

# REFACTORING PDM

Total Refactoring of a 25 Years Old  
Desktop Application

# Agenda

PDM history and main challenges

Overview of the whole refactoring process

Technical concepts

Database migration

Organizational support

Schedule

## PDM history

- Started in the early 90ies as inhouse application for document management under VW 2.\*
- Focused on building industry (civil engineers, architects)
- After some enhancements used by 10 companies, including Schmidt with 50 users over 5 locations
- Development started by a small inhouse team
- Later outsourced to Heeg, Dortmund
- From 2016 to 2019 big enhancements by a funded research project driven by Schmidt and Heeg

per-documaps 2007-279\_DB\_Netz\_Regionalnetze\_3701\_55,258\_EU Seemenbachbücke\_Büdingen

PROJEKT KALENDER HONORAR CONTROLLING AUFGABEN VERWALTUNG COLLABORATION

Neu erstellen Bearbeiten Kopieren Speichern Löschen Eigenschaften Verknüpfungen Freigeben Drucken Senden Aktualisieren (F5) Outlookimport Mitarbeiter Status Messenger Projekttagbuch Hilfe

2007-279\_DB\_Netz\_Regionalnetze\_3701\_55,258\_EU

**Stammdaten**

**Beteiligte**

- 01: msexcel
- 02: msword
- 03: Versand
- 04: [Honorar]
- 05: [Papierkorb]
- 63: Seemenbach\_180409
- 66: A\_301\_Posteingang
- 67: A\_302\_Postausgang
- 68: A\_303\_Aktenvermerke
- 69: B\_302\_Sachbereich\_I\_Plangenehmigung
  - Antrag auf Planänderung\_03.06.08
    - B\_109\_Fotos
    - B\_2007-279\_LMP-01\_16.06.08 - Standard
    - B-07-279\_EP-01\_Änderungen gegen SB1
    - B\_109\_Fotos
    - Ortstermin 05.12.07
    - PlotCfgs
    - B\_2007-279\_LP-01\_13.05.08 - Standard
    - B-07-279\_BBP-01\_050208 - Standard
    - B-07-279\_EP-01\_050208 - Standard
    - B-07-279\_EP-01\_14.05.08 - Standard
  - 70: B\_304\_Ausführungsplanung
  - 71: B\_305\_Sachbereich\_V\_Fianzierungsantrag
  - 72: B\_306\_Ausschreibung
  - 73: B\_307\_Konzepte
  - 74: B\_308\_Bestandsunterlagen
  - 75: B\_309\_Fotos
  - 76: B\_310\_Versorgung
  - 77: B\_311\_Vermessungsunterlagen
  - 78: B\_312\_Fremdplanung

#	Name	Erw.	Index
01	[.]		
02	B_109_Fotos		
03	~\$Erläuterungsbericht_180708	doc	00-00-00
04	00aTitelblatt	doc	00-00-00
05	00b_Deckblatt_	doc	00-00-00
06	00d_Anlagenverzeichnis	doc	00-00-00
07	01_Liste der geänderten Unterlagen	doc	00-00-00
08	01_Vorwort zur Planänderung120608	doc	00-00-00
09	01_Vorwort zur Planänderung120608	pdf	00-00-00
10	02_Erläuterungsbericht_140508	doc	00-00-00
11	02_Erläuterungsbericht_180708	doc	00-00-00
12	03_Bauzeichnungen	doc	00-00-00
13	04_Bauwerksverzeichnis_Seite2	doc	00-00-00
14	04_Bauwerksverzeichnis	doc	00-00-00
15	05_Lage- und Maßnahmeplan	doc	00-00-00
16	07_Fotodokumentation	doc	00-00-00
17	09_Stellungnahme Dritter_Zusammenstellun	doc	00-00-00
18	09_Stellungnahme Dritter	doc	00-00-00
19	10_Umweltscreening	doc	00-00-00
20	55258-ivl-1	tif	00-00-00
21	55258-ivl-2	tif	00-00-00
22	acad	frmp	00-00-00
23	B_2007-279_LMP-01_16.06.08 - Standard	zip	00-00-00
24	B_2007-279_LMP-01_16.06.08	bak	00-00-00
25	B_2007-279_LMP-01_16.06.08	dwg	00-00-00
26	B-07-279_BBP-01_16.06.08	bak	00-00-00
27	B-07-279_EP-01_Änderungen gegen SB1 - St:	zip	00-00-00
28	B-07-279_EP-01_Änderungen gegen SB1	bak	00-00-00
29	B-07-279_EP-01_Änderungen gegen SB1	dwg	00-00-00
30	B-07-279_EP-01_Änderungen aeen SB1	pdf	00-00-00

