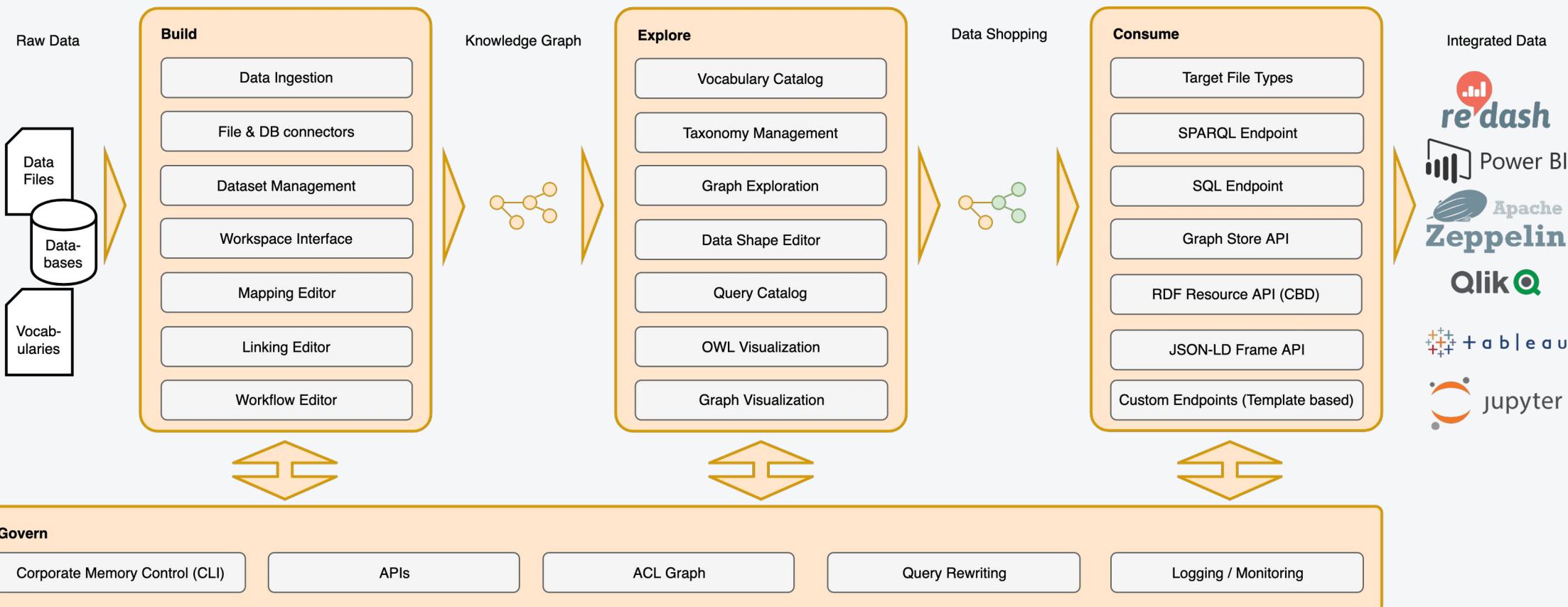
# Global identification, multiple perspectives



# Semantic metadata vs flat metadata



# User Journey and Functional Areas



# Linking as general rules mechanism

**eccena Corporate Memory**

link-loans-2-customer START WORKSPACE ACTIVITIES EDITOR EVALUATE EXECUTE LEARN REFERENCE LINKS

Finished in 4.901s BACK RESET DETAILS

Linkage Rule ^ Fitness: 99.5 (based on 3 positive and 0 negative reference links)

Uncertain links

Path	Value
rdfs:label	(Aaron Yundt: 21937 USD)
sdo:birthDate	1974-07-10
rdf:type	[http://schema.org/LoanOrCredit]
sdo:legalName	Aaron Yundt
sdo:interestRate	(Variable)
sdo:accountId	FUGBGHG86GF655
sdo:amount	21937
sdo:currency	USD
sdo:postalCode	6564

Path	Value
sdo:legalName	Aaron Yundt
sdo:birthDate	1974-07-10
rdf:type	[http://schema.org/Rating]
sdo:postalCode	6564
sdo:birthDate	1974-07-10
sdo:ratingValue	10
rdfs:label	(Aaron Yundt: 10)

CONFIRM DECLINE NOT SURE DONE

v20.03-6450-g2b14c25cc ©2020 eccena GmbH

Workspace: Product Demo user Logged in as: admin

**eccena Corporate Memory**

link-similar-products START WORKSPACE ACTIVITIES EDITOR EVALUATE EXECUTE LEARN REFERENCE LINKS

Link Limit: unlimited Link Type: pv:similarProduct

No score available ✓

Source Paths: Products-Demo-Int... (custom path, pv:areaOfExpertise, pv:id, pv:hasProductManager, nv:price)

Target Paths: Products-Demo-Int... (custom path, pv:depth\_mm, rdf:label, pv:id, pv:hasProductManager, nv:price)

Transformations recommended: Constant, Lower case, Tokenize

Comparators recommended: Jaccard, Levenshtein distance, Numeric Equality, String Equality

Aggregators recommended: And, Average, Or

20.03-6450-g2b14c25cc ©2020 eccena GmbH

Workspace: Product Demo user Logged in as: admin

# Data defined UI Configuration

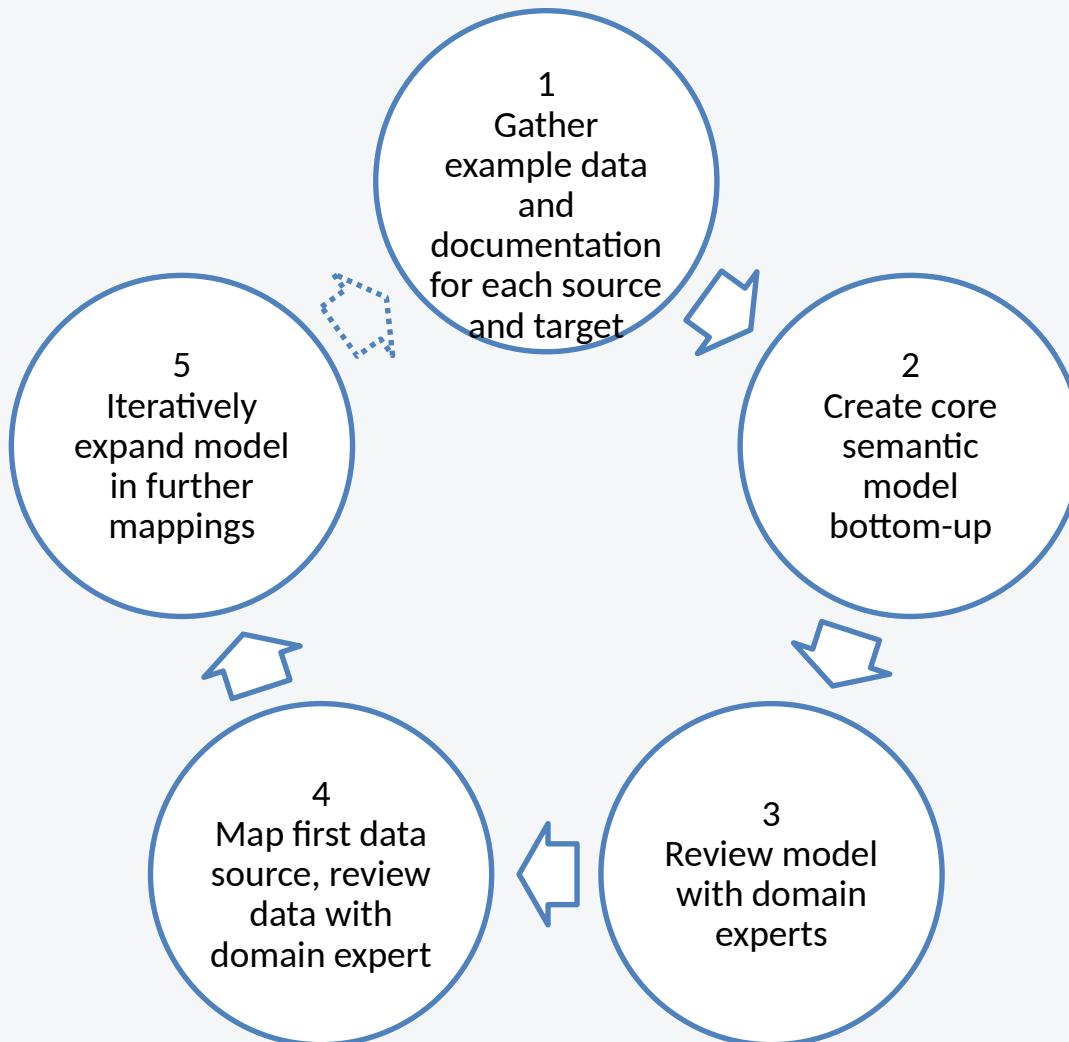
- Framework for interactive data editors that uses W3C SHACL
- Supporting trees of graphs to partition data
- Application UI can be flexibly configured, e.g. including navigation
- Multiple such application configurations can be provided, to support multiple perspectives on the same knowledge graph
- Custom functionality by event driven query hooks

<https://documentation.eccenca.com/latest/explore/building-a-customized-user-interface>

The screenshot shows the eccenca Corporate Memory interface. On the left is a navigation sidebar with sections like Agent, Employee, Manager, Product, Hardware, Service, Department, Price, Dataset, and Product Category. The 'Hardware' section is currently selected. The main right panel displays a 'Meter Transducer' resource with various properties: ID (Z249-1364492), Name (Meter Transducer), Price (amount: 4.12, currency: EUR), and category (Transducer). Below the properties, there are several linked resources: I241-8776317 - Component Confabulation, PS16-8211068 - IoT Data Marketing, and Engineering. A blue edit icon is visible in the bottom right corner of the main panel.

