

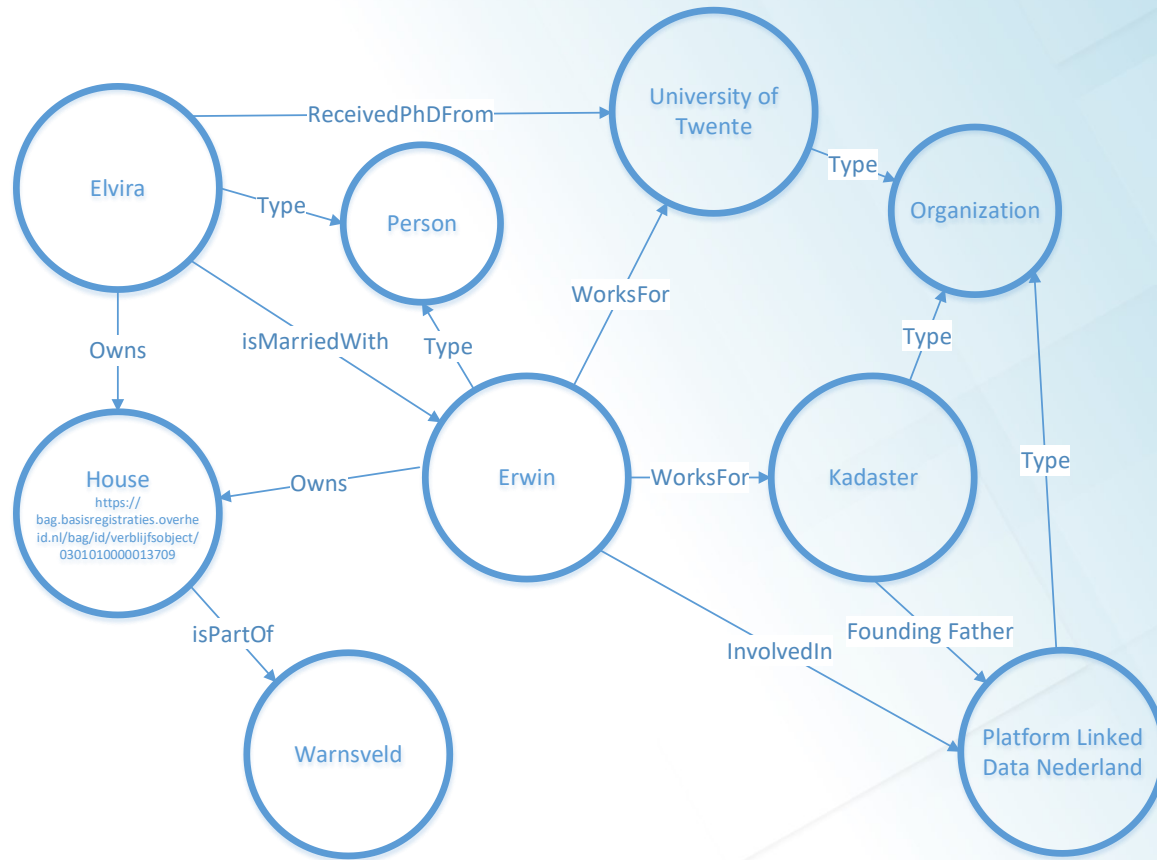
kadaster



The Knowledge Graph as Interoperability Foundation

Erwin Folmer 14-6-2023
Erwin.Folmer@kadaster.nl

The Case at the Dutch Land Registry



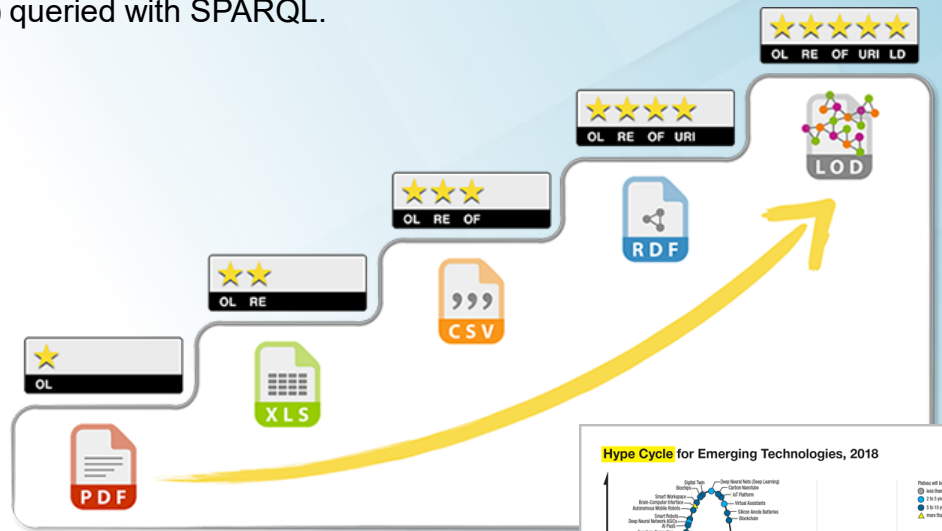
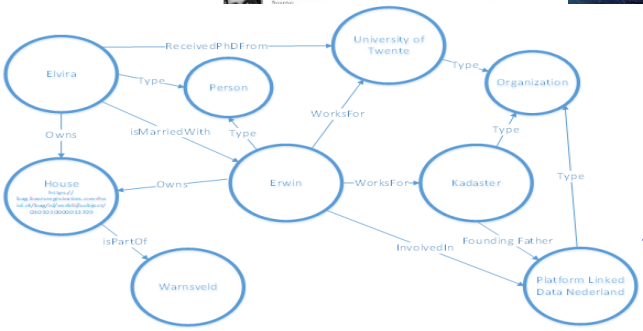
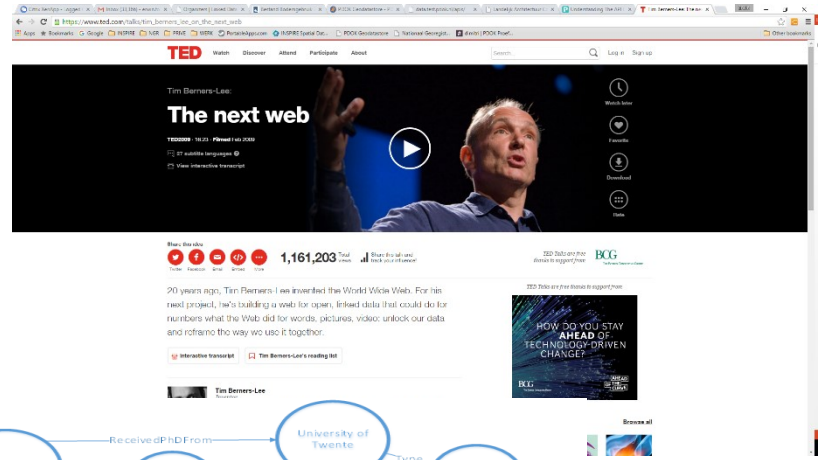
Content