2016-107\_Stadt\_Lennestadt\_Brücke\_Schu

**Stammdaten**

**Beteiligte**

- 01: [Honorar]
- 02: [Papierkorb]
- 03: -> Texte&Tabellen
- 04: -> Schriftverkehr
  - Postausgang
  - Posteingang
  - Briefverkehr
  - Sonstiges
- 05: -> Zeichnungen
- 06: -> Berechnungen
- 07: <- LP0\_Bestand\_alt
- 08: <- LP1\_Grundlagenermittlung
  - Vergleichskosten Brücken
  - Prüfberichte
    - Baustoffprüfungen
      - 09: LP2\_Vorentwurfshft
    - 10: LP5\_Ausführungsplanungshft
    - 11: <- LP6\_Ausschreibung

#	Name	Erw.	Index
01	[.]		
01.01	Auftrags-LV Minigolf	pdf	01-00-00
01.02	Preisspiegel Brücke Böminghausen	pdf	01-00-00
01.03	Preisspiegel Brücke Kattengerich	pdf	01-00-00
01.04	Preisspiegel Brücke Sparkasse Kirchhund	pdf	01-00-00
01.05	Preisspiegel Lennebrücke Finntrop	pdf	01-00-00
02	Prüfberichte		
02.01	PRUEFERICHT_0000020_0_2014E	PDF	01-00-00
03	Baustoffprüfungen		
03.01	Prüfbericht 144-2016	pdf	01-00-00
03.02	Prüfbericht 165-2016	pdf	01-00-00

## Main challenges

The impact by the results of the research project did not fully meet the customer's expectations regarding

- performance
- maintainability
- modularity / extendability

Large parts of the old Smalltalk code are in a very bad state. The database design had been migrated from an OODB (Versant) to PostgreSQL and has many issues.

# Overview of the whole process

- Important goals of the refactoring
- Main design decisions
- Dealing with Pharo
- Dealing with existing data
- Project management

## Important goals of the refactoring

- Redesign the most critical use cases for performance
- Support external and internal collaboration
- Simplifying and unifying form-based GUI development
- Starting the refactoring already in Pharo to reduce overall costs

## Most important meta goals

- Solve the basic issues before building the application
- Enable changes of business logic by design





## Main design decisions

- Redesign data representation for maximum speed
- Implement an isolated database migration process
- Enhance the aPart framework as software base
- Consequently modularize the application
  - Support configurations with different functional base
  - Use external services
- Decouple critical functionality from main image
  - Use more than one CPU
  - Restart sub image without leaving main image
- Start development with Pharo 8

# Dealing with Pharo

## Issues:

- Current code has to be ported at least partially
- Pharo know-how is needed in the new team
- Windows support of Pharo has to be improved

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### Issues:

- Current code has to be ported at least partially
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### Solutions:

- Contract Pavel
- Start working with Pharo ... and ask Pavel
- Contract Inria RMod

## Dealing with existing data

### Main tasks:

- Migrate document data (projects, doc records, doc files)
- Migrate identity data (companies, persons)
- Migrate important associated data (addresses, roles)

### Biggest problems:

- Production database is far behind the structure developed in research project, and is growing daily
- Document data structure is highly inconvenient

## Results of data migration

Based on a few days of expert help:

- Migration of 500K documents and 1M histories including employee data to new structure running in 3 minutes (SQL scripts driven by shell)
- Renaming and moving 500K document files in 15 minutes (including detailed logging of missing document files)

<https://winand.at>

# Project management

Reasons for outsourcing project management:

- External partner will ask other important questions than people who are directly involved
- External partner can bring in special knowledge that is not available inhouse
- Part of a strategy for knowledge backup

Implicit prerequisites:

- Agreement on fundamentals of product development
- Good level of personal understanding

# Refactoring of Godot gaming engine

- Developed by Juan Linietsky and Ariel Manzur (Buenos Aires)
- Started in 2002
- Download size 23MB (Unity / Unreal: several GB)
- Executable size 52MB, function range comparable to „big“ engines

## Interview with Juan Linietsky

Translated quotation from German computer magazine c't, issue July 6th:

*Q: How do you prevent the software from bloating?*

*Linietsky: By rewriting. After each project implemented with Godot, Ariel Manzur (co-author of Godot) and I looked at the code - and rewrote it. We did that three, four, maybe five times. Therefore, the current state is now really good. ... Sometimes we talk for several months before we implement something new. I think, that is also the reason why Godot is so small and efficient.*



## Special techniques used in PDM

- Micro use cases as basic „currency“ of persistency changes
- Micro use cases act on narrow data channels, being open to connect to external services
- Propagating all changes by commands to internal collaboration partners
- Zero-delay project change based on pushing files to local client drives
- GUI development by mockup editor
- New approach to display hierarchies with tables


