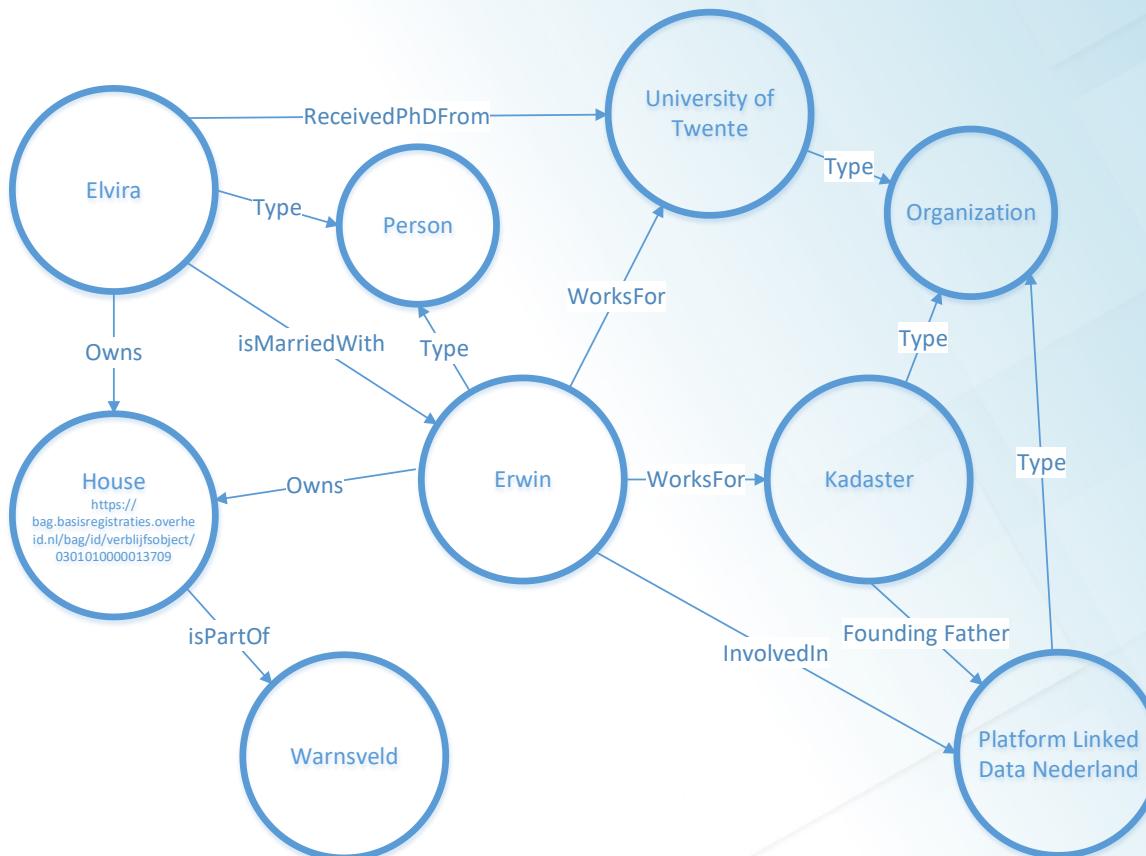


kadaster



The Knowledge Graph as Interoperability Foundation



Content

- Context – Linked Data (@NL) – Kadaster
- Why Linked Data @ Kadaster
- The road we took & lessons
 - Phase 1 – Kadaster Data Platform
 - Lessons & Renewed Focus
 - Phase 2 – The Kadaster Knowledge Graph
- Latest Developments



What is Linked Data?

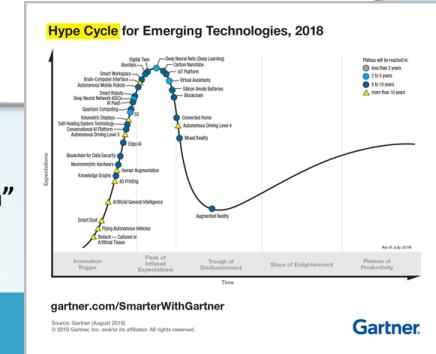


Linked Data: A way of publishing data (reusable, web standards, semantics, related to open and big data). Data is stored as triples (RDF standard) and can be (federated) queried with SPARQL.

The screenshot shows a TED talk page with a video of Tim Berners-Lee speaking. The video player has a play button and a progress bar. Below the video, there are social sharing icons and a count of 1,161,203 views. To the right, there's a thumbnail for a BCG report titled 'How do you stay ahead of technology-driven change?' with a subtitle '225 titles are free today to report page'. At the bottom, there's a graph visualization showing entities like Elvira, University of Twente, Person, Organization, Kadaster, and Platform Linked Data Nederland connected by various relationships such as 'Receive dPhDFrom', 'Type', 'WorksFor', 'Owning', 'isMarriedWith', 'IsPartOf', 'InvolvedIn', and 'Founding Father'.

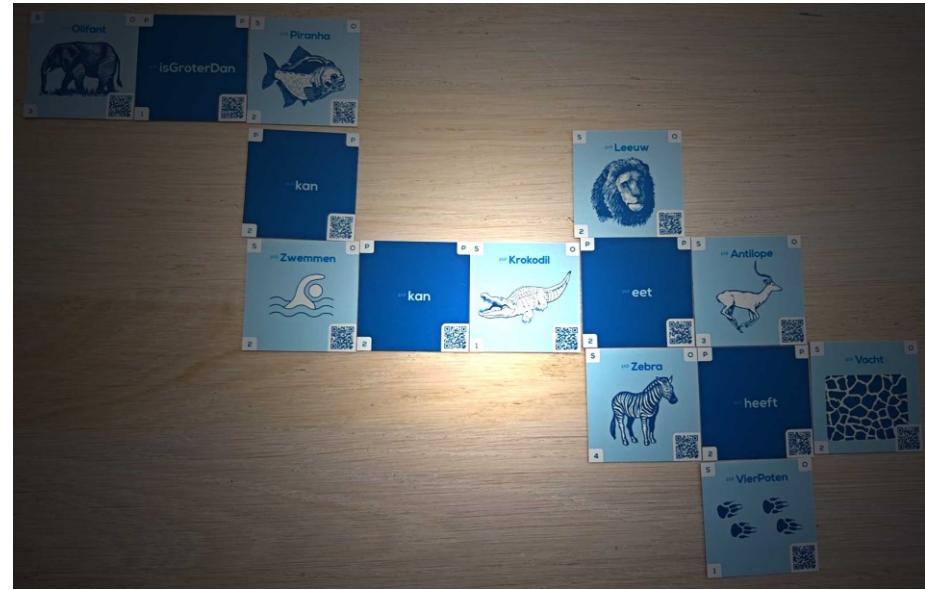
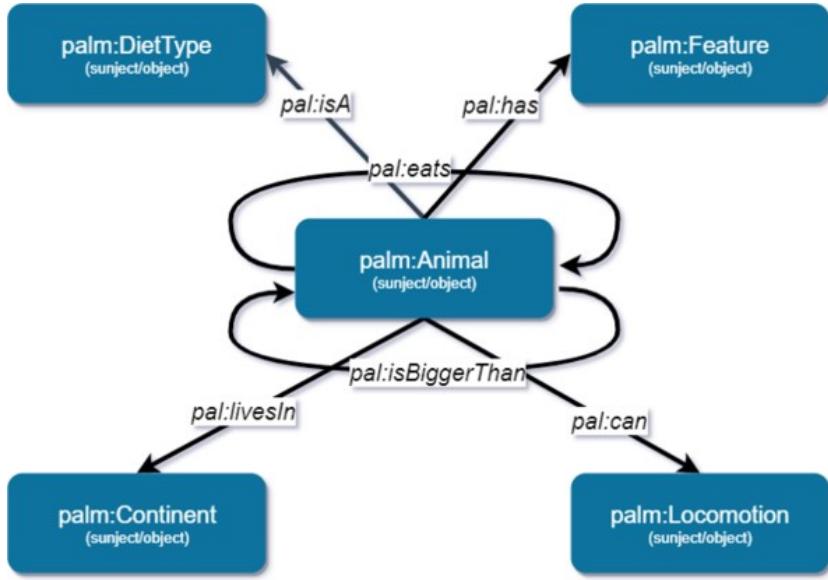