- 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

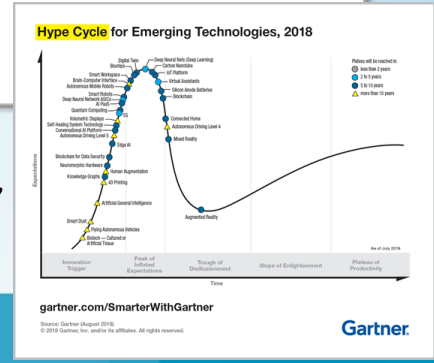
What is Linked Data?



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.

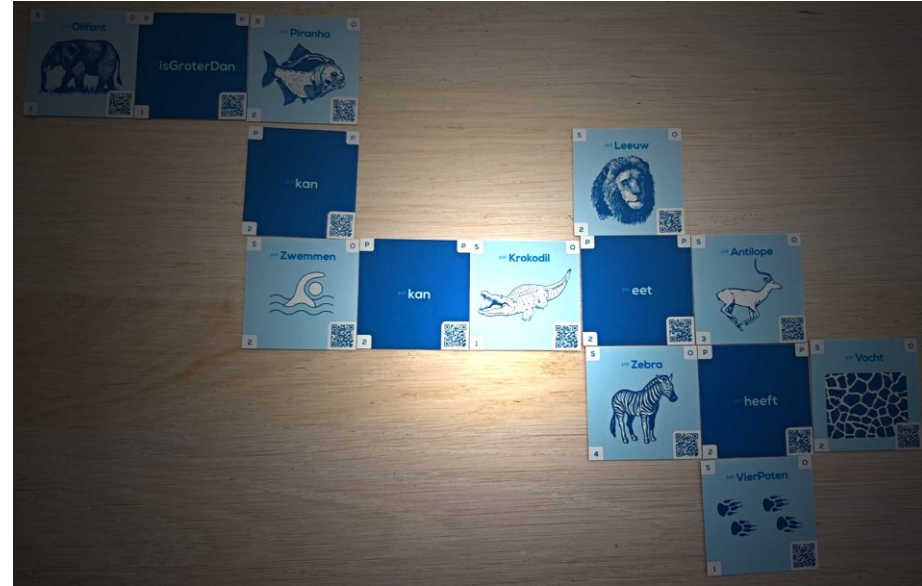
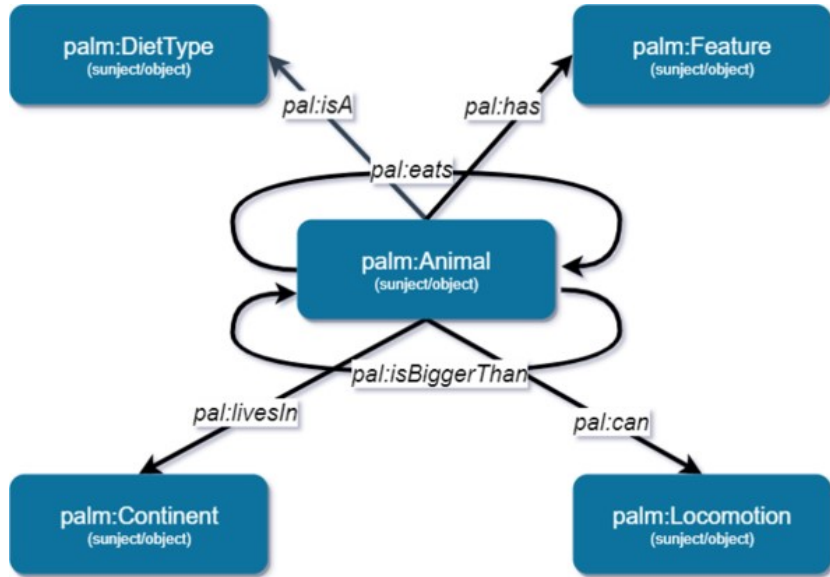


“To Graph or Not to Graph? That Is Not the Question — You Will Graph”
 Mark Beyer, Distinguished VP Analyst, 14 december 2020
<https://www.gartner.com/doc/reprints?id=1-250E2EC1&t=210112>



Linked Data in the Netherlands

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





Play-a-LOD

Browser

Table

SPARQL

Graphs 1

Services 1

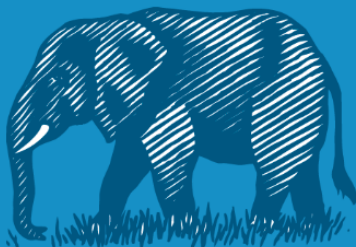
Assets 48

Insights >

https://playalod.nl/dieren/id/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



Platform Linked
Data Nederland

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](#)

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.

Clariah Wizard

A specific application of the LD Wizard configured for use in the Clariah 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.netwerkdigitaalervoed.nl

network digital 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

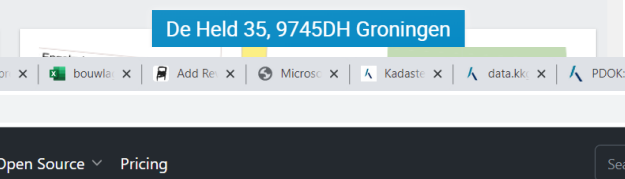
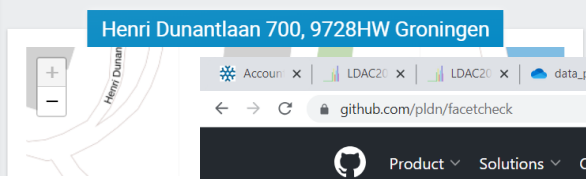
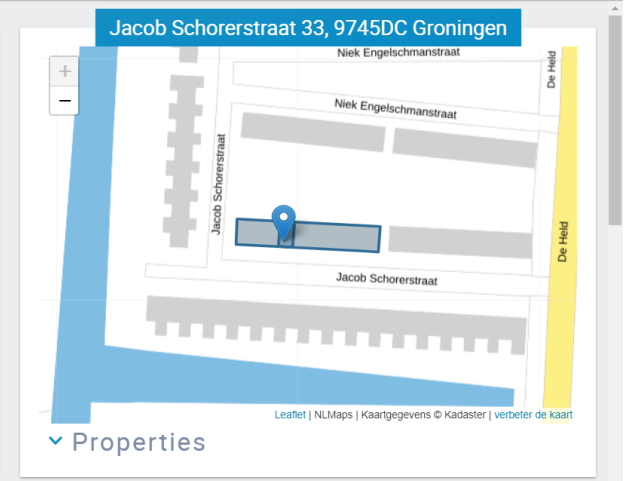
WOONPLAATS