Project **2017-212**


LP1

Sonstige

 Unterschrift Thomas Orth

Lageplän


 Lageplan Bf. Morsbach

 Lageplan Änderungen

Zeichnungen

Ing\_LP3\_

 LP-01

 Stempel

 LP-01

 LP-01

 LP-01

 LP-01

 LP-01.1


 LP-01

 LP-01.2

 LP-01.3


 LP-01.3


Ing\_LP1\_

 20107-212\_Bf Morsbach\_Verschiebung

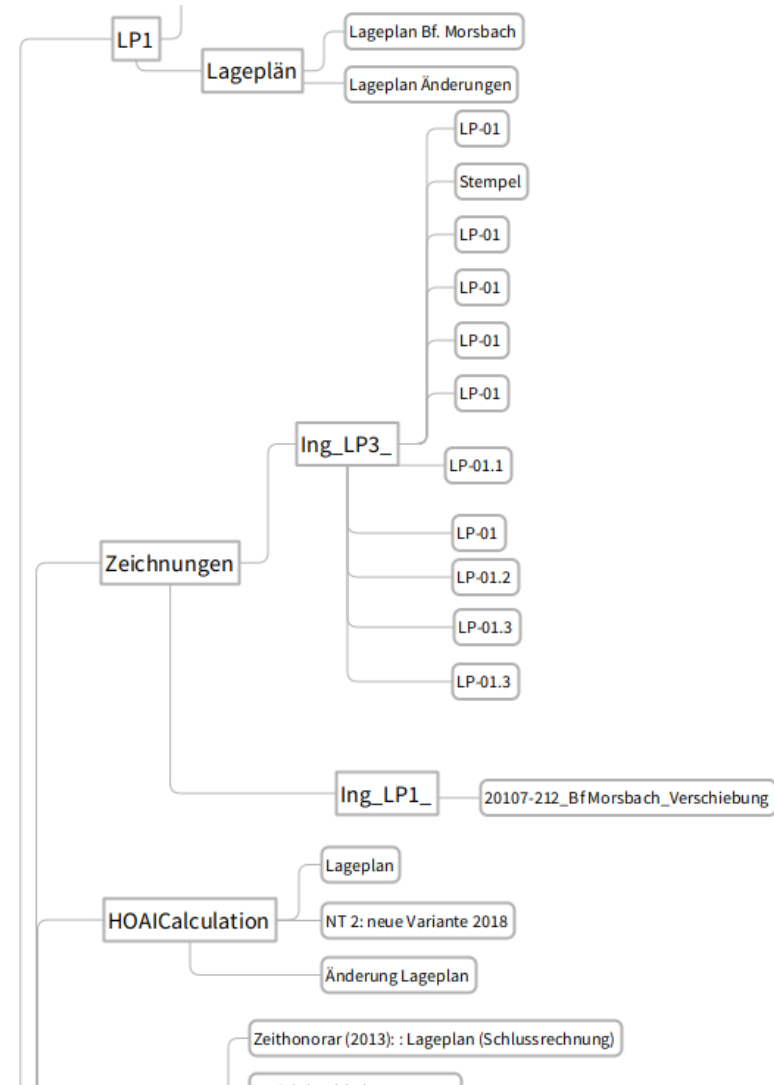
HOAICalculation

 Lageplan

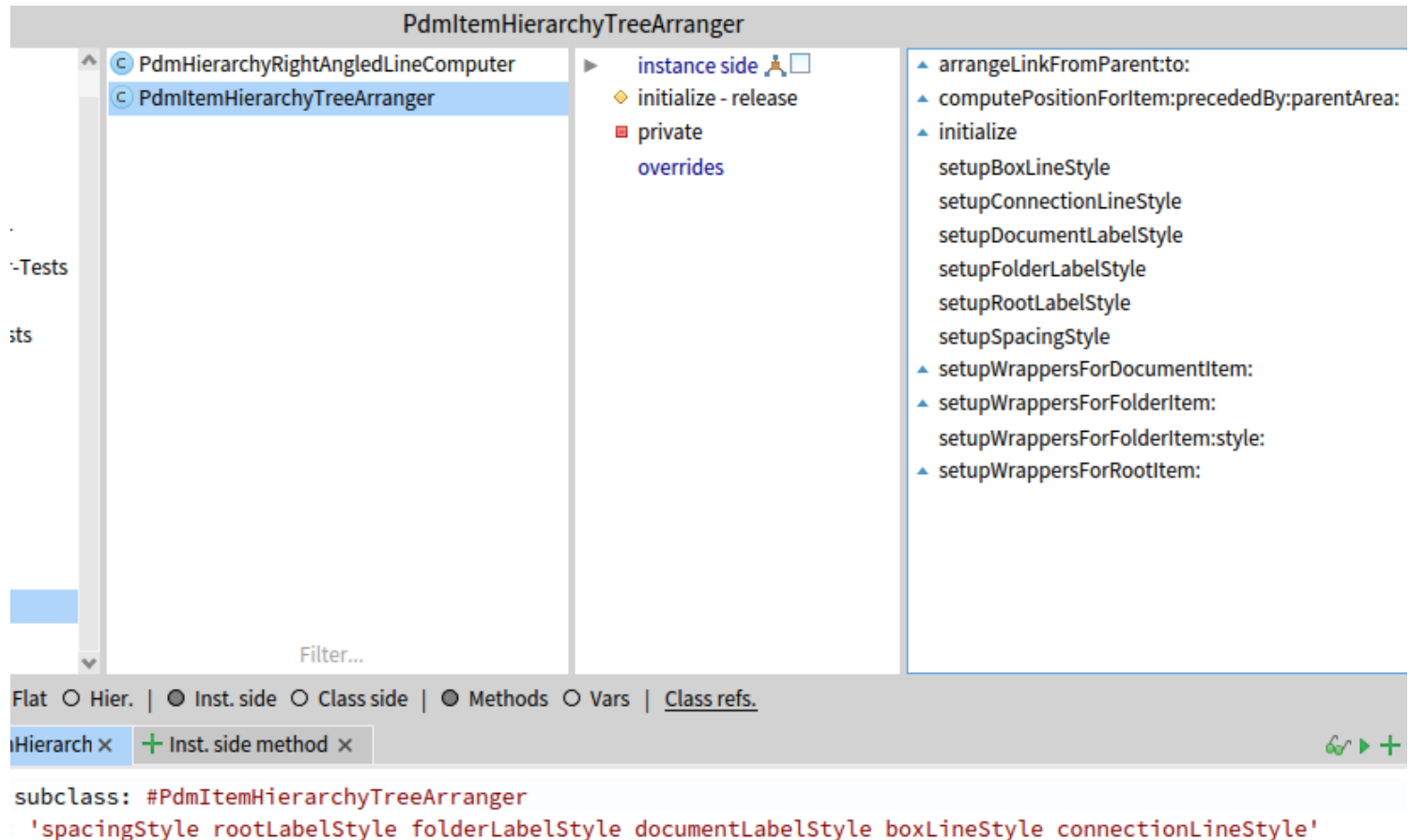
 NT 2: neue Variante 2018

 Änderung Lageplan

Honorar



# Tree Arranger



The screenshot shows an IDE interface with the following components:

- Class Hierarchy:** A tree view on the left showing `PdmHierarchyRightAngledLineComputer` as a superclass of `PdmItemHierarchyTreeArranger`.
- Class Name:** `PdmItemHierarchyTreeArranger` is displayed at the top of the editor.
- Instance Side:** A list of instance-side methods and attributes:
  - `instance side` (with a person icon)
  - `initialize - release` (with a diamond icon)
  - `private` (with a red square icon)
  - `overrides` (in blue text)
- Methods List:** A list of methods on the right side:
  - `arrangeLinkFromParent:to:`
  - `computePositionForItem:precededBy:parentArea:`
  - `initialize`
  - `setupBoxLineStyle`
  - `setupConnectionLineStyle`
  - `setupDocumentLabelStyle`
  - `setupFolderLabelStyle`
  - `setupRootLabelStyle`
  - `setupSpacingStyle`
  - `setupWrappersForDocumentItem:`
  - `setupWrappersForFolderItem:`
  - `setupWrappersForFolderItem:style:`
  - `setupWrappersForRootItem:`
- Navigation:** A bottom bar with tabs for `Hierarch` and `+ Inst. side method`.
- Code Snippet:** A snippet showing a subclass definition:
 

```
subclass: #PdmItemHierarchyTreeArranger
    'spacingStyle rootLabelStyle folderLabelStyle documentLabelStyle boxLineStyle connectionLineStyle'
```

# Database design specialities

Associations over several layers (targets left):