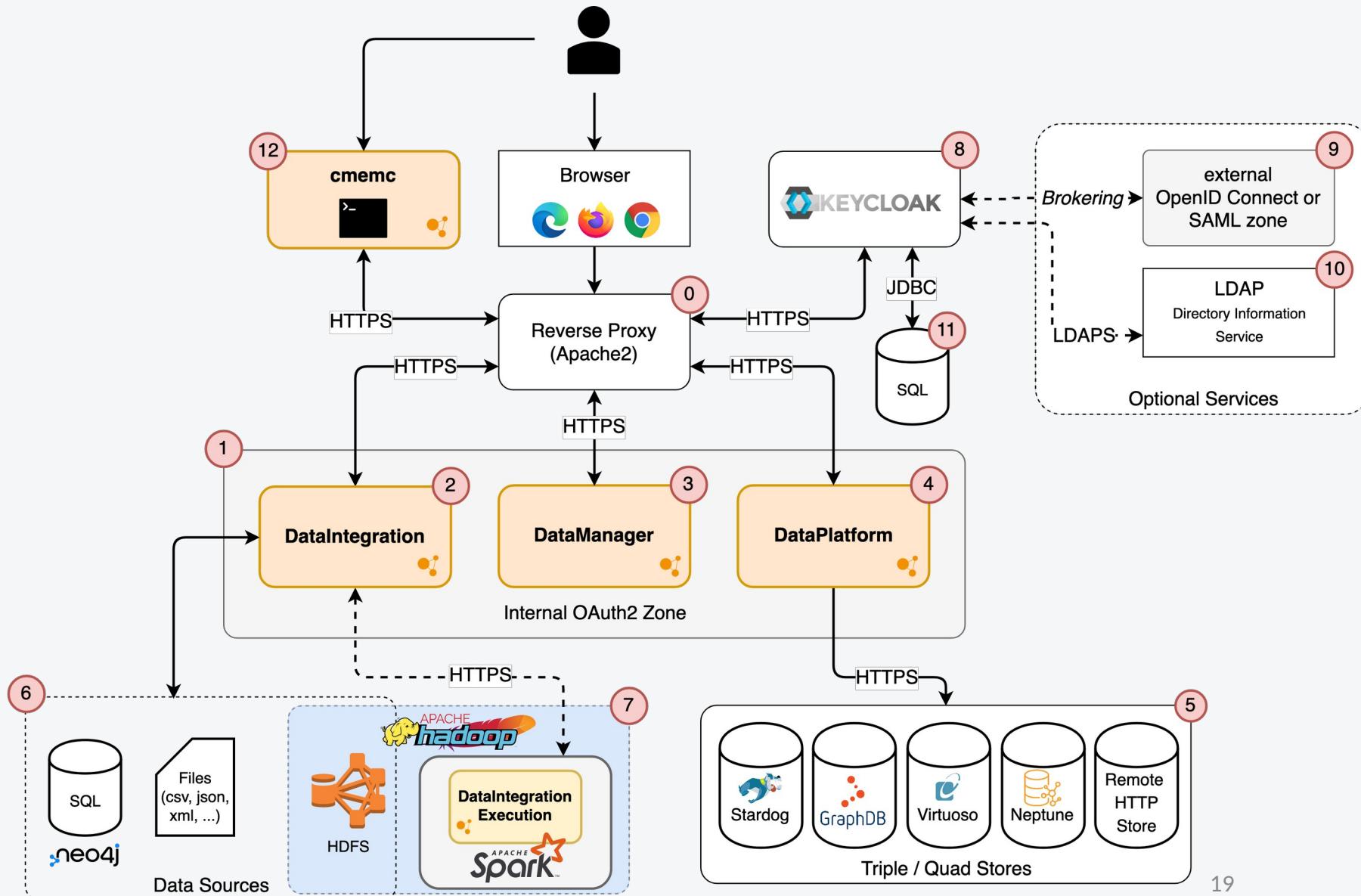
The screenshot shows a documentation page titled 'Building a customized User Interface'. The left sidebar includes links to Back, Explore, Dataset Catalog, Vocabulary Catalog, Taxonomy Management, Graph Exploration, Query Module, and Building a customized User Interface. The main content area has a heading 'Building a customized User Interface' and a sub-section 'Introduction'. It explains how shapes allow for creating a customized Linked Data user interface. The right sidebar contains sections for 'Introduction', 'Defining forms', 'NodeShapes', 'PropertyShapes', 'Using forms', 'Editing existing resources', and 'Creating new resources'.

# Enterprise Knowledge Graph Project Flow



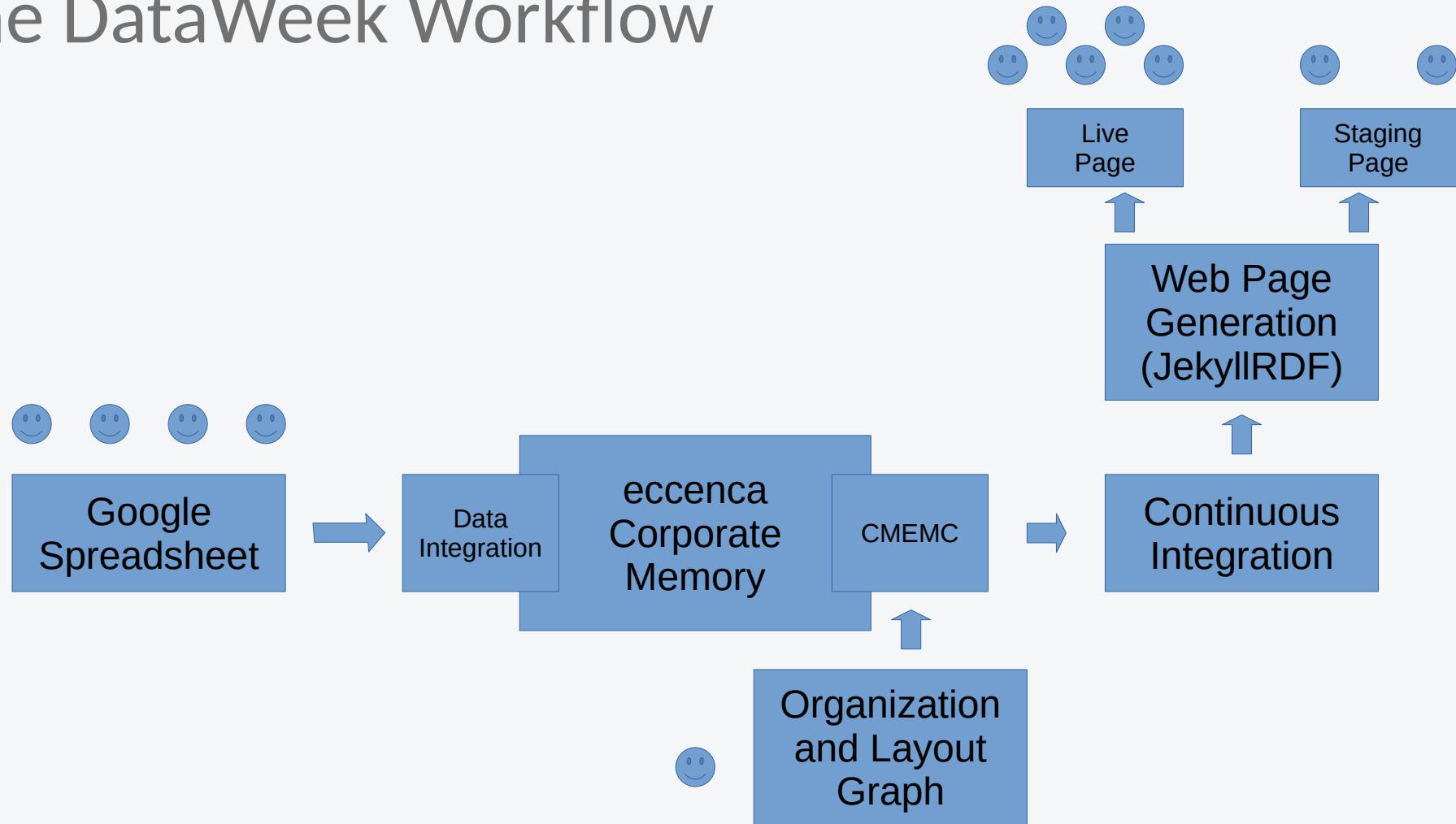
1. Analyze data sources and understand domain
2. Find or build a semantic model (ontology/vocabulary)
3. Create the mappings
4. Clean, enrich and link data
5. Explore the results  
... Re-iterate if needed ...