OPPERVLAKTE (M²)

BOUWJAAR (JAAR)

TYPE

- Brandweerkazerne
- Gemeentehuis
- Gevangenis
- Kasteel
- Kerk
- Kunstijsbaan
- Moskee
- Museum



github.com/pldn/facetcheck

Product Solutions Open Source Pricing

Search Sign in Sign up

pldn / facetcheck (Public)

Notifications Fork 0 Star 0

<> 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

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

The Billion Triples Cases

Home / About NXP / Smarter World Blog / Is Linked Data the Future of Data Integration in the Enterprise?

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 deliver content to our customers, at the right time in their format and in a way that is as simple as making PDF documents, we need to be able to integrate data from multi-channel publications (web/mobile/print) and explain how NXP is tackling these challenges.

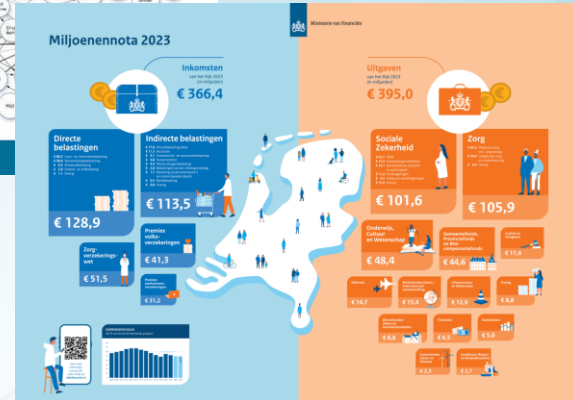
At NXP, similar to many other large organizations, we have a complex information landscape. Data and content is scattered



Belastingdienst

Linked Data tegen fraude

Marcel van Mackelenbergh

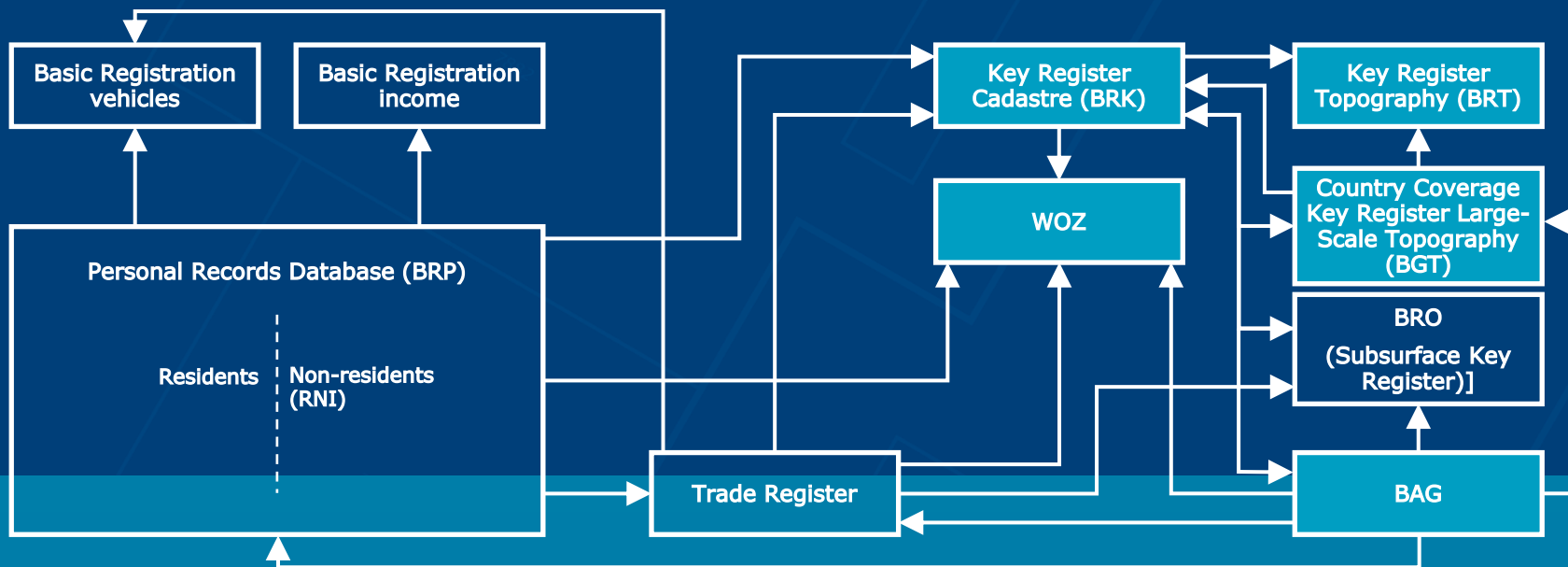


<https://www.linkedin.com/pulse/fundamentals-digitalisation-towards-holographic-flores-bakker/>

Do you know Kadaster?



Key Registers in the Netherlands





Key registers and national facilities

Key Registers

National facilities

Other Tasks

Key Register

Key Register Addresses & Buildings (BAG)

KLIC (Dutch Cable and Pipeline Information Centre)

Cadastre (BRK)
Key Register Information System

- Registrations spread across government organizations.