Hierarchy node

- <- Hierarchy child

- <- Document / Folder

  - <- Document File

  - <- Document History

- <- Project



# Project items

```

SELECT p.id AS projectid,
       p.idstring AS projectidstring,
-- ...
       n1.locnames ->> 'de'::text AS lastentrytype
FROM ccproject p
     JOIN hnode h ON p.hroot = h.hroot
     LEFT JOIN ccdoc d ON d.hnode = h.id
     LEFT JOIN ccdocfile df ON d.id = df.ccdoc AND h.nodetype = 'D'::bpchar
     LEFT JOIN ccfolder f ON f.hnode = h.id
     LEFT JOIN ccname n ON n.id = d.ccname OR n.id = f.ccname
     LEFT JOIN LATERAL ( SELECT dh.ccdoc,
                             dh.entrytype
-- ...
                         FROM ccdochistory dh
                         WHERE dh.ccdoc = d.id ORDER BY dh.entrytime DESC LIMIT 1) lasthistory ON true
     LEFT JOIN ccname n1 ON n1.id = lasthistory.entrytype
     LEFT JOIN ccidentity lastuser ON lastuser.id = lasthistory.ccuser
     LEFT JOIN LATERAL ( SELECT dh.ccdoc,
                             dh.entrytype
-- ...
                         FROM ccdochistory dh
                         WHERE dh.ccdoc = d.id ORDER BY dh.entrytime LIMIT 1) firsthistory ON true
     LEFT JOIN ccname n2 ON n2.id = firsthistory.entrytype
     LEFT JOIN ccidentity firstuser ON firstuser.id = firsthistory.ccuser
ORDER BY d.id;

```

# Insert by CTE

```
dpath AS (  
|SELECT imsproject, nextccval('hnode_id_seq') id, node, nodepath, parent, lev  
  FROM (SELECT  
    imsproject  
    , patharray[1:COALESCE(lev,1)] node  
    , array_to_string(patharray[1:COALESCE(lev,1)], extfilepathsep(), '') nodepath  
    , patharray[1:lev-1] parent  
    , COALESCE(lev, 0) lev  
  FROM (SELECT imsproject  
    , externalfilepath  
    -- externalfilepath NULL is for special docs only. Use their object_type marked with '$$' as path name.  
    , string_to_array(COALESCE(externalfilepath, extfilepathforobjtype(object_type)), extfilepathsep() ) patharray  
  FROM fdw_tempdocument) d  
 LEFT JOIN LATERAL (SELECT lev  
  FROM  
    UNNEST(patharray) WITH ordinality AS u(comp, lev)  
 ) lat ON (true)  
 INNER JOIN docproject p ON (p.projid = d.imsproject)  
 -- provide root node even if project has no documents or no documents under empty path.  
 -- calling UNION makes everything distinct.  
 UNION SELECT projid, ARRAY[]::text[], '', NULL::text[], 0 FROM docproject  
 ) unusedalias  
),
```

# Translatable names / name types

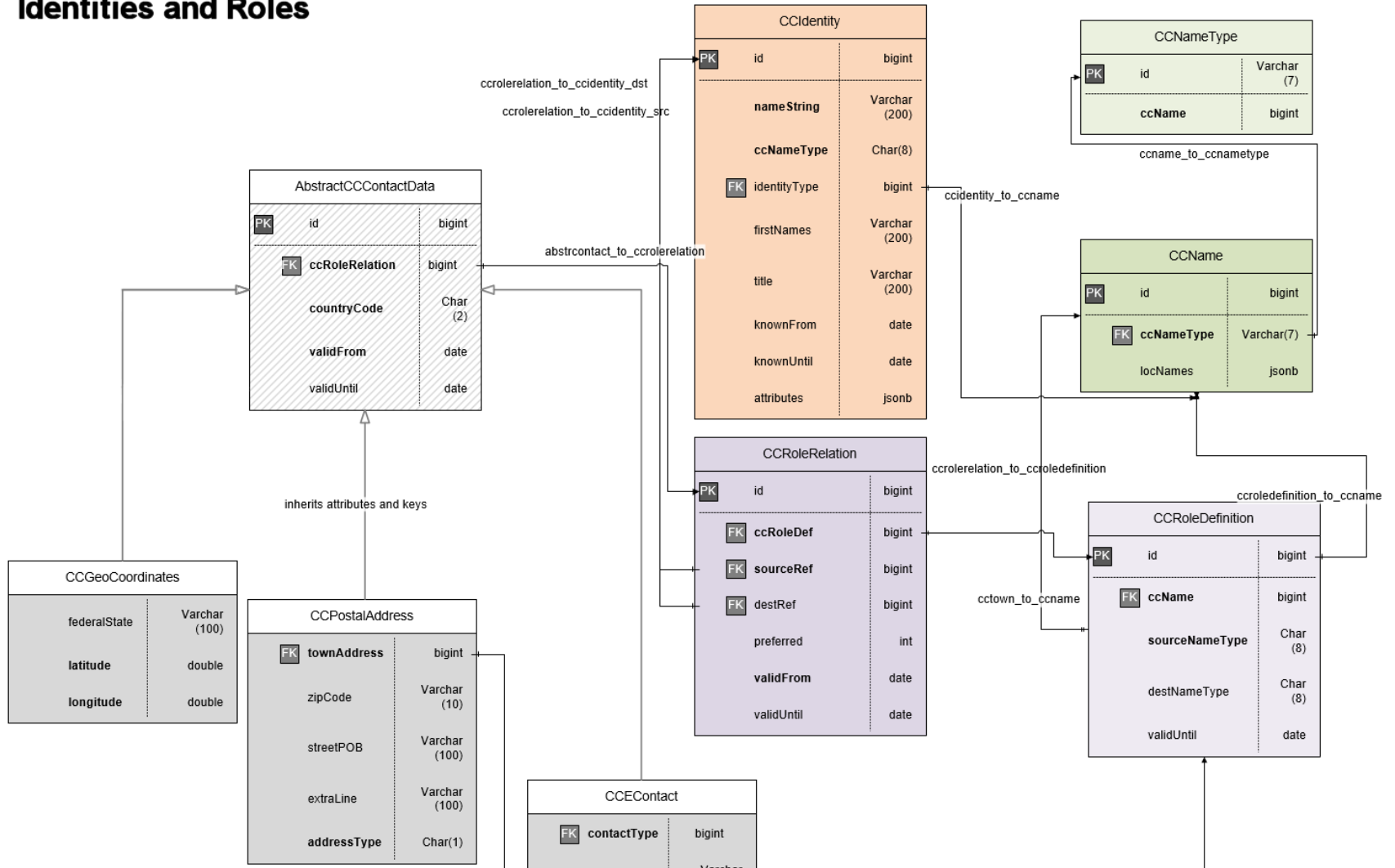
```

1 select nt.id as "Name type id", n.locnames->>'en' as english,
2 n.locnames->>'de' as german from ccnametype nt
3 inner join ccname n on (nt.ccname = n.id) order by n.id
    
```