"To Graph or Not to Graph? That Is Not the Question — You Will Graph"
 Mark Beyer, Distinguished VP Analyst, 14 december 2020
<https://www.gartner.com/doc/reprints?id=1-250E2EC1&ct=210112>



Linked Data in the Netherlands

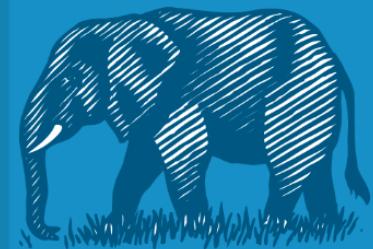
- Platform Linked Data the Netherlands (PLDN)
- Billion Triples Cases



[Home](#) Play-a-LOD[Browser](#)[Table](#)[SPARQL](#)[Graphs](#) 1[Services](#) 1[Assets](#) 48[Insights](#) ><https://playalod.nl/dieren/id/Olifant>

Olifant

Olifant

[Dier](#)<https://playalod.nl/dieren/id/Olifant>**Type**[Dier](#)**Label**

Olifant

SameAs[Elephant](#)

Q7378

Depiction**Aantal kaarten**

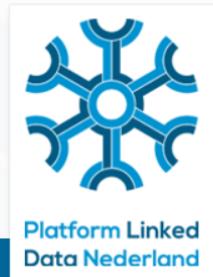
1

Heeft punten

3

Is SPO

S/O



Innovatie door betekenisvol verbinden

Home

SPARQL Endpoint

OSM Dataset

PLDN Website

OpenStreetMap (OSM) Dataset



De OpenStreetMap dataset is een publicatie van de Linked Data versie van de welbekende geospatiale datasets van [OpenStreetMap](#).

De beschikbaarstelling van deze dataset is een samenwerkingsverband tussen de volgende drie partijen:

- Platform Linked Data Nederland (PLDN)
- CGI Infra and asset management lab
- Triply

OpenStreetMap (OSM)

OpenStreetMap (OSM) is een project dat als doel heeft om vrij beschikbare en bewerkbare geografische gegevens te verzamelen, zodat daaruit landkaarten en andere diensten kunnen gemaakt worden. Eenieder die zich inschrijft, kan eraan meewerken. Het invoeren en aanpassen van de geografische data steunt volledig op vrijwilligers. Het is mede opgericht uit onvrede met de hoge kosten die commerciële kaartbedrijven vragen voor hun producten. Reeds meer dan 20 miljoen kilometer wegen, fiets- en voetpaden werden in kaart gebracht door middel van het overnemen van gegevens van luchtfoto's en zelf op pad te gaan met een GPS-apparaat. In juni 2020 waren elke dag

gemiddeld zo'n 6300 vrijwilligers actief aan het bijdragen.

Bron: [OSM Wiki](#)

[Dataset details](#)

Playlod - PLDN Carnivoor - Play-a-LOD - playlod Luipaard - Play-a-LOD - playlod Platform Linked Data Nederland HackaLOD 4-5 november 2022 - Nieuw tabblad Kadaster Labs LDWizard LDWizard +

github.com/pldn/LDWizard

README.md

LD Wizard: Create Linked Data in One Spell

LD Wizard is a framework for creating end-user focused Graphical User Interfaces (GUIs) that simplify the creation and publication of linked data.

1. LD Wizard Project

So far, the following LDWizard variants have been configured from the LDWizard Core:

Cultural Heritage Wizard
A specific configuration of the LD Wizard by the Dutch Digital Heritage Network.

UM - Humanities and Social Sciences
A specific configuration of the LD Wizard by the University of Maastricht for transforming tabular data in the humanities and the social sciences.

UM - BioLink
A specific configuration of the LD Wizard by the University of Maastricht for transforming BioLink tables.

GeoData Wizard
A specific application of the LD Wizard configured for linking Dutch geo data to the BAG and BRT.

Clarliah Wizard
A specific application of the LD Wizard configured for use in the Clarliah research infrastructure for the humanities.

2. LD Wizard Documentation

The LD Wizard project uses the following guidance documents for the LD Wizard development community activities:

CODE_OF_CONDUCT
Describes our preferred interaction behavior.

CONFIGURING
Describes how to configure a new LD Wizard variant.

CONTRIBUTING
Describes how to develop local LD Wizard code.

BOUNTY_PROGRAM
Describes how organizations can place bounties and how developers can solve bounties and also gives an overview of the current bounty issues.

GOVERNANCE
Describes our lightweight governance structure incl. the gatekeeper role.

3. Attribution

LD Wizard is an initiative of the following organizations and people:

- Dutch Digital Heritage Network (NDE), Enno Meijers & Ivo Zandhuis.
- The Netherlands' Cadastre, Land Registry and Mapping Agency (Kadaster), Erwin Folmer.

Nieuw tabblad Kadaster Labs LDWizard LDWizard +

ldwizard.netwerkdigitaalergoed.nl

network
digitaal
erfgoed

LDWizard - Erfgoed

1 Upload 2 Configure 3 Publish

No file selected

LOAD YOUR CSV FILE

BACK NEXT RESTART

LDWizard

Documentation Dataplatform Github

Nieuw tabblad Kadaster Labs LDWizard LDWizard +

labs.kadaster.nl/demonstrators/geodatawizard/#1

GeoData Wizard

1 Upload 2 Configure 3 Publish

No file selected

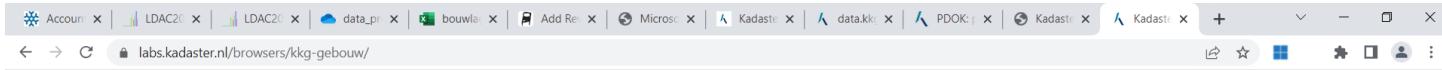
LOAD YOUR CSV FILE

Or try it with an example CSV file

BACK NEXT

LDWizard

Documentation Dataplatform Github



CLASS
 Gebouw

POSTCODE

WOONPLAATS

OPPERVLAKTE (M²)
1 10.000

BOUWJAAR (JAAR)
202 2.023

TYPE
 Brandweerkazerne
 Gemeentehuis
 Gevangenis
 Kasteel
 Kerk
 Kunststijlbaan
 Moskee
 Museum

Oscar Wildestraat 1, 9746AR Groningen

Jacob Schorerstraat 33, 9745DC Groningen

Henri Dunantlaan 700, 9728HW Groningen

De Held 35, 9745DH Groningen

Properties

Properties

Accoun x LDAC20 x LDAC20 x data_pr... x bouwla... x Add Re... x Micros... x Kadast... x data.kk... x PDOK... x Kadast... x GitHub x +

← → ⌂ labs.kadaster.nl/browsers/kkg-gebouw/

pldn / facetcheck Public

Product Solutions Open Source Pricing

Search Sign in Sign up

Code Issues Pull requests Actions Projects Security Insights

master 1 branch 0 tags Go to file Code About

LaurensRietveld 1.0.56 741595c on Sep 12, 2022 384 commits

Notifications Fork 0 Star 0

The facetized browser developed by Triply.
This browser is configured for specific

The Billion Triples Cases

Is Linked Data the Future of Data Integration in the Enterprise?