Kadaster source holder of:

Key Register

Key Register Large-Scale Topography (BGT)

Schematic view

Key Register Cadastre (BRK)

Topography (BRT)

- Key Register Topography (BRT)

- 5 registrations from other organisations (national facilities)

Valuation of real estate (WOZ)

Energy Labels

Act on the Recognisability of Public Law

Restrictions and Real Estate (WKPB)

National Triangulation Network

Ruimtelijkeplannen.nl

Defense

Hét platform voor hoogwaardige geodata

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

PDOK views

1.2 billion

BGT views

1.008.000

KLIC notifications

26.4 million

Information Products

3.5 billion

BAG inquiries

Summary

Kadaster = data

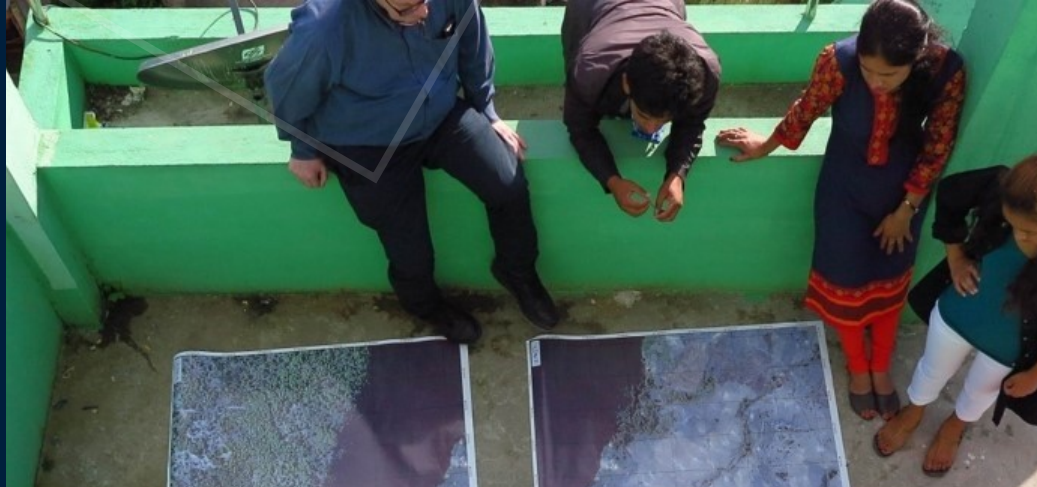
kadaster



Kadaster Data Platform

The development of the Spatial
Data Platform of the Future

Why?



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



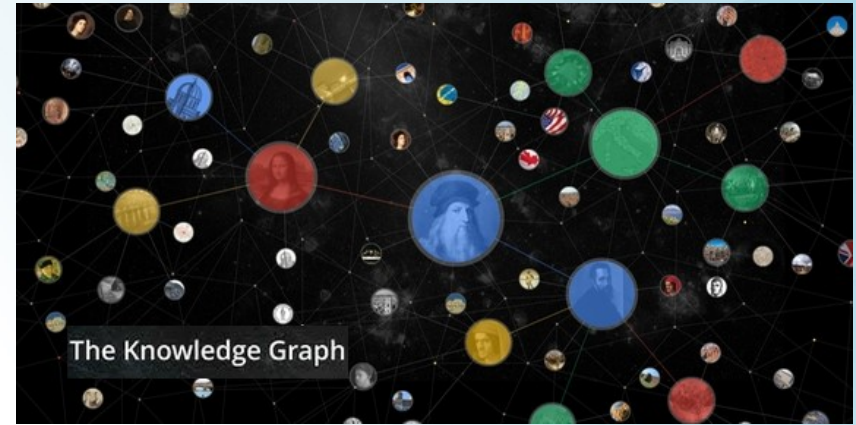
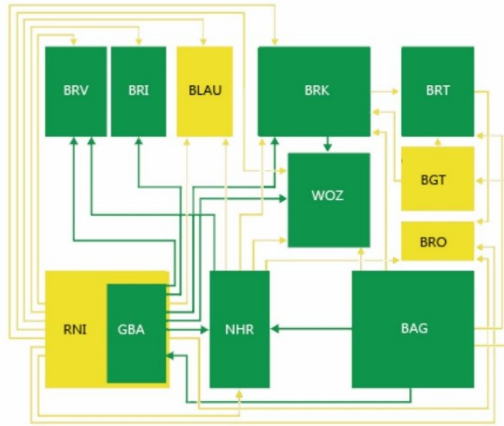
What is the problem with copying?

Not only intrinsic quality

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



From data silo's to connected information



closed



open

Spatial data: to the web

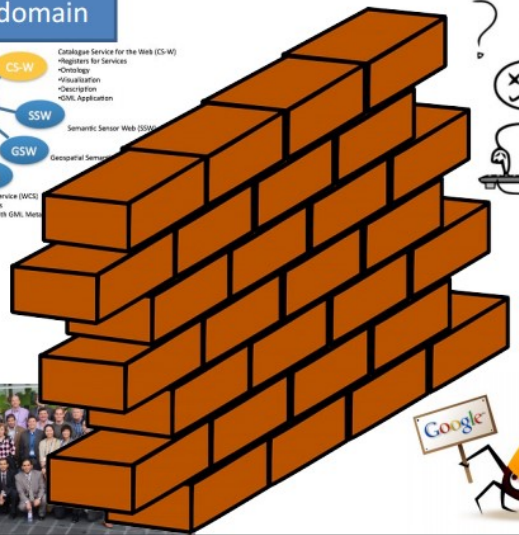
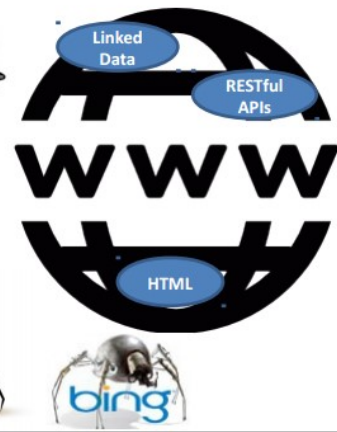
Reaching more people with spatial data



Geospatial domain



Rest of the world



What is the problem?



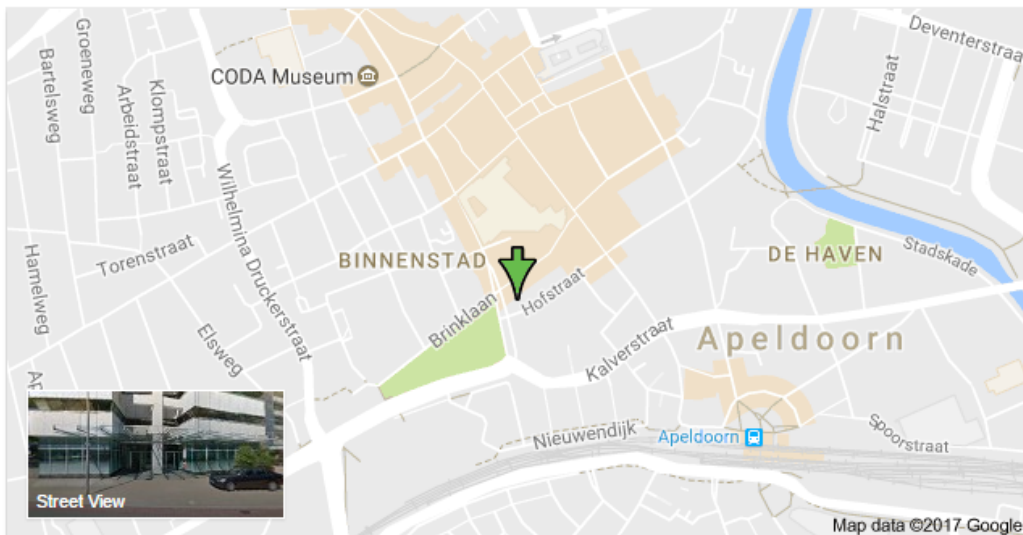
hofstraat 110



Press **F11** to exit full screen

All Maps Images Shopping Videos More Settings Tools

About 1.230.000 results (0,71 seconds)