[Data Output](#) [Explain](#) [Messages](#) [Notifications](#)

	Name type id character (8)	english text	german text
1	NameTN	Name type name	Namenstypname
2	ProjN	Project name	Projektname
3	FolderN	Folder name	Ordnername
4	DocN	Document name	Dokumentname
5	HistN	History state	Historienstatus
6	RoleN	Role name	Rollenname
7	CountrN	Country name	Ländername
8	TownN	Town name	Städtename
9	EContTN	E-contact type name	E-Kontakttypname
10	AttribN	Attribute name	Attributname
11	IcPersTN	Person type name	Personentypname
12	IcOrgTTN	Organisation type name (top)	Organisationstypname (Top)
13	IcOrgSTN	Organisation type name (sub)	Organisationstypname (Sub)
14	IcLocTTN	Location type name (top)	Ortstypname (Top)
15	IcLocSTN	Location type name (sub)	Ortstypname (Sub)

# Identities and Roles





# Inserting Identities and Roles

```
insert into ccidentity (id, namestring, ccnametype, identitytype, attributes) values ( (nextccval('ccidentity_id_seq')),
    'IBS Exertal', 'IcOrgSTN', (findNameIdDE('IcOrgSTN', 'Standort')), '{"Acronym": "IBS-E"}'
);
insert into ccrolerelation (id, ccRoleDef, sourceRef) values ( (nextccval('ccrolerelation_id_seq')),
    (findroledefde( 'IcOrgTTN', 'Ist Hauptsitz')),
    (findOrgIdByAcronym('IBS'))
);
insert into ccrolerelation (id, ccRoleDef, sourceRef, destRef) values ( (nextccval('ccrolerelation_id_seq')),
    (findroledefde( 'IcOrgSTN', 'gehört zu', 'IcOrgTTN')),
    (findOrgIdByAcronym('IBS-E')), (findOrgIdByAcronym('IBS'))
);
```

# Unary role relations

```
1 select * from findallunaryrolerelations('en')
```

Data Output Explain Messages Notifications

	<b>sourcename</b> character varying	<b>rolename</b> text
1	Ingenieurbüro für Bauwesen Schmidt GmbH	is head office
2	Ingenieurbüro für Bauwesen Schmidt GmbH	is PDM license holder