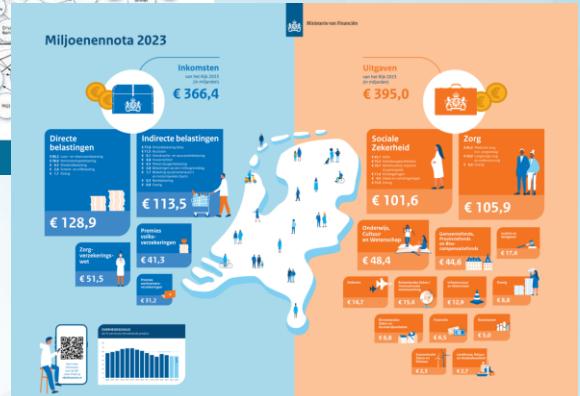
January 7, 2013 by John Walker

In today's multi-screen world we need to be able to serve our customer, at the right time in their format and in a simple as making PDF documents, we need to find multi-channel publications (web/mobile/print) and explains how NXP is tackling these challenges.

RDF/LD als enabler

POLITIE

Gegevensgerichte benadering

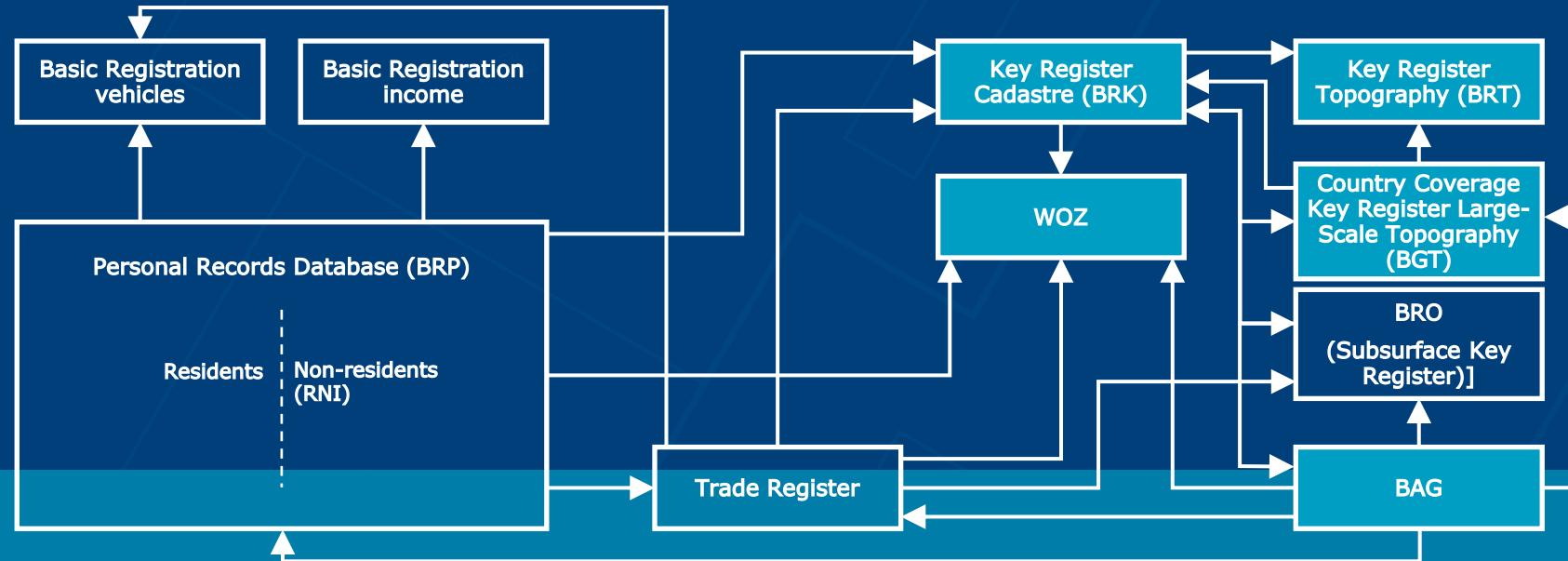


<https://www.linkedin.com/pulse/fundamentals-digitalisation-towards-holographic-flores-bakker/>

Do you know Kadaster?



Key Registers in the Netherlands



Key registers and

Key Registers

National facilities

National facilities

Key Register

Cadastre (BRK)

- Registrations spread across government organizations.

Kadaster source holder of:

Key Register

Topography (BRT)

Key Register Cadastre (BRK)

Key Register Topography (BRT)

- 5 registrations from other organisations (national facilities)

Valuation of real estate (WOZ)

Other Tasks

KLIC (Dutch Cable and Pipeline Information Centre)

Schematic view

Energy Labels

Act on the Recognisability of Public Law Restrictions and Real Estate (WKPB)

National Triangulation Network

Ruimtelijkeplannen.nl

Defense



MENU ☰

Hét platform voor hoogwaardige geodata

[Bekijk alle datasets](#)[Ontdek de PDOK Viewer](#)[Ontdek de Vectoratile Viewer](#)[Bekijk de PDOK promofilm](#)

Bij PDOK vind je open datasets van de overheid met actuele geo-informatie. Deze datasets zijn benaderbaar via geo webservices en beschikbaar als downloads. Daarnaast vind je hier inspirerende cases over de mogelijkheden van deze geo datasets. [Meer info over PDOK](#)

87.000.000

datacalls per dag

239

hoogwaardige datasets

Waarom PDOK?

Kwaliteit

PDOK levert hoge kwaliteit (standaard ISO 25010)

Hoogwaardige geodata

PDOK biedt hoogwaardige en actuele open geodatasets

Webservices / API's

De geodata is benaderbaar via standaard OGC- en W3C



Key figures 2022

465.800

Deeds of transfer

494.500

Deeds of mortgage

91.100

Survey entries

29.1 billion

PDOC views

1.2 billion

BGT views

1.008.000

KLIC notifications

26.4 million

Information Products

3.5 billion

BAG inquiries

7884
7882
7883

Summary

Kadaster = data

kadaster

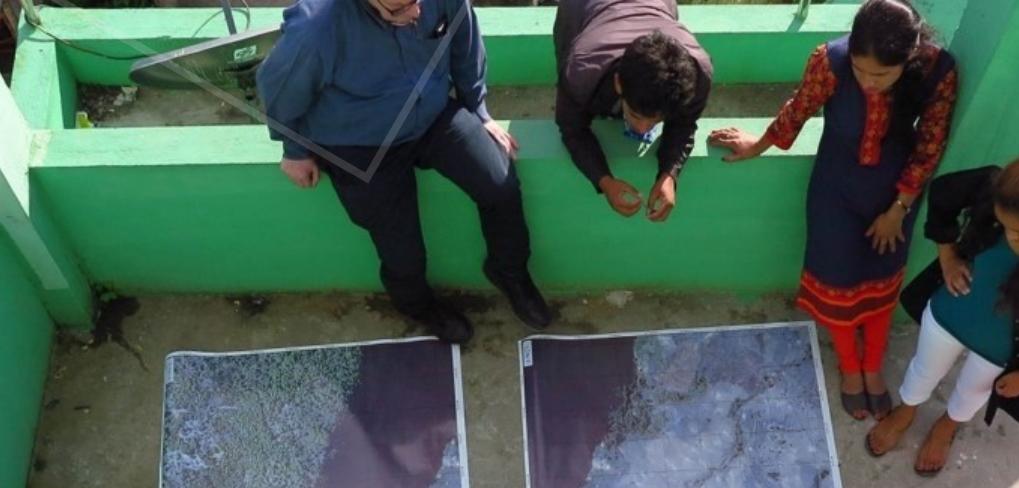


Kadaster Data Platform

The development of the Spatial Data Platform of the Future

Why?