Hofstraat 110, 7311 KZ Apeldoorn

[Get directions](#)

Kadasterkantoren

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

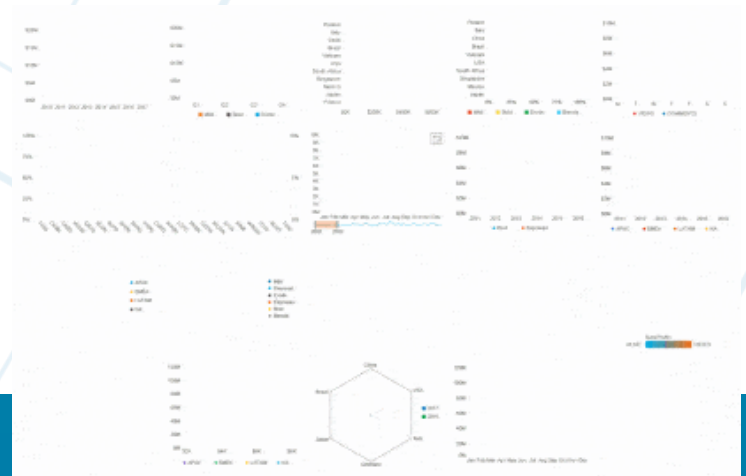
Hofstraat 110 7311 KZ Apeldoorn Telefoon receptie: 088-183 20 00. Routebeschrijving kantoor de Grift.

Particulier; Woningwaarde · Eigendom · Grenzen ...

Analytics Friendly

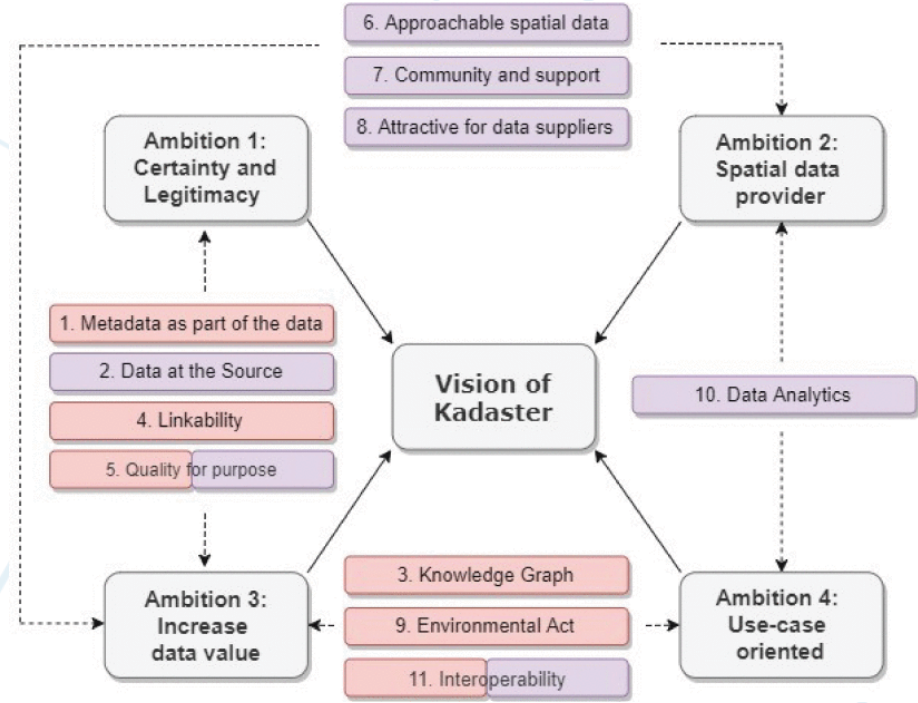
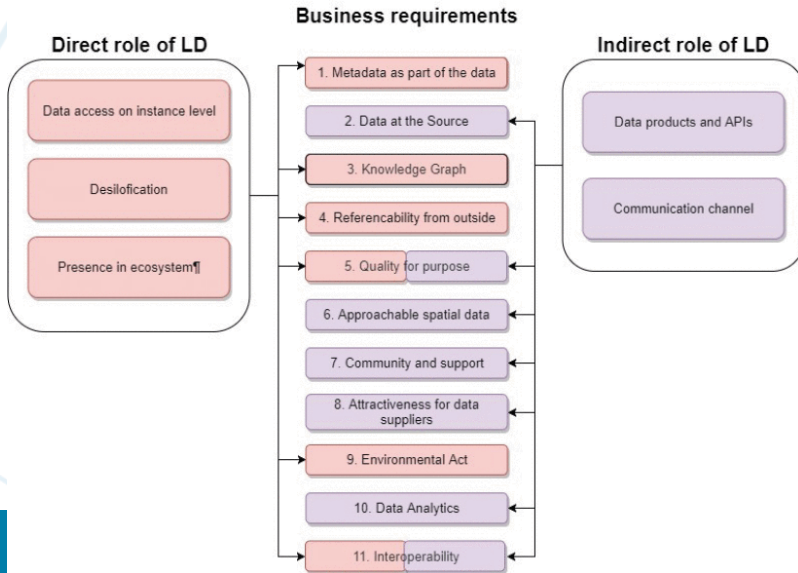
(Self Service GIS)

- Citizen (non GIS professional)
- Data at the Source – Data Ecosystem
- Semantics (Transparency, Reproducibility)
- 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.2020.3004041>

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Kadaster Data Platform

The development of the Spatial
Data Platform of the Future

Phase 1 - KDP

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;

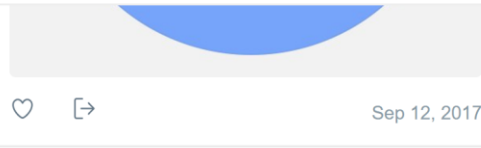
<https://brt.basisregistraties.overheid.nl/top10nl/id/gebouw/102625209>