# Reference Architecture Corporate Memory



# SAMPLE USE CASES

# The DataWeek Workflow



# The DataWeek Workflow

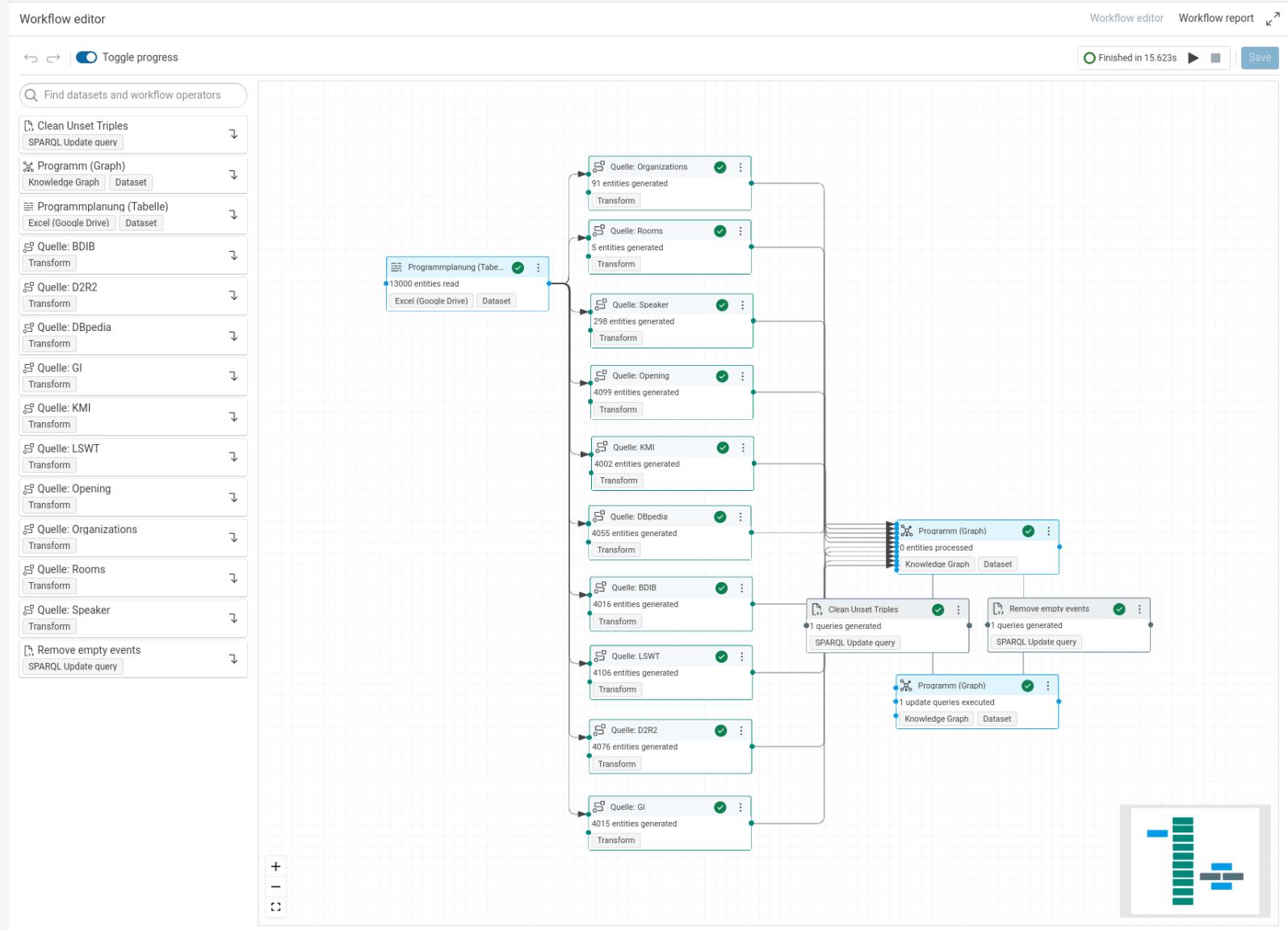
View      Download    View    X

Nur Lesezugriff    100%    https://dataweek.de/#SebastianBrandt

	A	B	C	D	E	F
	Title	Name	Description_en	Description_de	Affiliation	
1	IRI	Maximilian Barth	Business Development & Strategic Partnerships Manager	Manager für Geschäftsentwicklung und strategische Partnerschaften	<a href="https://stackfuel.com/de/">https://stackfuel.com/de/</a>	
52	<a href="https://dataweek.de/#MaximilianBarth">https://dataweek.de/#MaximilianBarth</a>	Maximilian Pensel	Data Scientist	Data Scientist	<a href="https://www.alexanderthamm.com/">https://www.alexanderthamm.com/</a>	
53	<a href="https://dataweek.de/#MaximilianPensel">https://dataweek.de/#MaximilianPensel</a>	Mehdi Azarafza	Scientific Researcher	Wissenschaftlicher Mitarbeiter	<a href="https://infai.org/">https://infai.org/</a>	
54	<a href="https://dataweek.de/#MehdiAzarafza">https://dataweek.de/#MehdiAzarafza</a>	Dr. Michael Martin	Head of Competence Center	Leiter Kompetenzzentrum	<a href="https://infai.org/">https://infai.org/</a>	
55	<a href="http://aksw.org/MichaelMartin">http://aksw.org/MichaelMartin</a>	Dr. Milan Dojchinovski	Research Associate / Assistant Professor	Wissenschaftlicher Mitarbeiter / Assistentenprofessor	<a href="https://infai.org/">https://infai.org/</a>	
56	<a href="http://aksw.org/MilanDojchinovski">http://aksw.org/MilanDojchinovski</a>	Miriam Welz			<a href="https://scads.ai/">https://scads.ai/</a>	
57	<a href="https://dataweek.de/#MiriamWelz">https://dataweek.de/#MiriamWelz</a>	Mirko Mühlport	Team leader at City of Leipzig/Digital City Department, CUT Projekt	Teamleiter bei Stadt Leipzig/Referat Digitale Stadt, CUT Projekt	<a href="https://www.leipzig.de/buergerservice-und-verwaltung/a">https://www.leipzig.de/buergerservice-und-verwaltung/a</a>	
58	<a href="https://dataweek.de/#MirkoMuehlport">https://dataweek.de/#MirkoMuehlport</a>	Mirza Mohtashim Alam	Research Associate	Wissenschaftlicher Mitarbeiter	<a href="https://infai.org/">https://infai.org/</a>	
59	<a href="https://dataweek.de/#MirzaMohtashimAlam">https://dataweek.de/#MirzaMohtashimAlam</a>	Dr. Nadine Kuhla von Bergmann	CEO	CEO	<a href="https://creativeclimatecities.org/de/">https://creativeclimatecities.org/de/</a>	
60	<a href="https://dataweek.de/#NadineKuhlaVonBergmann">https://dataweek.de/#NadineKuhlaVonBergmann</a>	Dr. Nadine Weissmann	Requirements Engineer	Anforderungsengineerin	<a href="https://www.datev.de/">https://www.datev.de/</a>	
61	<a href="https://dataweek.de/#NadineWeissmann">https://dataweek.de/#NadineWeissmann</a>	Nadja Riedel	City of Leipzig/Digital City Department	Stadt Leipzig/Referat Digitale Stadt	<a href="https://www.leipzig.de/buergerservice-und-verwaltung/a">https://www.leipzig.de/buergerservice-und-verwaltung/a</a>	
62	<a href="https://dataweek.de/#NadjaRiedel">https://dataweek.de/#NadjaRiedel</a>	Dr. Nadja Riedel	Senior project manager at City of Leipzig/Digital City Department	Senior Projektmanager bei Stadt Leipzig/Referat Digitale Stadt	<a href="https://www.leipzig.de/wirtschaft-und-wissenschaft/digital">https://www.leipzig.de/wirtschaft-und-wissenschaft/digital</a>	
63	<a href="https://dataweek.de/#NadjaRiedel">https://dataweek.de/#NadjaRiedel</a>	Dr. Natanael Arndt	Senior Linked Data Expert	Senior Linked Data Expert	<a href="https://www.eccenca.com/">https://www.eccenca.com/</a>	
64	<a href="http://aksw.org/NatanaelArndt">http://aksw.org/NatanaelArndt</a>	Nieves Sande	Research and Event Manager	Research and Event Manager	<a href="https://www.eccenca.com/">https://www.eccenca.com/</a>	
65	<a href="https://dataweek.de/#NievesSande">https://dataweek.de/#NievesSande</a>	Norman Radtke			<a href="https://infai.org/">https://infai.org/</a>	
66	<a href="http://aksw.org/NormanRadtke">http://aksw.org/NormanRadtke</a>	Oliver Graef	Group Manager Corporate Analysis and Rating	Gruppenleiter Unternehmensanalyse und Rating	<a href="https://www.datev.de/">https://www.datev.de/</a>	
67	<a href="https://dataweek.de/#OliverGraef">https://dataweek.de/#OliverGraef</a>	Oliver Herrmann			<a href="https://htwk-leipzig.de/">https://htwk-leipzig.de/</a>	
68	<a href="https://dataweek.de/#OliverHerrmann">https://dataweek.de/#OliverHerrmann</a>	Paulo Ricardo Vivirkado Car mo			<a href="https://infai.org/">https://infai.org/</a>	
69	<a href="https://dataweek.de/#PauloRicardoVivirkadoCarmo">https://dataweek.de/#PauloRicardoVivirkadoCar mo</a>	Dr. Richard Figura	CEO	CEO	<a href="https://www.ciss.de">https://www.ciss.de</a>	
70	<a href="https://dataweek.de/#RichardFigura">https://dataweek.de/#RichardFigura</a>	Robin Römer	Co-Founder	Mitgründer	<a href="https://cityscaper.de/">https://cityscaper.de/</a>	