kadaster



vision Kadaster

Making reliable data accessible to everyone. Through a single digital gateway.
That is our job, by connecting and providing certainty.
When data from different sources is combined, valuable insight is generated
offering solutions for challenges in society. Our contribution to
a sustainable and livable society. In the Netherlands and abroad.

Kadaster's Ambitions



Providing certainty of ownership
and use of anything above and
below the surface



Offering a platform for anyone to
handle spatial information
anywhere and anytime



Supporting society in using spatial
information to solve issues that
matter



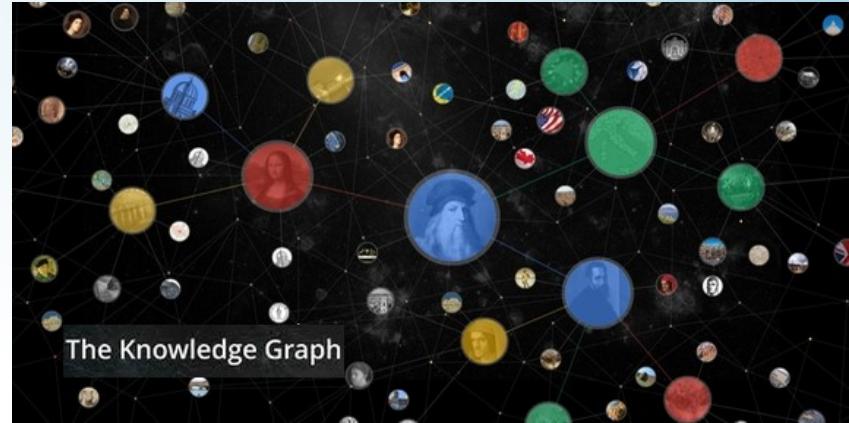
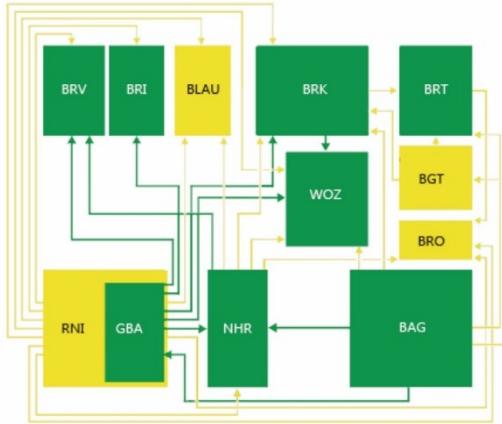
What is the problem with copying?

Not only intrinsic quality

- The leaflet (metadata) is essential
- Semantics
- Provenance
- Transparency is key!



From data silo's to connected information

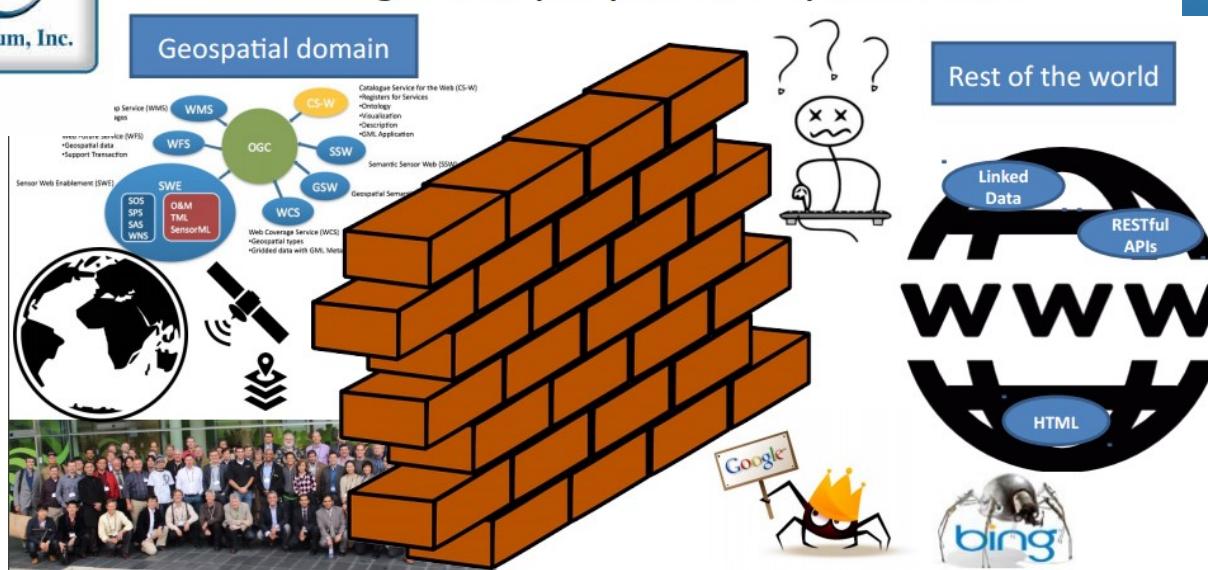


closed



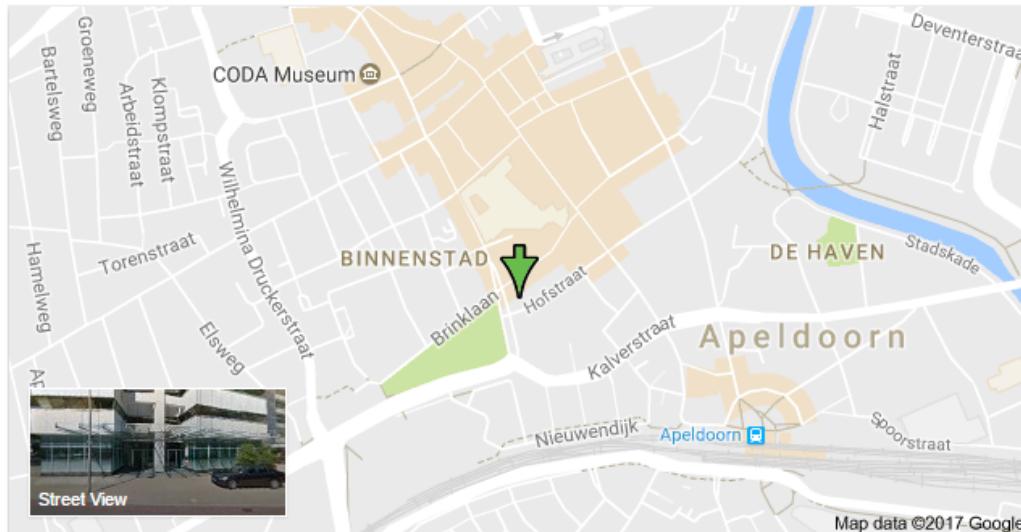
Spatial data: to the web

Reaching more people with spatial data



What is the problem?