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



Heart icon, Share icon, 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

Heart icon, Share icon, 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:

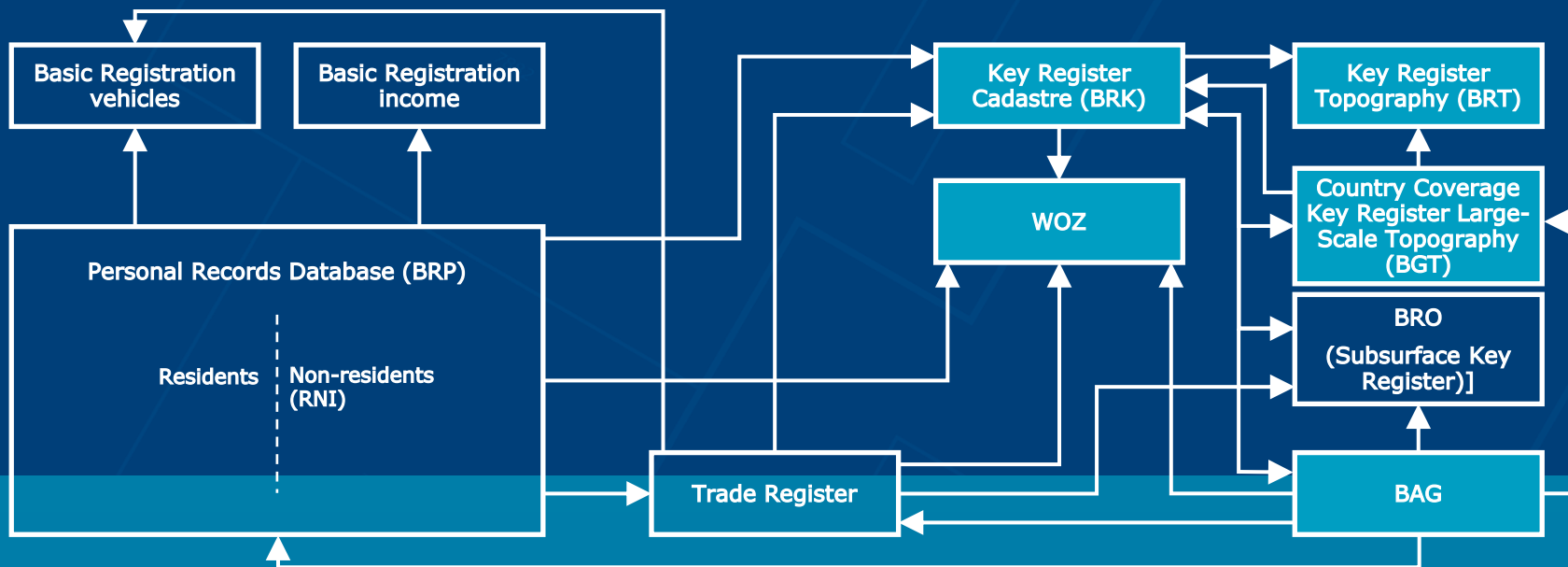
- Improvements in data models (the “ultimate” model)
- Data quality issues (completeness, metadata, etc)

My advise: Keep it simple

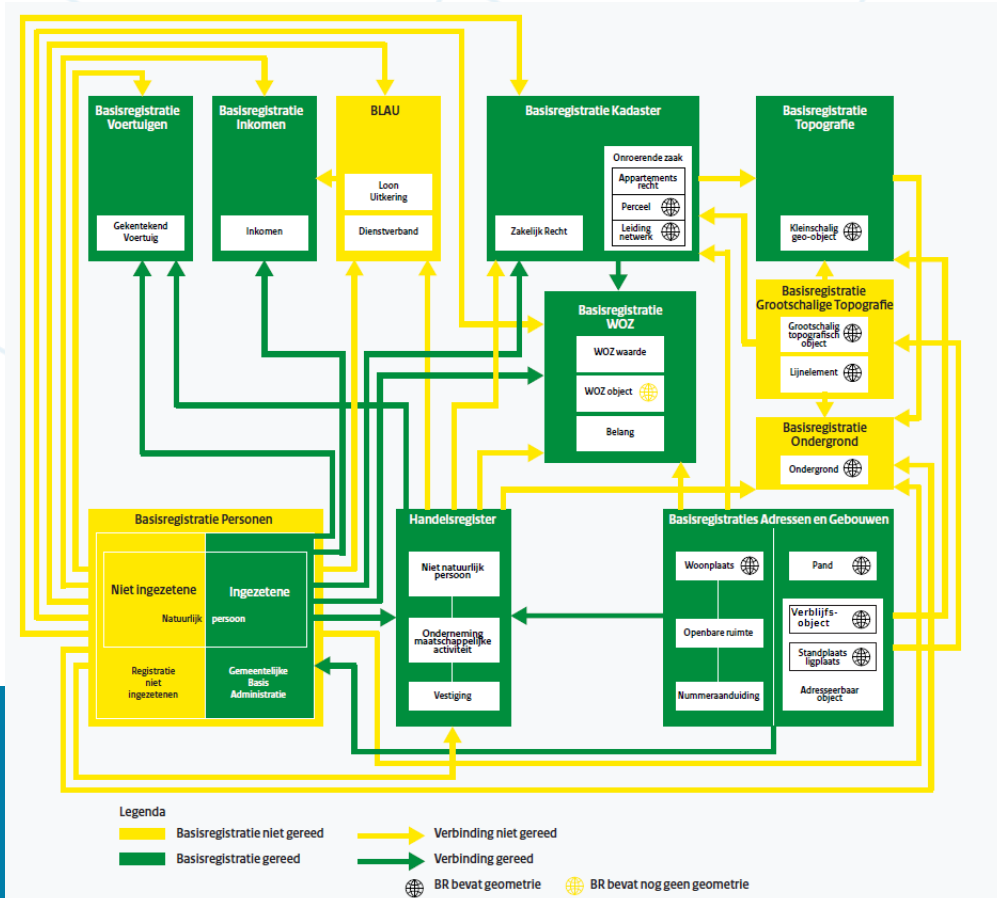
- Sparql queries complex
- Federation....ahum....
- GeoSparql partly supported
- 4 star Linked Data



key registers in the Netherlands



Dutch Humour: System of Silos



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

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?