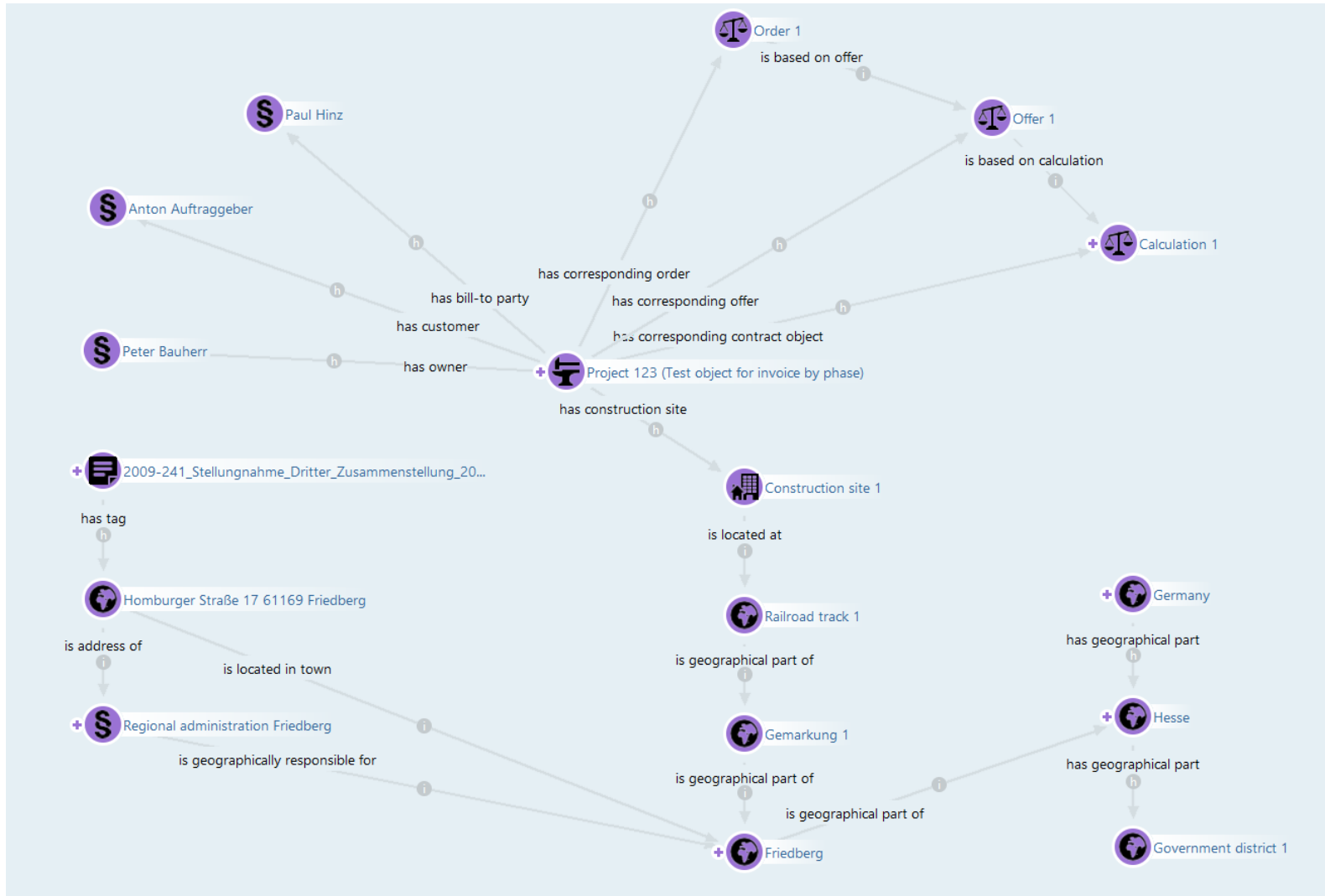
# Find all unary role relations

```
CREATE OR REPLACE FUNCTION public.findallunaryrolerelations(lang text)
  RETURNS TABLE(sourcename character varying,
                rolename text)
AS $BODY$
BEGIN
  RETURN QUERY
  SELECT (i.namestring || CASE WHEN i.firstnames IS NULL THEN '' ELSE ', ' || i.firstnames END)::varchar
         AS sourcename,
         rn.locnames->>lang AS rolename
  FROM ccidentity i
  INNER JOIN ccrolerelation rr ON (rr.sourceRef = i.id AND rr.destref IS null)
  INNER JOIN ccroledefinition rd ON (rd.id = rr.ccroledef)
  INNER JOIN ccname rn ON (rn.id = rd.ccname);
END; $BODY$;
```