About 1.230.000 results (0,71 seconds)



Hofstraat 110, 7311 KZ Apeldoorn

[Get directions](#)

Kadasterkantoren

<https://www.kadaster.nl/kadasterkantoren> ▾ [Translate this page](#)

Hofstraat 110 7311 KZ Apeldoorn Telefoon receptie: 088-183 20 00. Routebeschrijving kantoor de Grift.

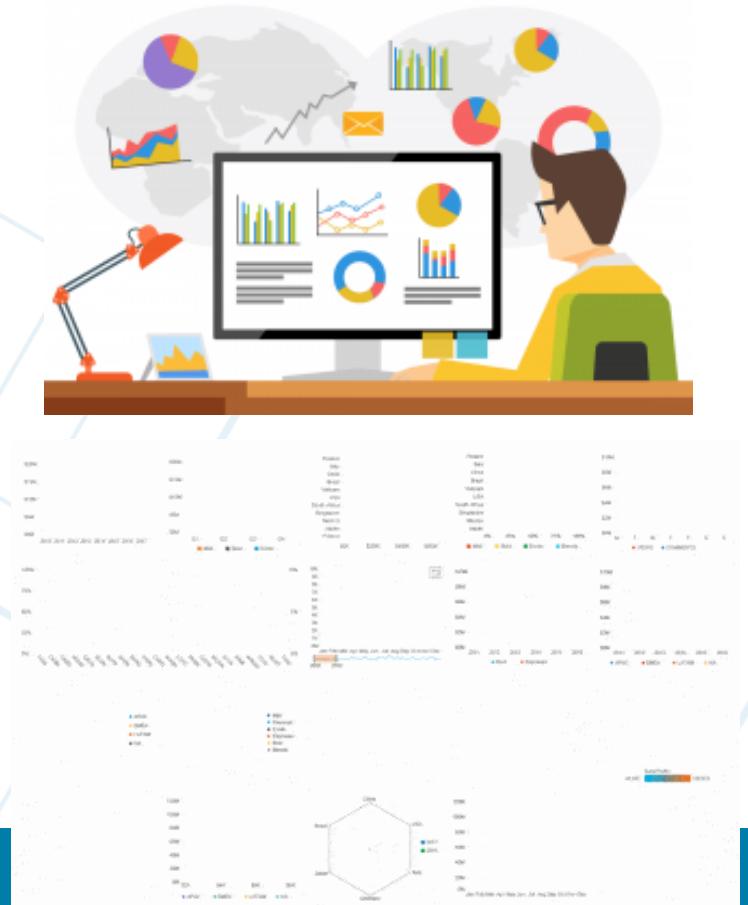
Particulier · Woningwaarde · Eigendom · Grenzen ...

Analytics Friendly

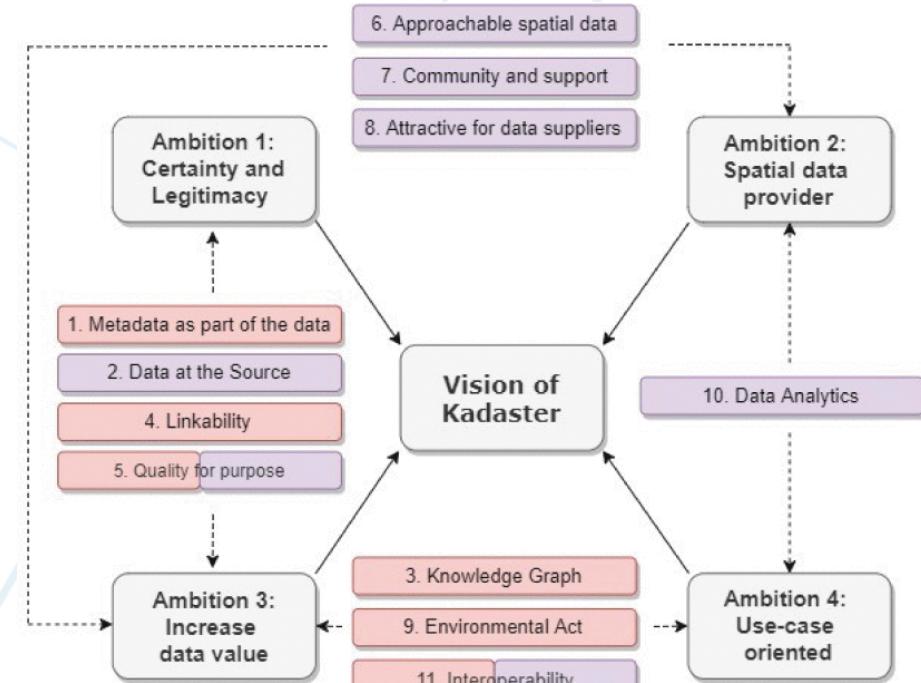
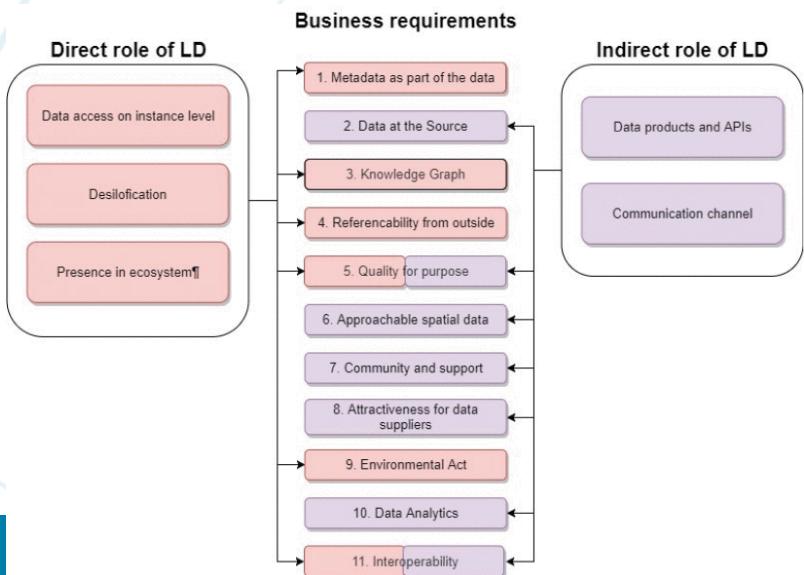
(Self Service GIS)

- Citizen (non GIS professional)
- Data at the Source – Data Ecosystem
- Semantics (Transparency, Reproducability)
- The Web (only a browser)
- Map integration – GIS functionality
- (integration with more advanced tools)

(GIS = Geographic Information System)



In summary



E. Folmer, S. Ronzhin, J. Van Hillegersberg, W. Beek and R. Lemmens,
"Business Rationale for Linked Data at Governments:
A Case Study at the Netherlands' Kadaster Data Platform,"
in IEEE Access, vol. 8, pp. 70822-70835, 2020,
<https://doi.org/10.1109/ACCESS.2020.2984691>

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Kadaster Data Platform

The development of the Spatial Data Platform of the Future

Phase 1 - KDP

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Demo

A dataset as linked data:

<https://data.labs.kadaster.nl>

My Blog Events & Press

Rather than publishing online a database of railway station locations in the Netherlands and expecting a user to then query the database for “Amsterdam Centraal Station”, publish the database giving each record a URI so for example Amsterdam Centraal Station becomes;

<https://brt.basisregistraties.overheid.nl/top10nl/id/gebouw/10262520>
9

Now this is something I can paste into an email, tweet or even share on Facebook !