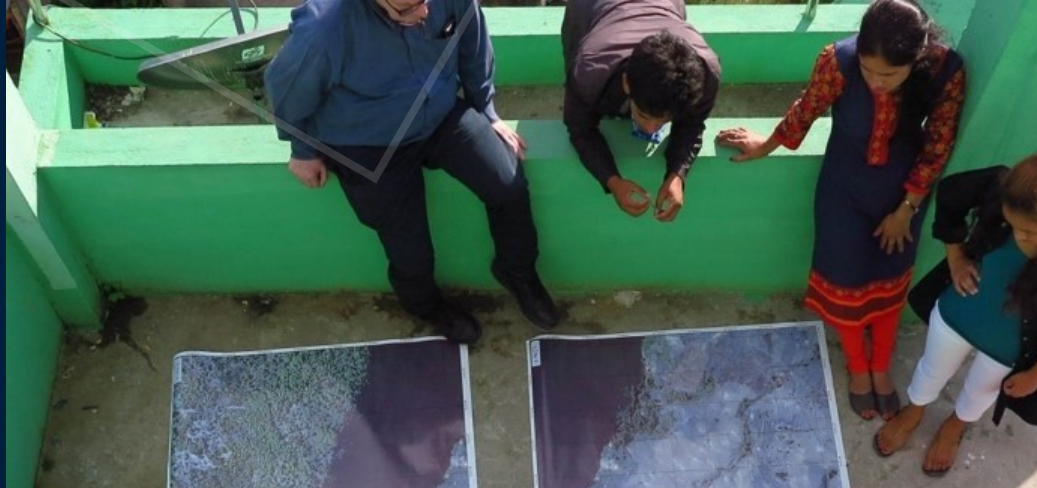


Geo-informatie voor iedereen

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

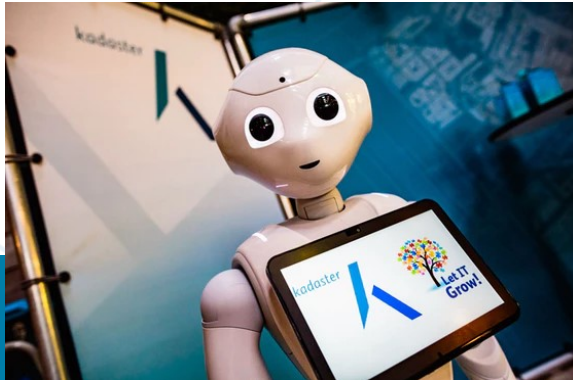
Making reliable data accessible to everyone. Through a single digital gateway. That is our job, by connecting and providing certainty.

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!



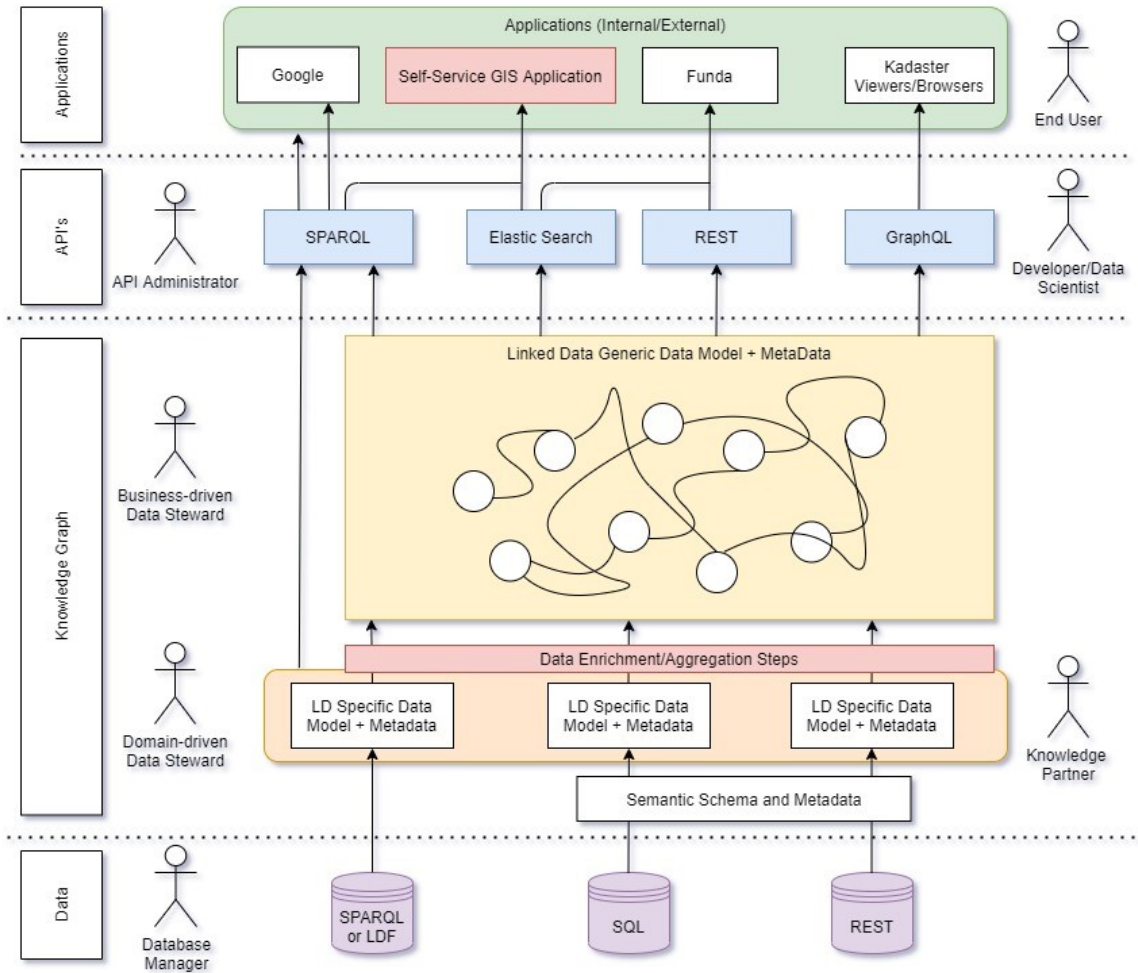
I search for a palace (BRT) with a surface of 1500 m² (BAG) which is a national trademark (RDE), and 100,000 lire the neighborhood (WAZ) in Berg en Bos (CBS).



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>



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

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Kadaster Knowledge Graph

Latest Developments on Usability

- Inspiration
- Easy/less SPARQL

Warning: Work in Progress!