71	<a href="https://dataweek.de/#RobinRoemer">https://dataweek.de/#RobinRoemer</a>	Dr. Ronny Maik Leder	Director	Direktor	<a href="https://naturkundemuseum.leipzig.de/">https://naturkundemuseum.leipzig.de/</a>	
72	<a href="https://dataweek.de/#RonnyMaikLeder">https://dataweek.de/#RonnyMaikLeder</a>	Roy Meissner			<a href="https://infai.org/">https://infai.org/</a>	
73	<a href="http://aksw.org/RoyMeissner">http://aksw.org/RoyMeissner</a>	Dr. Ruslan Hrushchak	Managing director	Geschäftsführer	<a href="https://appplant.de/de/home/">https://appplant.de/de/home/</a>	
74	<a href="https://dataweek.de/#RuslanHrushchak">https://dataweek.de/#RuslanHrushchak</a>	Dr. Sabine Gründer-Fahrer			<a href="https://infai.org/">https://infai.org/</a>	
75	<a href="http://aksw.org/SabineGruenderFahrer">http://aksw.org/SabineGruenderFahrer</a>	Saideshwar Kota			<a href="https://www.wichita.edu">https://www.wichita.edu</a>	
76	<a href="https://dataweek.de/#SaideshwarKota">https://dataweek.de/#SaideshwarKota</a>	Sakyi Mannah			<a href="https://srilw.de/">https://srilw.de/</a>	
77	<a href="https://dataweek.de/#SakyiMannah">https://dataweek.de/#SakyiMannah</a>	Sebastian Gemkow	Saxon State Minister for Science	Sächsischer Staatsminister für Wissenschaft	<a href="https://www.smwk.sachsen.de/">https://www.smwk.sachsen.de/</a>	
78	<a href="https://dataweek.de/#SebastianGemkow">https://dataweek.de/#SebastianGemkow</a>	Sebastian Graetz	Project manager Digital City Unit	Projektmanager bei Referat Digitale Stadt	<a href="https://www.leipzig.de/wirtschaft-und-wissenschaft/digital">https://www.leipzig.de/wirtschaft-und-wissenschaft/digital</a>	
79	<a href="https://dataweek.de/#SebastianGraetz">https://dataweek.de/#SebastianGraetz</a>	Dr.-Ing. Sebastian Hellmann	AKSW, DBpedia Association	AKSW, DBpedia Association	<a href="https://infai.org/">https://infai.org/</a>	
80	<a href="http://aksw.org/SebastianHellmann">http://aksw.org/SebastianHellmann</a>	Dr. Sebastian Lehmann	Senior AI Engineer	Senior AI Engineer	<a href="https://appsfactory.de/">https://appsfactory.de/</a>	
81	<a href="https://dataweek.de/#SebastianLehmann">https://dataweek.de/#SebastianLehmann</a>	Dr. Sebastian Tramp	CTO	CTO	<a href="https://www.eccenca.com/">https://www.eccenca.com/</a>	
82	<a href="http://aksw.org/SebastianTramp">http://aksw.org/SebastianTramp</a>	Dr. Sebastian-Philipp Brandt	Senior Key Expert: Knowledge Graph and Data Management	Senior Key Expert: Knowledge Graph and Data Management	<a href="https://siemens.com/">https://siemens.com/</a>	
83	<a href="https://dataweek.de/#SebastianBrandt">https://dataweek.de/#SebastianBrandt</a>	Selina Mudrack			<a href="https://srilw.de/">https://srilw.de/</a>	
84	<a href="https://dataweek.de/#SelinaMudrack">https://dataweek.de/#SelinaMudrack</a>	Simon Albrecht	IT Consultant at Stadtwerke Leipzig	IT-Berater bei Stadtwerke Leipzig	<a href="https://www.i.de/stadtwerke/">https://www.i.de/stadtwerke/</a>	
85	<a href="https://dataweek.de/#SimonAlbrecht">https://dataweek.de/#SimonAlbrecht</a>	Simon Bin			<a href="https://infai.org/">https://infai.org/</a>	
86	<a href="http://aksw.org/SimonBin">http://aksw.org/SimonBin</a>	Simon Maris	Research Associate	Wissenschaftlicher Mitarbeiter	<a href="https://www.burg-halle.de/hochschule/einrichtungen/bur">https://www.burg-halle.de/hochschule/einrichtungen/bur</a>	
87	<a href="https://dataweek.de/#SimonMaris">https://dataweek.de/#SimonMaris</a>	Smitha Haridasan	PhD student at School of Computing at Wichita State University	PhD student at School of Computing at Wichita State University	<a href="https://www.wichita.edu">https://www.wichita.edu</a>	
88	<a href="https://dataweek.de/#SmithaHaridasan">https://dataweek.de/#SmithaHaridasan</a>					

Opening 4.7. LSWT 5.7. DBpedia 6.7. BDIB 7.7. D2R2 6.7. GI 8.7. KMI 8.7. Speaker Organizations Rooms Anzahl: 8 Erkunden

# The DataWeek Workflow



# The DataWeek Workflow

Summary 

Label Quelle: Speaker

Mapping editor  Transform evaluation  Transform execution 

Person		
<input type="radio"/> homepage Document	Person	Person, Person 
<input type="radio"/> Affiliation n/a		
Mapping rules (9)		
 <b>Description (de)</b> dcterms:description	LanguageValueType (de)	Description_de 
 <b>Description (en)</b> dcterms:description	LanguageValueType (en)	Description_en 
 <b>Homepage</b> foaf:homepage	Document	n/a 
 <b>Pref Label</b> skos:prefLabel	StringValueType	Title, Name 
 <b>Title</b> foaf:title	StringValueType	Title 
 <b>Name</b> foaf:name	StringValueType	Name 
 <b>Bio (de)</b> .../standards/elementset/gnd#biographicalOrHistoricalInformation	LanguageValueType (de)	Bio_de 
 <b>Bio (en)</b> .../standards/elementset/gnd#biographicalOrHistoricalInformation	LanguageValueType (en)	Bio_en 
 <b>Affiliation</b> schema:affiliation	n/a	Affiliation 

# The DataWeek Workflow

The screenshot illustrates the DataWeek workflow interface, showing a search results page and a detailed view of a resource's properties.