Kudos to the Dutch Kadaster for taking this approach and providing this example, Ordnance Survey you could do the same ?

This approach also results in such data becoming part of the “mainstream” web indexable and searchable, but I argue the key benefit is the “linkability”

The [Spatial Data on the Web best practice document](#), something of course I recommend you taking a longer look at provides many



Sep 12, 2017

Ed Parsons Retweeted



Sam Zipper
@ZipperSam

Google Earth Engine + [@NASA_Landsat](#) = annual 30 m resolution [#irrigation](#) maps!

Cool new study by [@JillDeines](#):
onlinelibrary.wiley.com/doi/10.1002/20...



Annual irrigation dynamics in t...
Sustainable management of agricultural water resources
onlinelibrary.wiley.com



Sep 11, 2017

Embed

View on Twitter

Lessons learned

It can be much less work than expected, but in the end it is not.

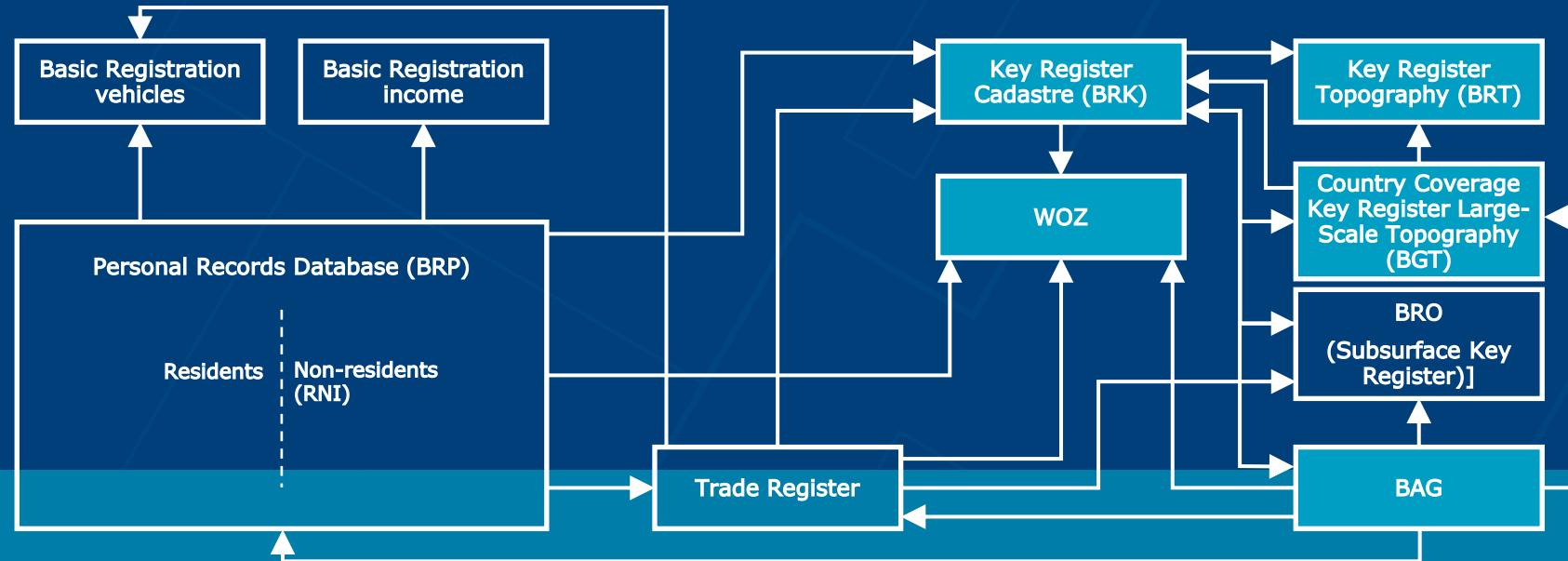
Projects are interfered with other issues:

- Improvements in data models (the “ultimate” model)
- Data quality issues (completeness, metadata, etc)

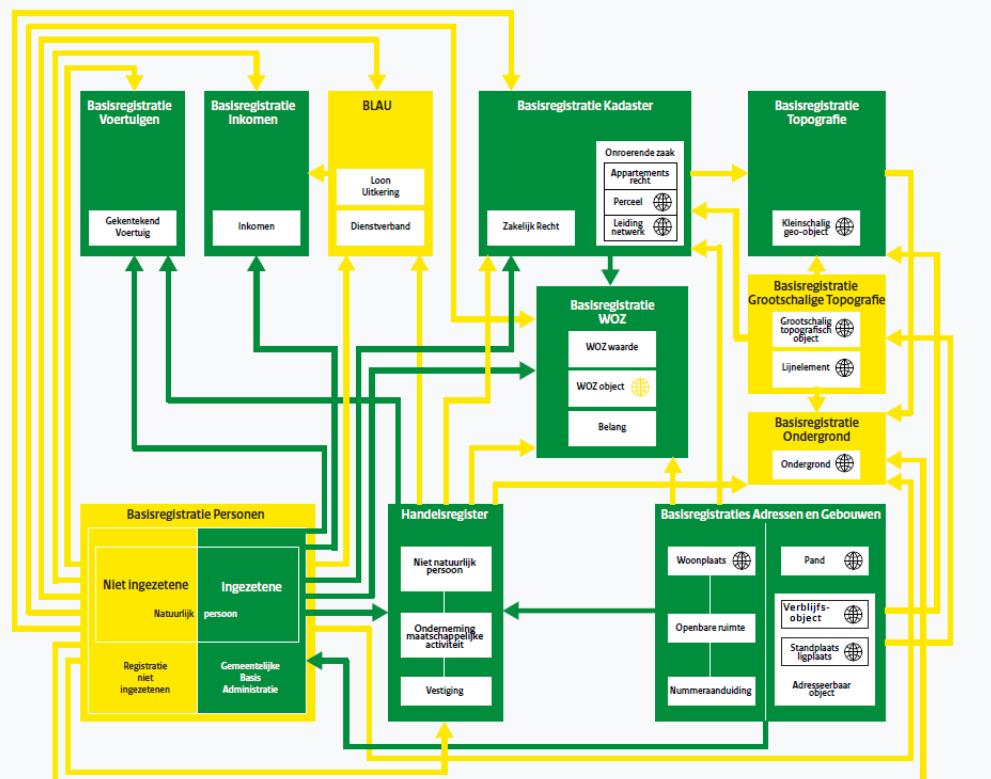
My advise: Keep it simple

- Sparql queries complex
- Federation....ahum...
- GeoSparql partly supported
- 4 star Linked Data

key registers in the Netherlands



Dutch Humour: System of Silos



Legenda

■ Basisregistratie niet gereed
■ Basisregistratie gereed

→ Verbinding niet gereed
→ Verbinding gereed



BR bevat geometrie



BR bevat nog geen geometrie

Conclusion (~2019):

We created the ability...
...but have no links...still data silo's.

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Kadaster Knowledge Graph

Focus on Integrating Data for
Analysis (the Unknown Question)

Phase 2
Experiments 2020-2021
Production & Usability 2022-2023

kadaster

Can you imagine?