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

Variables

vboId
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/brt/>
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 ?
gebouwjaar ?gebruiksdoel ?basisschoolAfstand ?reinstationAfstand
bind(iri(concat('https://data.kkg.kadaster.nl/id/verblijfsobje
?vbo
16 a sor:Verblijfsobject;
17 sor:gebruiksdoel/skos:prefLabel ?gebruiksdoel;
18 sor:maaktDeelUitVan ?gebouw;
19 sor:hoofdadres ?nummeraanduiding;
20 sor:oppervlakte ?vloerOppervlakte0 .
21 ?gebouw
22 a sor:Gebouw;
23
```



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



Kadaster Query Builder

The screenshot shows the Kadaster Query Builder interface. At the top, the browser address bar displays the URL `labs.kadaster.nl/demonstrators/querybuilder/index.html`. The page title is "QUERYBUILDER KKG-LIGHT".

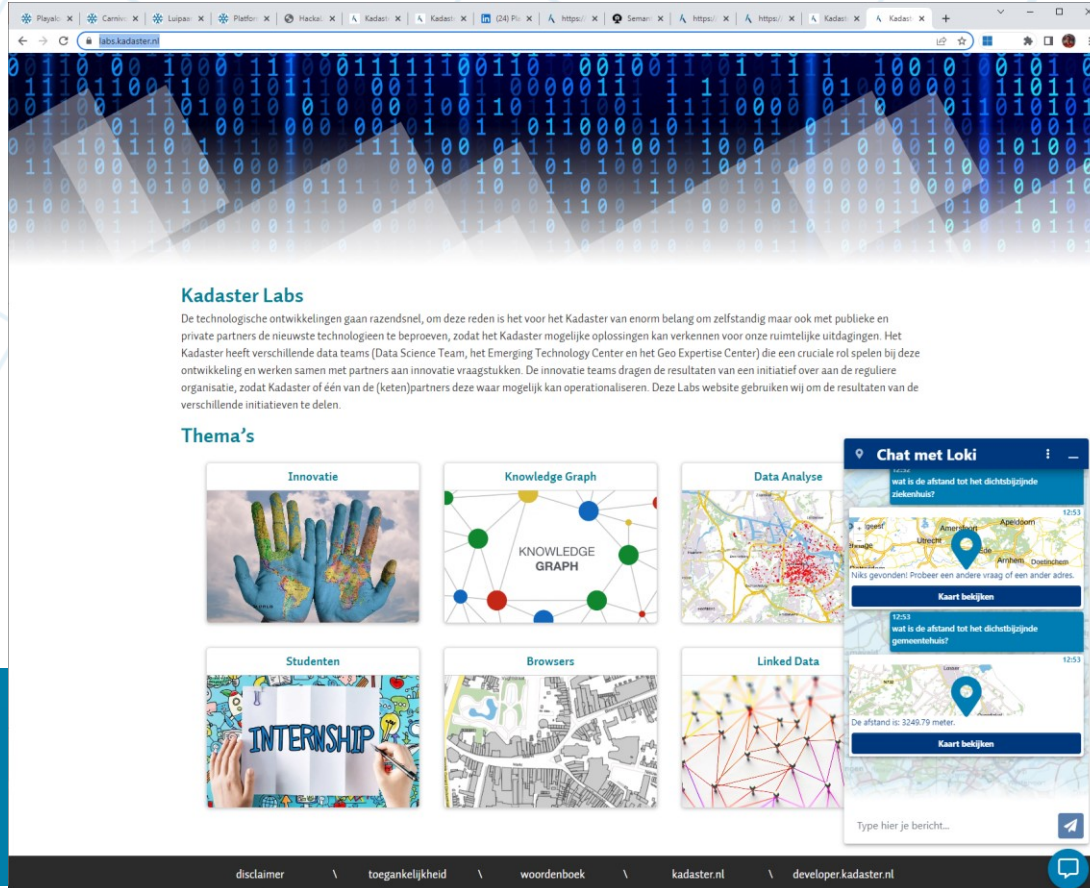
The main interface features a dropdown menu with "example 1" selected. Below it, a query is being built using a visual builder. The query consists of three main conditions connected by "And" operators:

- Condition 1: "Gebouw" (Building) with "gebruiksdoel" (Use) set to "winkelruimte" (Retail space).
- Condition 2: "Gebouw" (Building) with "bouwjaar" (Construction year) set to "from 1900 to 1940".
- Condition 3: "Gebouw" (Building) with "Ligt in" (Located in) set to "Gemeente 't Hertogenbosch" (Municipality 't Hertogenbosch).

Below the query builder, there is a play button to execute the query. The interface also includes options to "Toggle SPARQL editor", "Share", "Export query in JSON", and "Import query in JSON".

At the bottom, a map view is displayed, showing the results of the query overlaid on a map of the region around Empel and Giften. The map includes labels for various locations such as Hedel, Cruijffoort, Oud Empel, Empel, Rosmalen, Sprokkelbosch, Nuland, and Giften. The map is currently in "Normal" view, with options for "Grouped" and "Heatmap".

But, what if SPARQL is not needed?



Kadaster Labs

De technologische ontwikkelingen gaan razendsnel, om deze reden is het voor het Kadaster van enorm belang om zelfstandig maar ook met publieke en private partners de nieuwste technologieën te beproeven, zodat het Kadaster mogelijke oplossingen kan verkennen voor onze ruimtelijke uitdagingen. Het Kadaster heeft verschillende data teams (Data Science Team, het Emerging Technology Center en het Geo Expertise Center) die een cruciale rol spelen bij deze ontwikkeling en werken samen met partners aan innovatie vraagstukken. De innovatie teams dragen de resultaten van een initiatief over aan de reguliere organisatie, zodat Kadaster of één van de (keten)partners deze waar mogelijk kan operationaliseren. Deze Labs website gebruiken wij om de resultaten van de verschillende initiatieven te delen.

Thema's

- Innovatie
- Knowledge Graph
- Data Analyse
- Studenten
- Browsers
- Linked Data

Chat met Loki

12:53
wat is de afstand tot het dichtstbijzijnde ziekenhuis?

12:53
Niks gevonden! Probeer een andere vraag of een ander adres.

Kaart bekijken

12:53
wat is de afstand tot het dichtstbijzijnde gemeentehuis?

12:53
De afstand is: 3249,79 meter.

Kaart bekijken

Type hier je bericht...

disclaimer \ toegankelijkheid \ woordenboek \ kadaster.nl \ 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

Original text

Thank you ~~for inviting~~ me to your party last week.

Inputs

Thank you <X> me to your party <Y> week.

Targets

<X> for inviting <Y> last <Z>

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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The Case at the Dutch Land Registry

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