**Search Results:**

- User (3) Vocabularies (7) System (5) All (18)
- Enter search term
- aksw.org Research Group dataset <http://aksw.org/>
- Data Week Leipzig 2022 <https://dataweek.de/>
- Programm (Graph)** <https://dataweek.de/programm>

**Navigation:**

- Search
- Person
- Person
- Document
- Organization
- di\_Dataset
- Event
- dataweek.de\_Keynote

**Resource Properties View:**

Resource Properties References Turtle

**Properties:**

- type**: Person, Person
- Description**: Senior Key Expert: Knowledge Graph and Data Management@de, Senior Key Expert: Knowledge Graph and Data Management@en
- preferred label**: Dr. Sebastian-Philipp Brandt
- affiliation**: Siemens AG
- name**: Sebastian-Philipp Brandt
- title**: Dr.
- gnd\_biographicalOrHistoricalInformation**:

Sebastian Brandt is Senior Key Expert for knowledge-graphs and data management at Siemens Technology, the global research and development centre of Siemens. Apart from research, Sebastian is helping Siemens businesses get most out of their data across the entire product life-cycle. This involves the creation and maintenance of industrial knowledge-graphs and their deployment in real-world production scenarios. Prior to Siemens, Sebastian has worked extensively on ontology-based knowledge representation systems for the life-sciences in the Bio-Health Informatics Group at the University of Manchester. His research on subsets of OWL with efficient inference problems has opened the door to the OWL-EL facet in the ontology standard OWL 2.0@en

Sebastian Brandt ist Senior Key Expert für Wissensgraphen und Datenmanagement bei Siemens Technology, dem globalen Forschungs- und Entwicklungszentrum von Siemens. Neben seiner Tätigkeit in der Forschung unterstützt Sebastian Brandt Siemens-Unternehmen dabei, das Beste aus ihren Daten über den gesamten Produktlebenszyklus hinweg herauszuholen. Dies beinhaltet die Erstellung und Pflege von industriellen Wissensgraphen und deren Einsatz in realen Produktionszonen. Vor seiner Tätigkeit bei Siemens hat Sebastian in der Bio-Health Informatics Group an der University of Manchester intensiv an ontologiebasierten Wissensrepräsentationssystemen für die Biowissenschaften gearbeitet. Seine Forschung zu Teilmengen von OWL mit effizienten Inferenzproblemen hat die Tür zur OWL-EL-Facetten im Ontologie-Standard OWL 2 geöffnet. @de

Buttons: SHOW IN LIST, ADD, Edit, Delete

Footer: Found 7 results Properties per page 20 < Page 1 of 1 > +



eccenca GmbH  
Hainstraße 8  
D-04109 Leipzig  
Germany

+49 341 2650 8028  
[info@eccenca.com](mailto:info@eccenca.com)  
<https://eccenca.com>



**Hans-Chr. Brockmann**  
Geschäftsführer

Hainstraße 8  
D-04109 Leipzig  
Germany

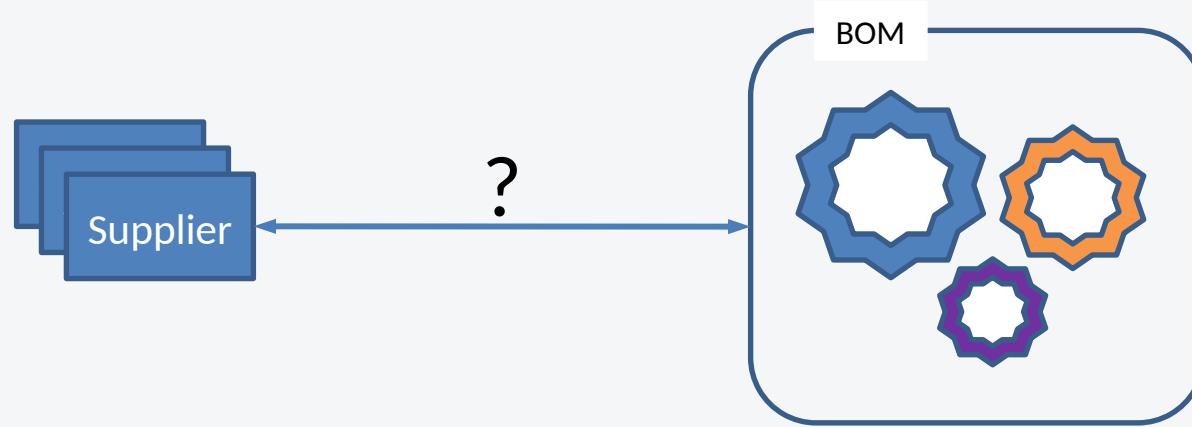
+49 511 3365 2810  
+49 173 3698 610

[brockmann@eccenca.com](mailto:brockmann@eccenca.com)  
<https://eccenca.com>



# **BACKUP**

# Apply Machine Learning to perform “Form Fit Functional” Material Linking



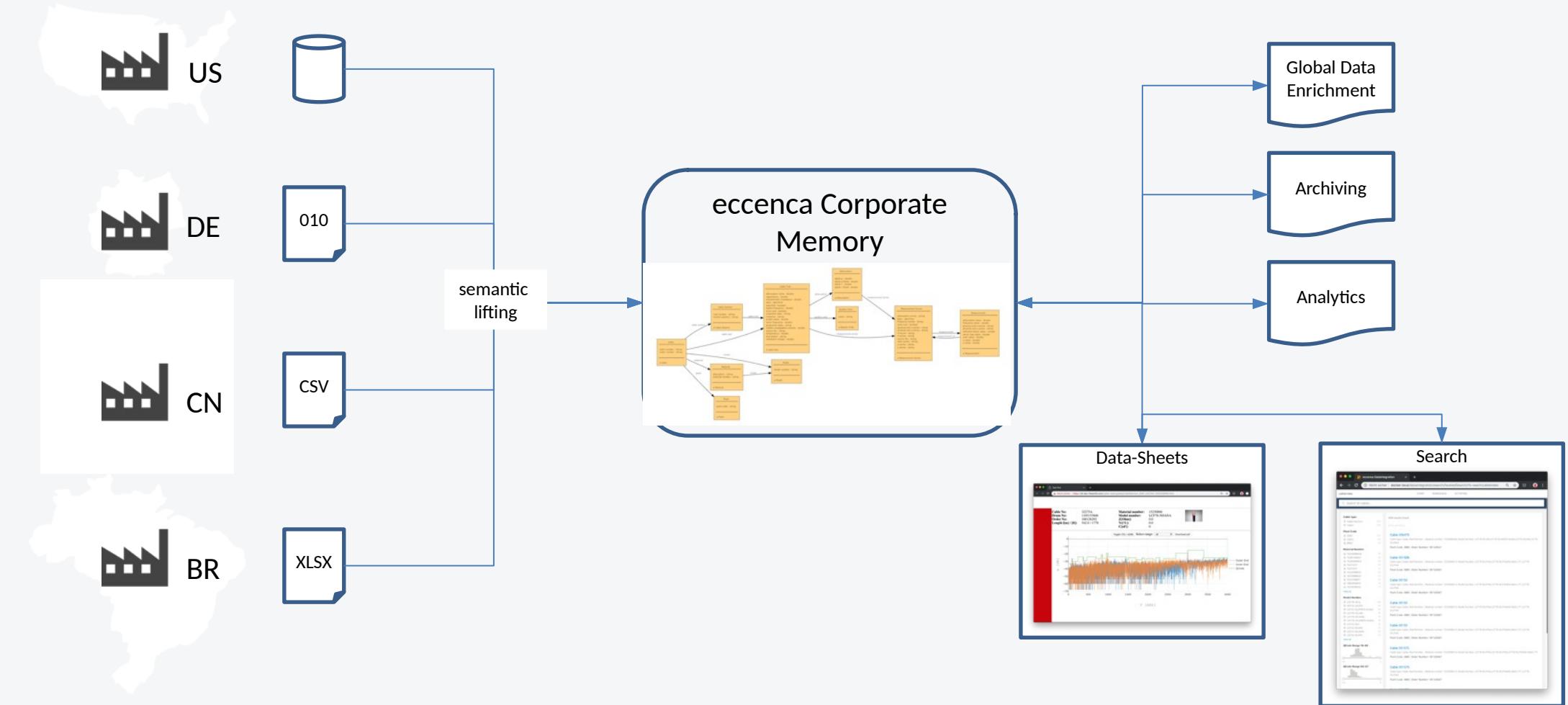
*Today based on part number matching and man-made part lists:*

MPN	Supplier
293D105X9016A2##E3	VISHAY
B45196E3105K10	KEMET
T491A105K016AS	KEMET
T491A105K016AT	KEMET
TAJA105K016RNJ	AVX

*Machine learning based on granular material properties like:*

<b>Capacitor Type</b>	TANTALUM CAPACITOR
<b>Capacitance</b>	1.0 µF
<b>Dielectric Material</b>	TANTALUM (DRY/SOLID)
<b>Mounting Feature</b>	SURFACE MOUNT
<b>Neg. Tolerance</b>	10.0 %
<b>Op. Temp.-Min</b>	-55.0 Cel
<b>Op. Temp.-Max</b>	85.0 Cel
<b>Package Shape</b>	RECTANGULAR PACKAGE
<b>Package Style</b>	SMT
...	