- That in 2023 we still offer data silo's?
- That citizens can only ask through Wikipedia or Google questions like; what are the churches built before 1900? And based on authentic government data no direct answer is possible?

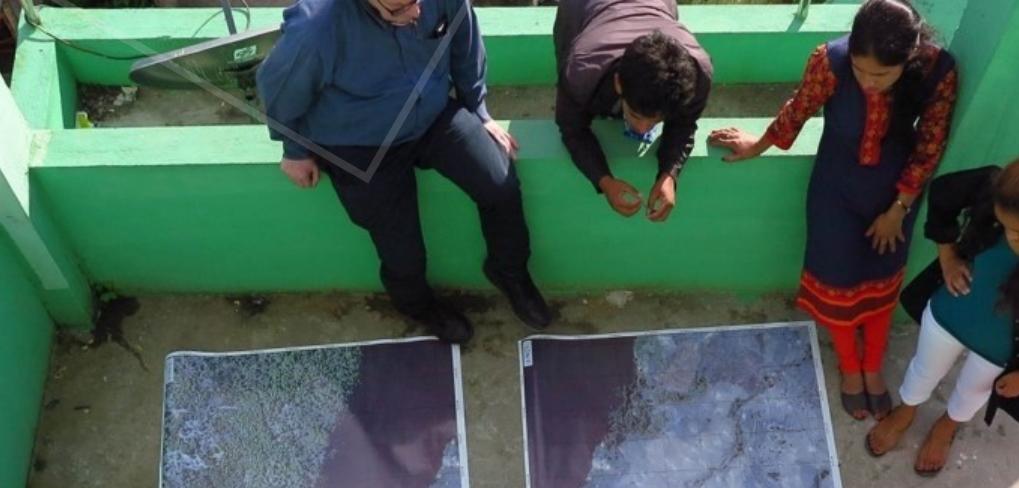


Geo-informatie voor iedereen

What is our ambition?

(<https://www.kadaaster.nl/over-ons/beleid/meerjarenbeleid>)

Wij vinden dat geo-informatie voor iedereen toegankelijk moet zijn. We bouwen ons platform verder uit met mogelijkheden voor analyse van data. Daarnaast gaan we datasets onderling koppelen. Voor de ontwikkeling ervan gebruiken we concrete vraagstukken van gebruikers.



vision Kadaster

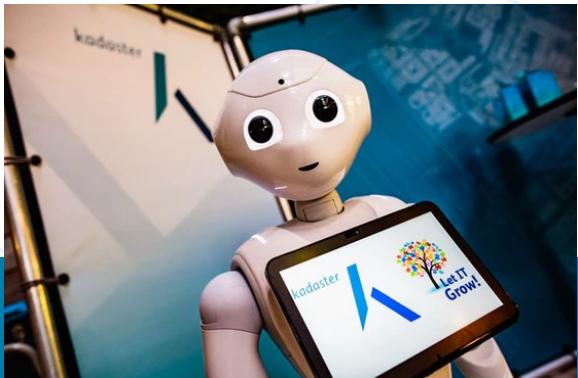
Making reliable data accessible to everyone. Through a single digital gateway.
That is our job, by connecting and providing certainty.

When data from different sources is combined, valuable insight is generated offering solutions for challenges in society. Our contribution to a sustainable and livable society. In the Netherlands and abroad.

My dream!



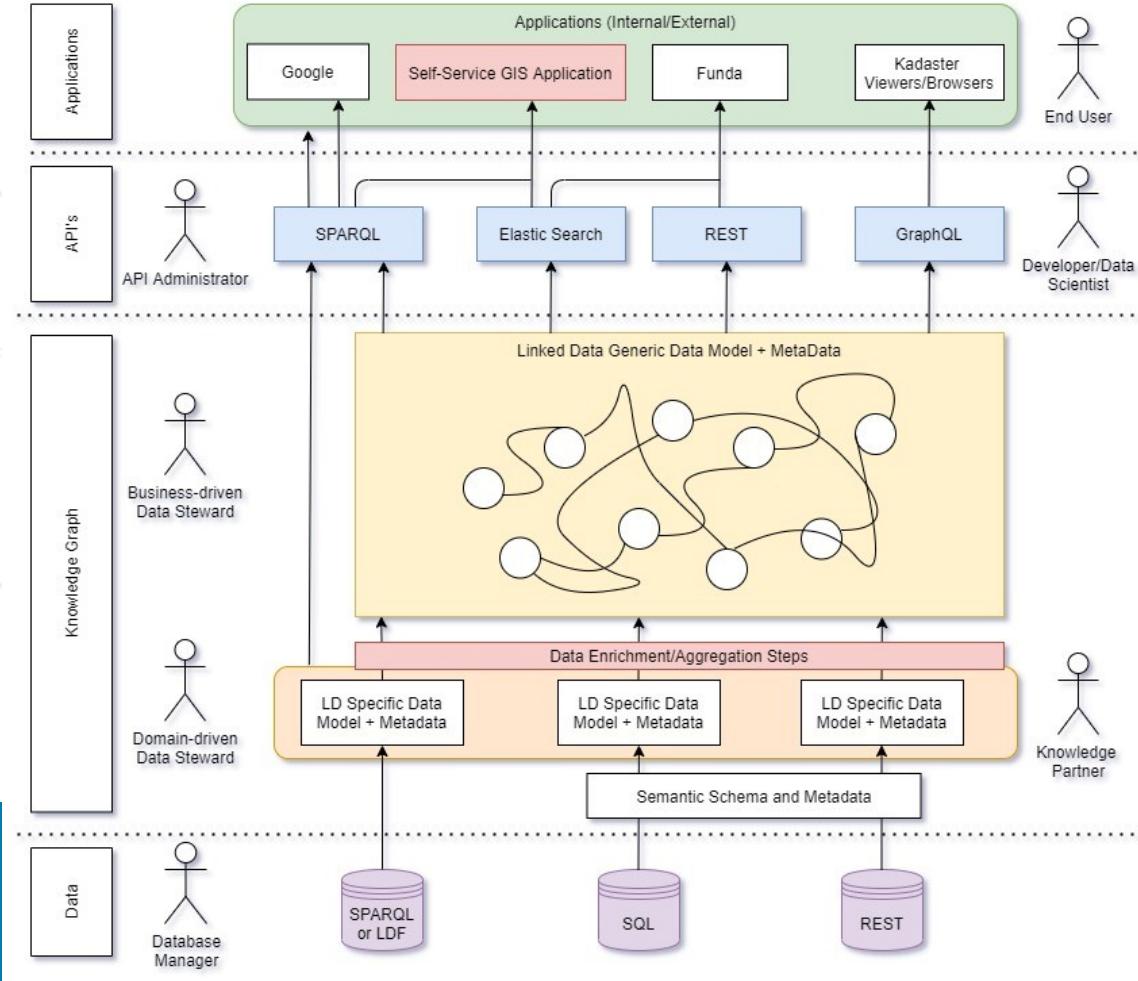
I search for a palace (BRIT) with a value of at least 250 birds (B&G) which has a location in the north of Haarlem (Raalte), and 1000 meters to the highway (N270). In the neighborhood called Berg en Bos (CBS).