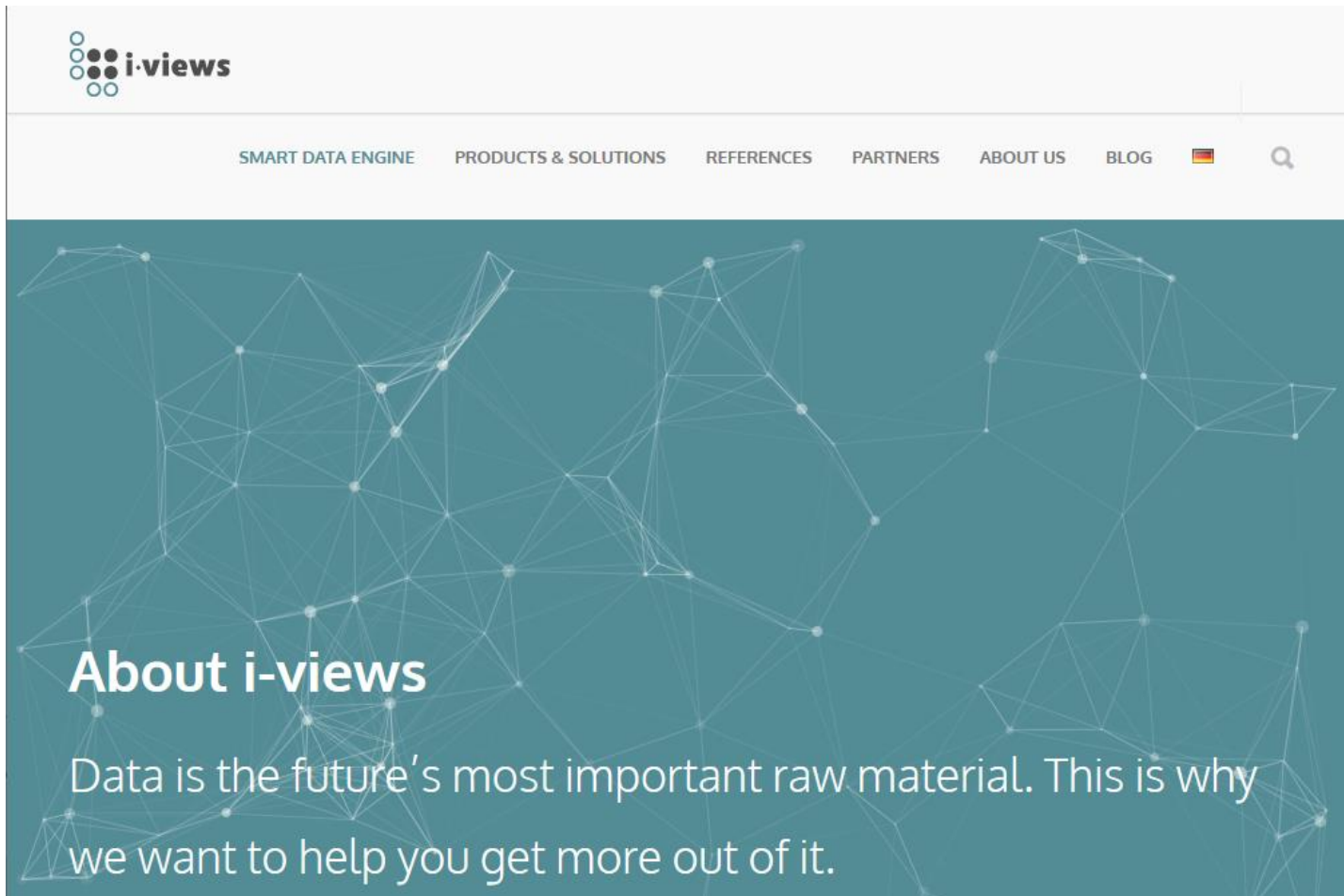
# Binary role relations

```
1 select * from findallbinaryrolerelations('en')
```

	Data Output	Explain	Messages	Notifications
	<b>sourcename</b> character varying	<b>rolename</b> text	<b>destname</b> character varying	
89	Schulte, Timo	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
90	Schulte, Christa	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
91	Schulte, Björn	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
92	Schult, Moritz	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
93	Schult, Jonas	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
94	Schult, Christian	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
95	Schwabe, Andreas	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
96	Sindlingen, Superiana	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
97	Skorak, Ralf	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
98	Schäfersmeyer, Melody	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
99	Sommer, Wilfried	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
100	Strigg, Susanne	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
101	Sturm, Maximilian	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
102	Vollmer, Karl-Josef	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
103	Walter, Stefan	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
104	Wahl, Samuel	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
105	Wilms, Manuela	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
106	Xie, Denghui	is administrated by	Ingenieurbüro für Bauwesen Schmidt GmbH	
107	Al-Hussainy, Mohammed	works for	IBS Extertal	
108	Albrecht, Karin	works for	IBS Schmallenberg	
109	Arnold, Rebecca	works for	IBS Schmallenberg	
110	Aslanoglu, Muhammed	works for	IBS Schmallenberg	
111	Bäcker, Suscha	works for	IBS LenneStadt	
112	Bell, Seem-El	works for	IBS Bad Honnef	
113	Beckmann, Marc	works for	IBS LenneStadt	



# intelligent views GmbH: <https://i-views.com>



## Schedule PDM

2019:

- Rebuilding document explorer
- All functionality based on micro use cases
- First support of collaboration functionality
- Mockup editor as GUI base

2020:

- Enhancing application functionality
- Integrating workflow concepts
- Connecting to i-views smart data engine