# Cross Site Semantic Data Harmonization



# Project Benefits

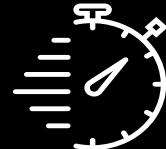
- 12% Inventory reduction contribution within 3 months
- 200% Project ROI Data-as-Service creates automation and productivity gains
- 70% of effort analyzing data  
Instead of finding, aligning, integrating and cleaning data

## BENEFIT Cases



Global S&OP  
Capacity Planning

- Less global inventory
- Better factory balancing



Customer Service Teams

- Improvement lead-times
- Automation



Customer Experience

- Self-service, on-demand production data

# About eccenca GmbH

## brox IT-Solutions GmbH

Gegründet: 1998  
Fokus: IT-Consulting  
IPR: Initiierung/Leitung eclipse.org/SMILA  
eccenca Enterprise Search  
Key Accounts: Volkswagen, Audi, Skoda, MAN, Telekom,  
Daimler, Bosch, Siemens, Continental



## eccenca GmbH

Gründung: 2013  
Fokus: Produkte/Lösungen  
Team Size: 35  
IPR: Linked Data, M2N Synchronization,  
Linking, Authentication/Data Security  
Kunden: Volkswagen, Bosch, Nokia, Infineon,  
Ericsson, Telekom, Daimler  
F&E Projekte: LUCID, ELDS, GeoKnow, Diachron  
Initiativen: MOBIVOC, OSFP



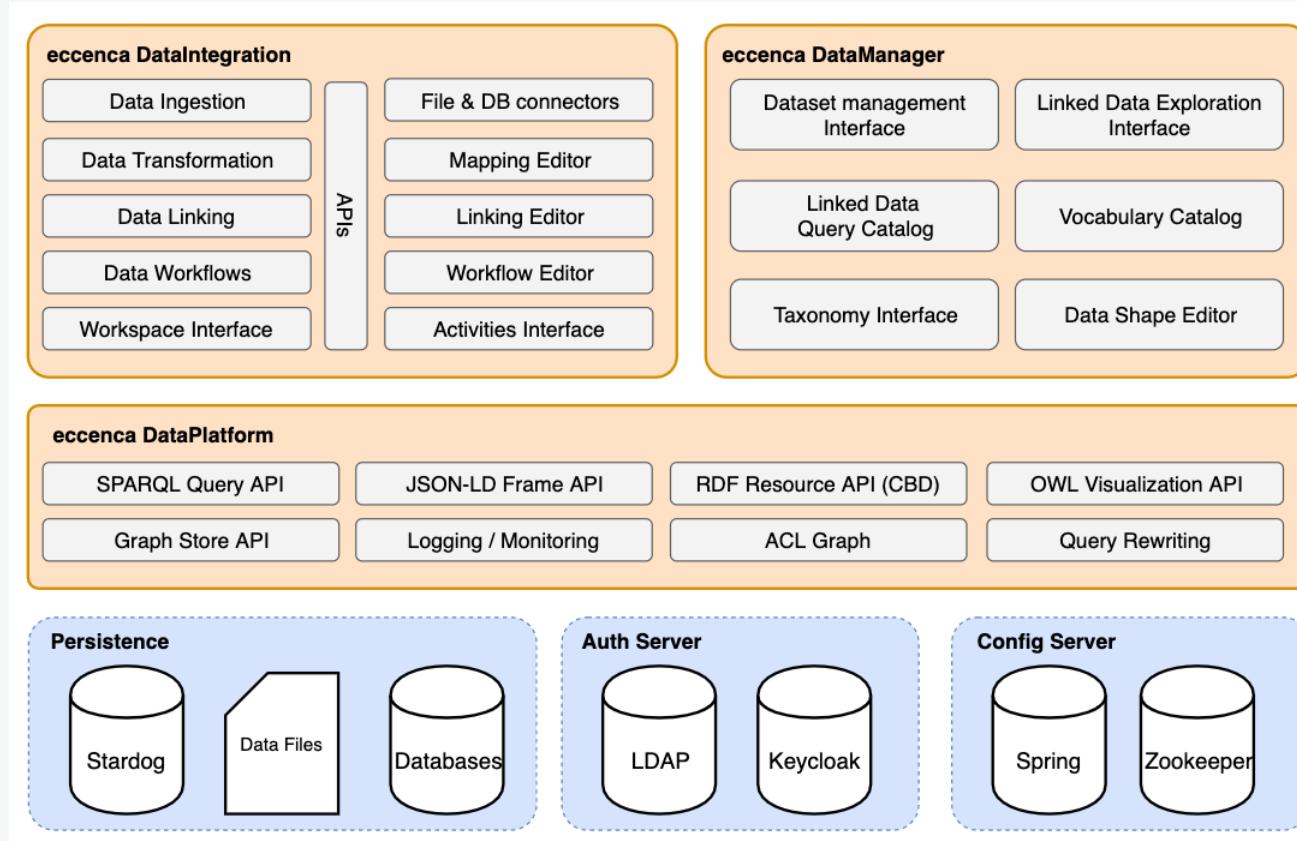
## AKSW – Universität Leipzig & Fraunhofer IAIS

Führende Linked Data Forschungseinheit in  
Europa. Initiator des nationalen Industrial Data Space

Initiator: DBpedia, Linked GeoData etc.  
Betreiber: Datenportal der EU-Kommission  
Team-Leitung: Prof. Dr. Sören Auer



# Technical Architecture



# eccenca DataManager – Features

- Management of Knowledge Bases (Named Graphs, Linked Data access optional)
- Tree, list and resource views
- Versioning (triple based)
- User management and access control
- Query Catalog
- Dataset Schema Browser
- Inline authoring
- Detailed edit view
- Add new resources and properties
- Search
- Facet based filtering
- Complex navigation hierarchies (spatial, class based, organization structure based)
-

# eccenca DataIntegration – Features

- UI allows to view and edit linkage rules
- Linkage rules are shown as a tree
- Editing using drag & drop
- DataIntegration provides a high level data manipulation and linking engine
  - Execution of linkage and integration rules on arbitrary datasets provided by eccenca DataPlatform
  - Manual creation of rules with an integrated editor
  - Automatic learning of rules based on training data (positive / negative lists)
-

# eccenca DataPlatform – Features

- DataPlatform is a semantic middleware which provides a unified access to structured data
  - W3C standards such as RDF / Linked Data and SPARQL
  - Authorization based on an RDF Access Control Model
  - Authentication via OAuth2 protocol
  - Integration with external User Management Systems (e.g. LDAP, Active Directory)
  - Versioning Support (tracking of changes on triples and graphs)
  - Integration of non-RDF sources via mapping and query rewriting technologies (RDB2RDF component)