Paleis het Loo

<https://brt.basisregistraties.overheid.nl/top10nl/id/gebouw/101895841>

The Architecture for the KKG



Kadaster Knowledge Graph

<https://data.kkg.kadaster.nl>



Kadaster
Knowledge
Graph

Lessons Learned

- It works for integrated data analysis and it is being used
- Promoting the KKG (not datasets as LD)
- One KKG for World Peace? Or Many?
 - Complexity for users
 - Complexity for tools
 - Maintenance
- Make it easier!
 - Educate
 - Inspire
 - Tools

The logo for Kadaster, featuring the word "kadaster" in a lowercase, sans-serif font. To the left of the text is a stylized graphic element composed of two overlapping triangles: a teal one pointing upwards and a dark blue one pointing downwards.

kadaster

Kadaster Knowledge Graph

Latest Developments on Usability

- Inspiration
- Easy/less SPARQL

Warning: Work in Progress!

kadaster

API GET: https://api.labs.kadaster.nl/queries/dst/ar-demo-data-voor-plaats/run?

Variables

vbold
0003010000129471

View populated query

```
1 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
2 PREFIX dct: <http://purl.org/dc/terms/>
3 PREFIX sdo: <https://schema.org/>
4 PREFIX brt_def: <http://brt.basisregistraties.overheid.nl/def/to...
5 PREFIX kad: <https://data.kkg.kadaster.nl/kad/model/def/>
6 PREFIX geo: <http://www.opengis.net/ont/geosparql#>
7 PREFIX sdo0: <http://schema.org/> #error in CBS data
8 PREFIX sor: <https://data.kkg.kadaster.nl/sor/model/def/>
9 PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
10 prefix time: <http://www.w3.org/2006/time#>
11 PREFIX wbk: <https://data.labs.kadaster.nl/cbs/wbk/vocab/>
12 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
13 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
14 SELECT DISTINCT ?gebouwNaam ?buurtNaam ?buurtID ?gemeenteNaam ?gebouw ?bouwjaar ?gebruiksdoel ?basisschoolAfstand ?treinstationAfstand ?vbo
15 bindiri(concat('https://data.kkg.kadaster.nl/id/verblijfsobject'; ?vbo
16 ?gebouw
17 a sor:Verblijfsobject;
18 sor:gebruiksdoel/skos:prefLabel ?gebruiksdoel;
19 sor:maaktDeelUitvan ?gebouw;
20 sor:hoofdadres ?nummeraanduiding;
21 sor:oppervlakte ?vloerOppervlakte0 .
22 ?gebouw
23 a sor:Gebouw;
```



Feature 3: Building Information

- Selected building identifier and building part identifier is used as input, all attribute information for both objects are returned in the UI
- Includes:
 - Building year
 - Floorsize
 - Parcel size
 - Municipality name
 - Neighbourhood name
 - Number of schools within a 3km radius
 - Distance to the nearest trainstation



ITU KALEIDOSCOPE
ACCRA2022

Kadaster Query Builder

https://hetkadaster... | Kadaster Labs | Kadaster Labs | Kadaster Labs | Loki V3 - Kadaster... | Querybuilder | Kadaster Labs | DataScienceAkter... | Playground - http... | +

labs.kadaster.nl/demonstrators/querybuilder/index.html

QUERYBUILDER KKG-LIGHT

example 1

Querying https://api.labs.kadaster.nl/datasets/kkg-light/KKG-Light-results-v2/services/KKG-Light-results-v2/sparql

First time here ? watch the tutorial !

Gebouw gebruksdoel
And
Gebouw bouwjaar bouwjaar from 1900 to 1940
And
Gebouw ligt in Gemeente s-Hertogenbosch

Toggle SPARQL editor | Share | Export query in JSON | Import query in JSON

Table Chart Geo Pivot Response Table 202 results in 0.23 seconds

Normal Grouped Heatmap Layers

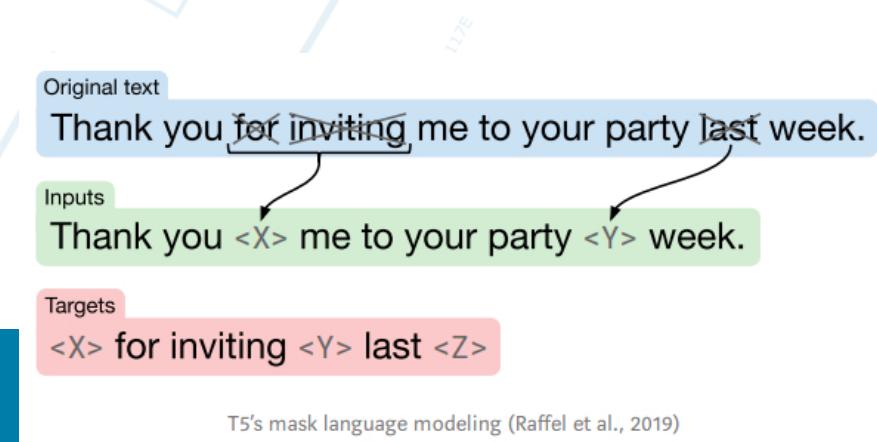
The screenshot shows the Kadaster Query Builder interface. At the top, there's a navigation bar with various tabs and a search bar containing the URL 'labs.kadaster.nl/demonstrators/querybuilder/index.html'. Below the header is a blue banner with the title 'QUERYBUILDER KKG-LIGHT' and a dropdown menu set to 'example 1'. A message 'Querying https://api.labs.kadaster.nl/datasets/kkg-light/KKG-Light-results-v2/services/KKG-Light-results-v2/sparql' is displayed. A 'First time here ? watch the tutorial !' link is present. The main area contains three query components connected by 'And' operators. The first component links 'Gebouw' to 'gebruksdoel' (winkelfunctie). The second component links 'Gebouw' to 'bouwjaar' (from 1900 to 1940). The third component links 'Gebouw' to 'ligt in' 'Gemeente' (s-Hertogenbosch). Below this is a map visualization showing a network of roads and water bodies, with several locations labeled: Heden, Crevicour, Oud Empel, Empel, Rosmalen, Spakkelbosch, Heesend, Lagekant, Geffen, Engelen, Deekant, and Drielandenpunt. The map includes a legend for 'Normal', 'Grouped', 'Heatmap', and 'Layers'.

But, what if SPARQL is not needed?

The screenshot shows the Kadaster Labs website (<https://www.kadaster.nl/labs>). The page features a large binary code grid at the top. Below it, the title "Kadaster Labs" is displayed, followed by a detailed text about technological developments and their impact on the cadastral office. A section titled "Thema's" contains six cards: "Innovatie" (a hand painted with a world map), "Knowledge Graph" (a network diagram), "Data Analyse" (a map with red dots), "Studenten" (a hand writing "INTERNSHIP" on a chalkboard), "Browsers" (a map interface), and "Linked Data" (a network diagram). To the right, there are two examples of the "Chat met Loki" feature, which allows users to ask questions like "what is the distance to the nearest hospital?" or "what is the distance to the nearest town hall?". The footer includes links for "disclaimer", "toegankelijkheid", "woordenboek", "kadaster.nl", and "developer.kadaster.nl".

Components

- 1) Tokenizer translates text to a list of numbers
- 2) Training on non-annotated big-data: denoising
- 3) Finetuning: predict a query from a conversation
- 4) Presenting the answer to the user



Current Work

Research

- Combination of tools;
starting with loki, then edit the query in advanced tooling. Drop a query in Loki.
- KG model for learning queries to AI.
- Advanced Graph access management

Ongoing

- Adding experimental data to KKG (e.g. number of floors)
- Adding links to other worlds (Knowledge Graphs)
- Governance of linking

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The Knowledge Graph as Interoperability Foundation

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