# Semantic Data Management

## Data in Context

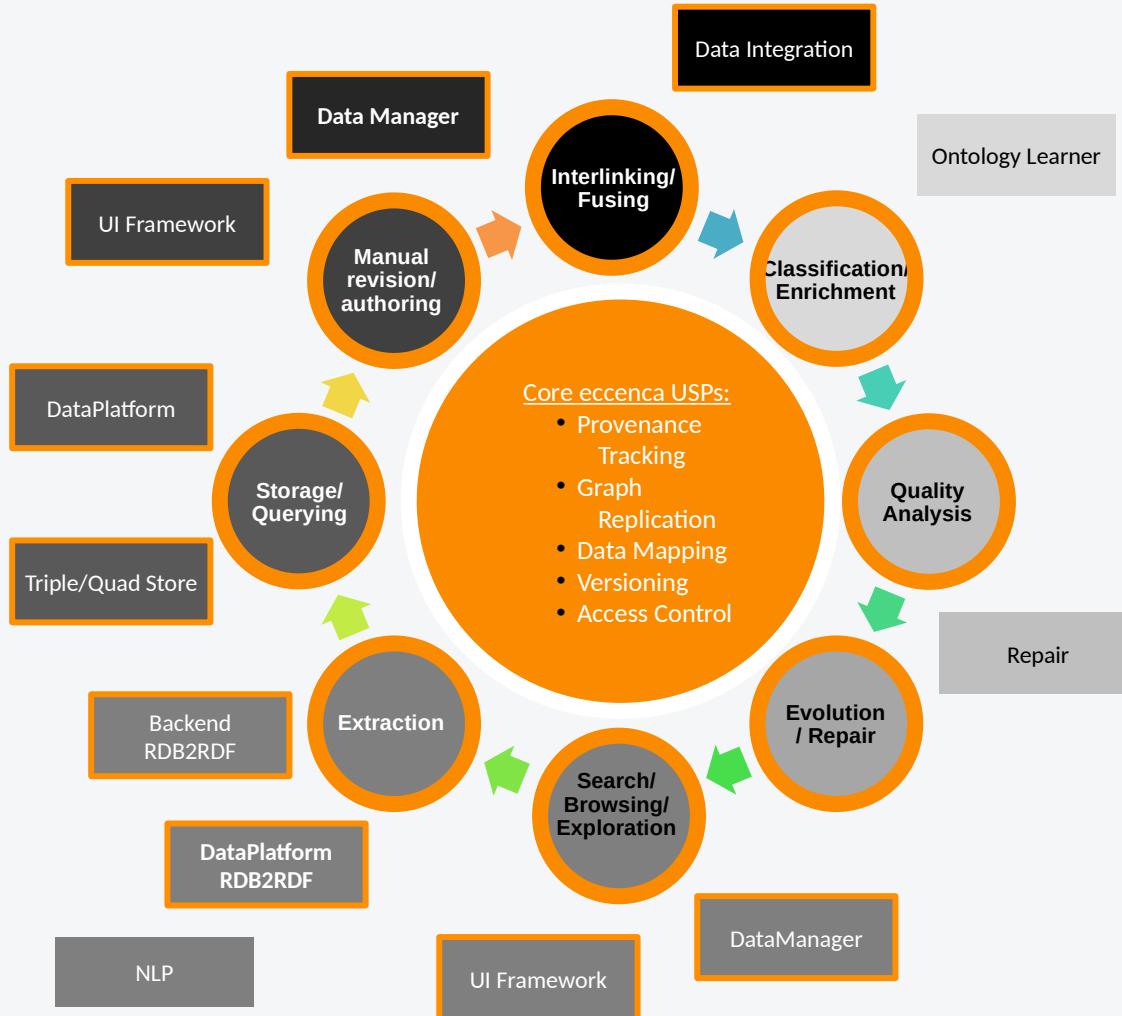
### What

- § Create knowledge graphs by connecting datasets and metadata to logical models
- § Physical data models unchanged!
- §
- Ø Explore metadata & structures
- Ø Query & Access data via models
- Ø Integrate data on model level
- Ø Share data on model level

### How

- § Leverage linked data principles
  - § Schema as data (RDF)
  - § Global identifiers (URIs)
  - § Linked data graphs (W3C)
- §
- § Catalog your data assets: datasets, vocabularies (models), ...
- § Publish-subscribe for sharing
- § Machine learning for integration

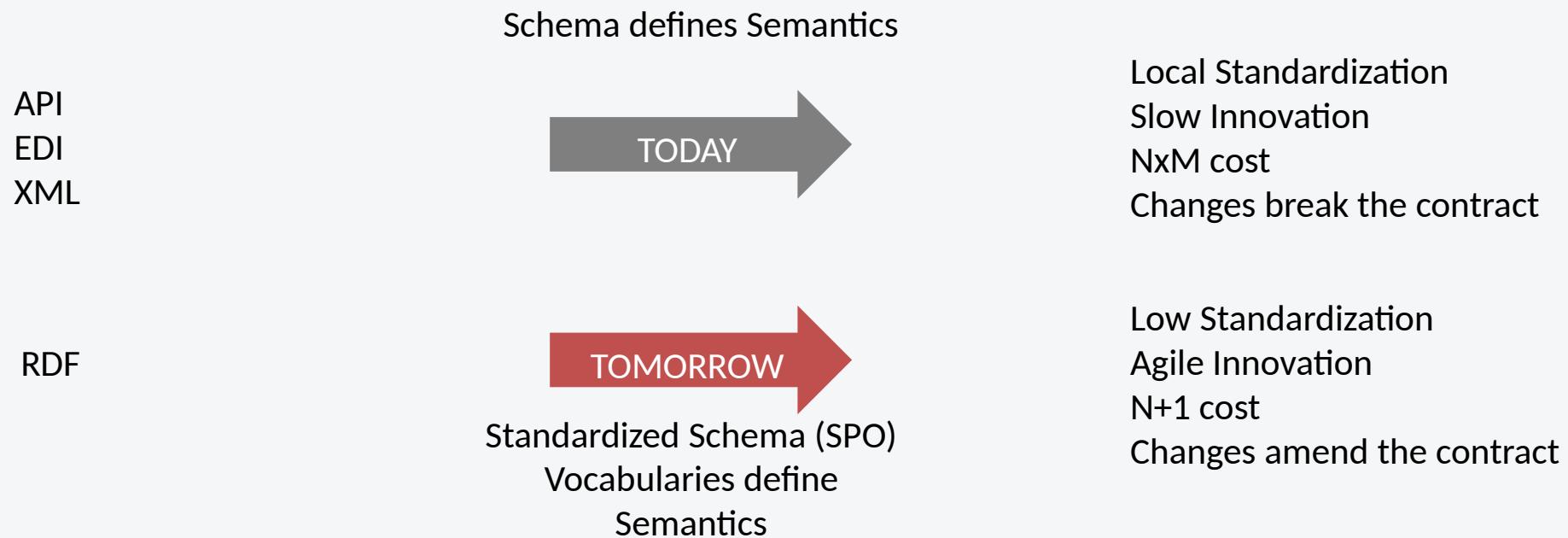
# Linked Data Life Cycle



- Extraction / Mapping
- Storage / Querying
- Manual Revision / Authoring
- Linking / Fusion
- Classification / Enrichment
- Quality / Evolution
- Search / Browse / Explore

# Changing the Data-Collaboration Paradigm

... by turning **STRINGS** into **THINGS**



# Other Use Cases

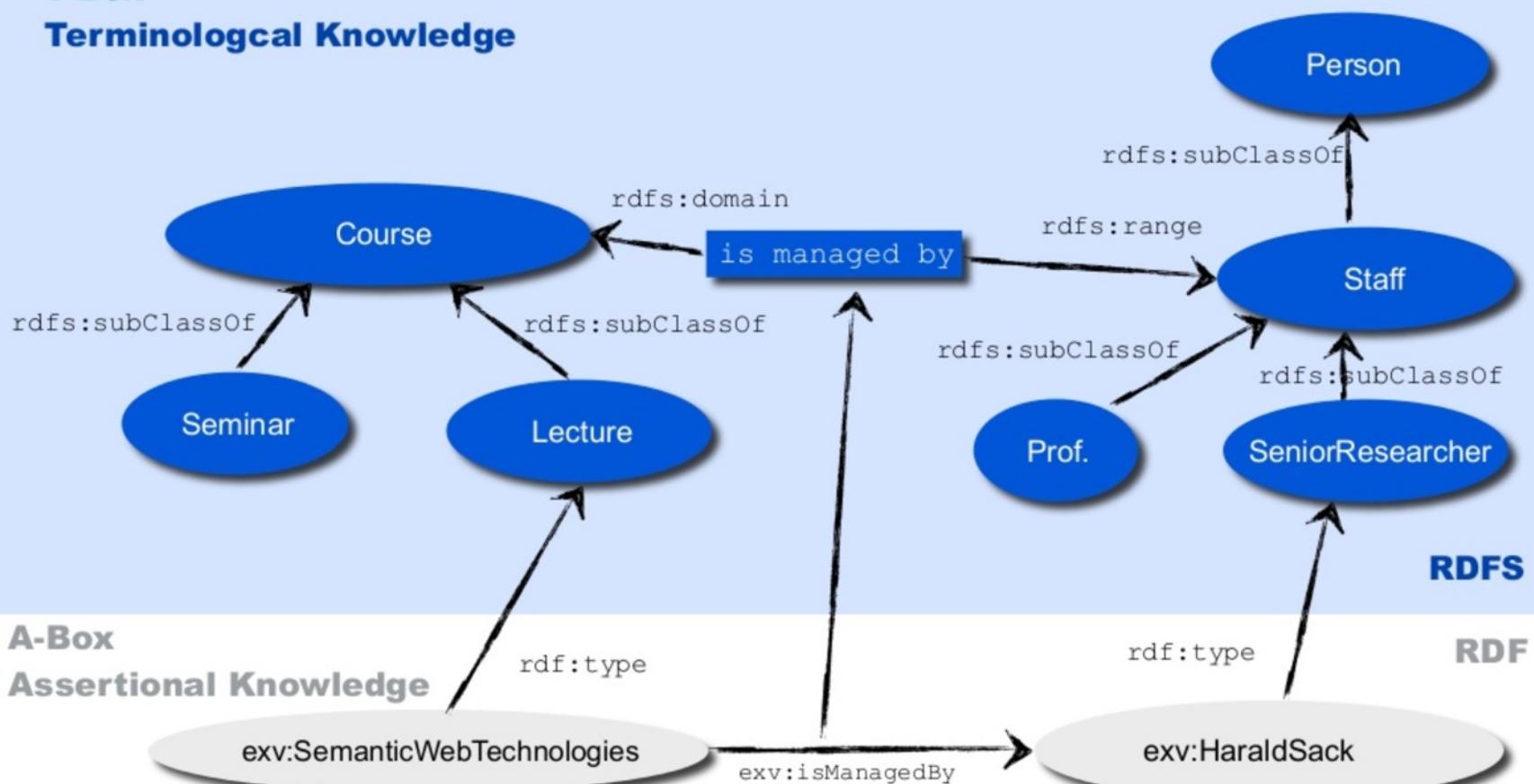
- Conceptual / semantic data model based data preparation for BI and analytics
- Yield management / lead time based dynamic pricing
- Data integration and central data hub for the Software Monetarization Platform project
- Semantic Enterprise Information Model
  - MDM, simplification, data preparation, analytics, etc.

# RDF +RDFS

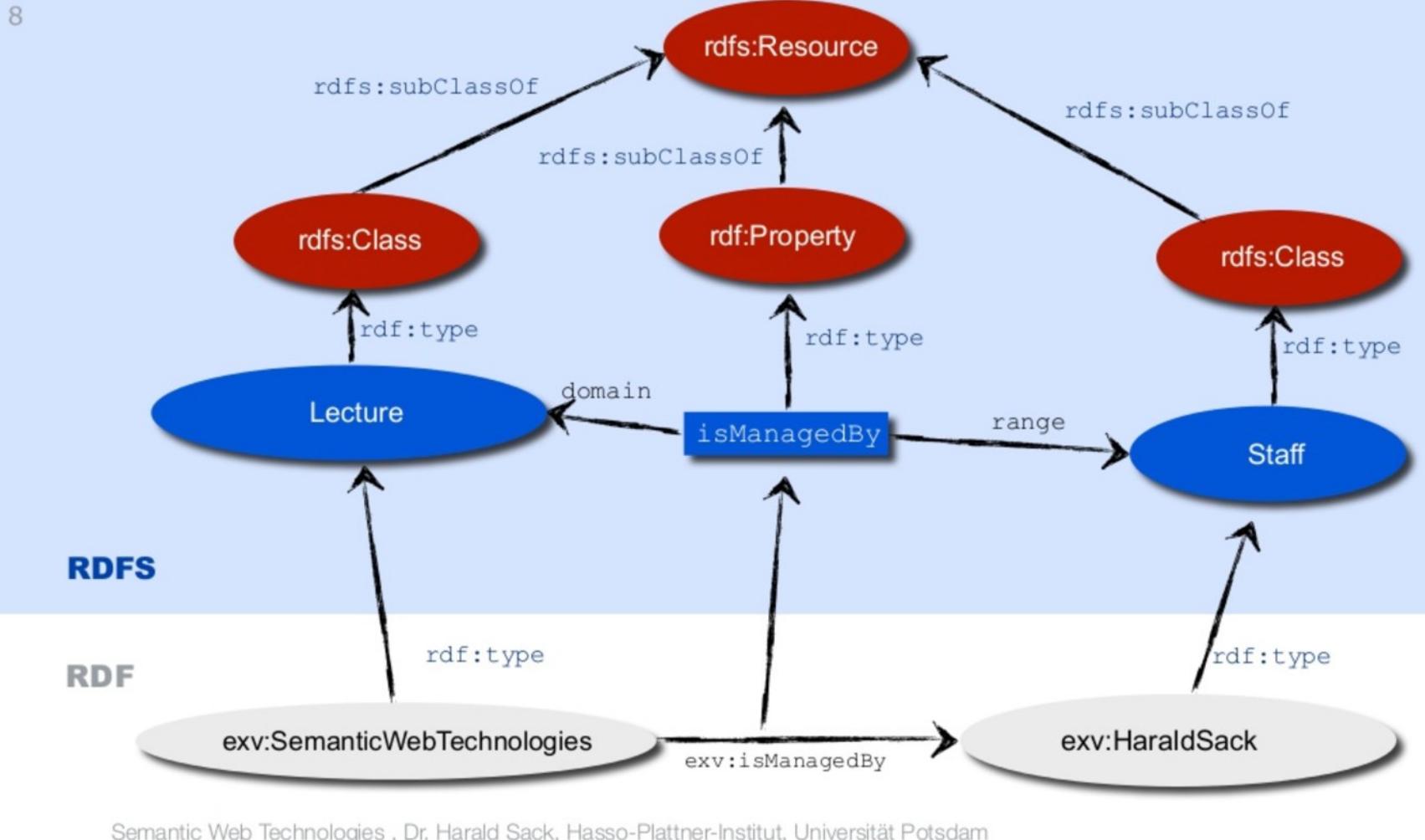
13

## T-Box

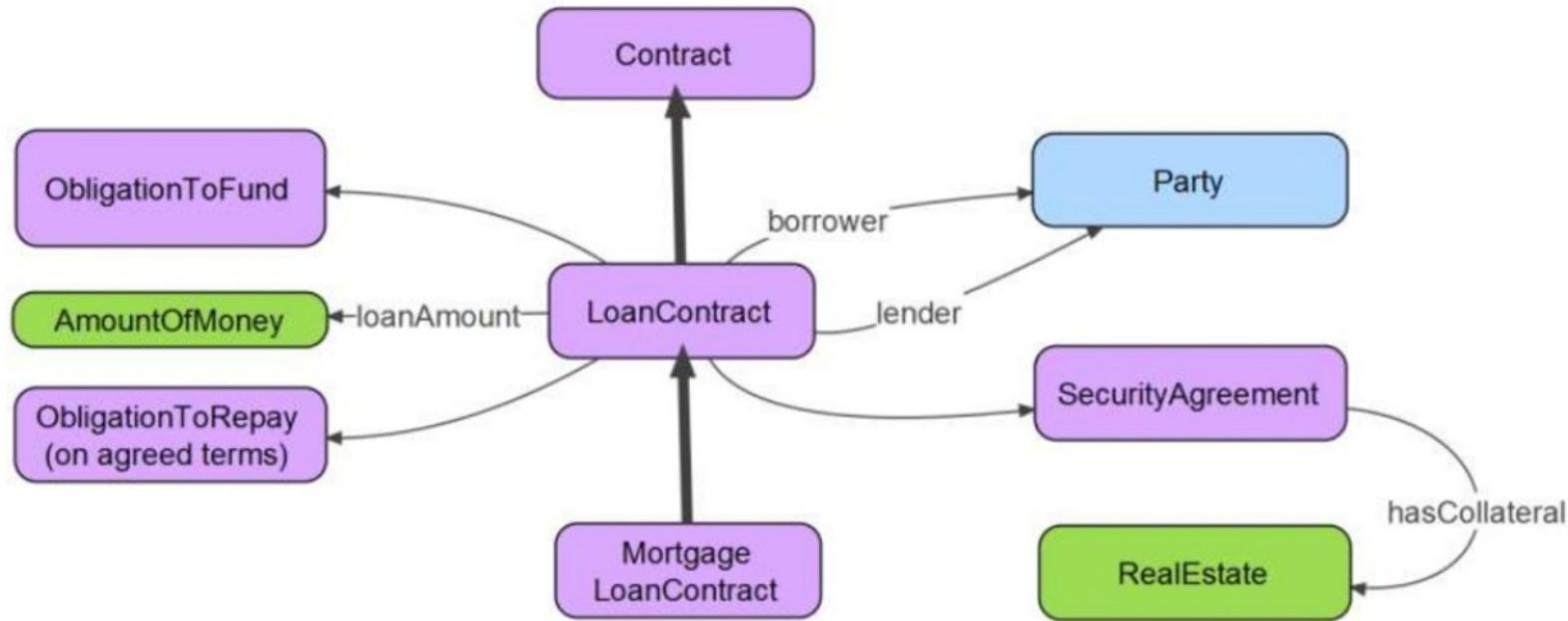
### Terminological Knowledge



# Classes, Properties, Instances



# OWL: Inferencing classification.



**Mortgage:** A LoanContract that has a SecurityAgreement where the collateral is RealEstate.  
Can infer into this class.

# SHACL: Checking Graph Patterns

## Constraints on values with another shape

Constraint	Description
node*	All values of a given property must have a given shape Recursion is not allowed in current SHACL

```
:User a sh:NodeShape, rdfs:Class ;  
  sh:property [  
    sh:path schema:worksFor ;  
    sh:node :Company ;  
  ] .  
  
:Company a sh:Shape ;  
  sh:property [  
    sh:path      schema:name ;  
    sh:datatype xsd:string ;  
  ] .
```

```
:alice a :User;  
  schema:worksFor :OurCompany .  
  
:bob   a :User;  
  schema:worksFor :Another .  😞  
  
:OurCompany  
  schema:name "OurCompany" .  
  
:Another  
  schema:name 23 .
```