

24th November 2022
Brecht Van de Vyvere

KNowledge On Web Scale (KNOWS)

DE VLAAMSE DATA SPACE MET SOLID EN LDES



vlaanderen
verbeelding werkt

IDLab – UGent – IMEC
<https://knows.idlab.ugent.be/>

Read-Write Web
enabling Web clients

Linked Data
architectures
enabling organizations

Personal data pods

querying

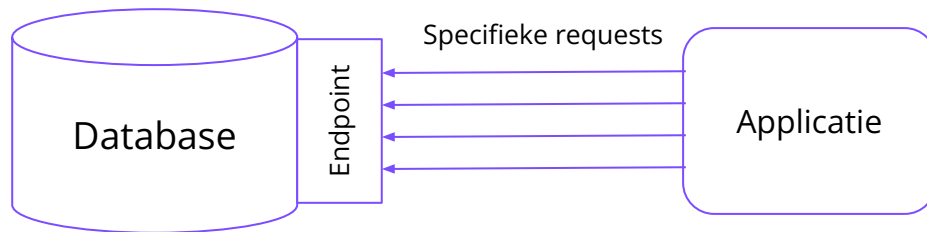
Stream
Reasoning

workflows &
orchestration

LD Event Streams
LD Fragments

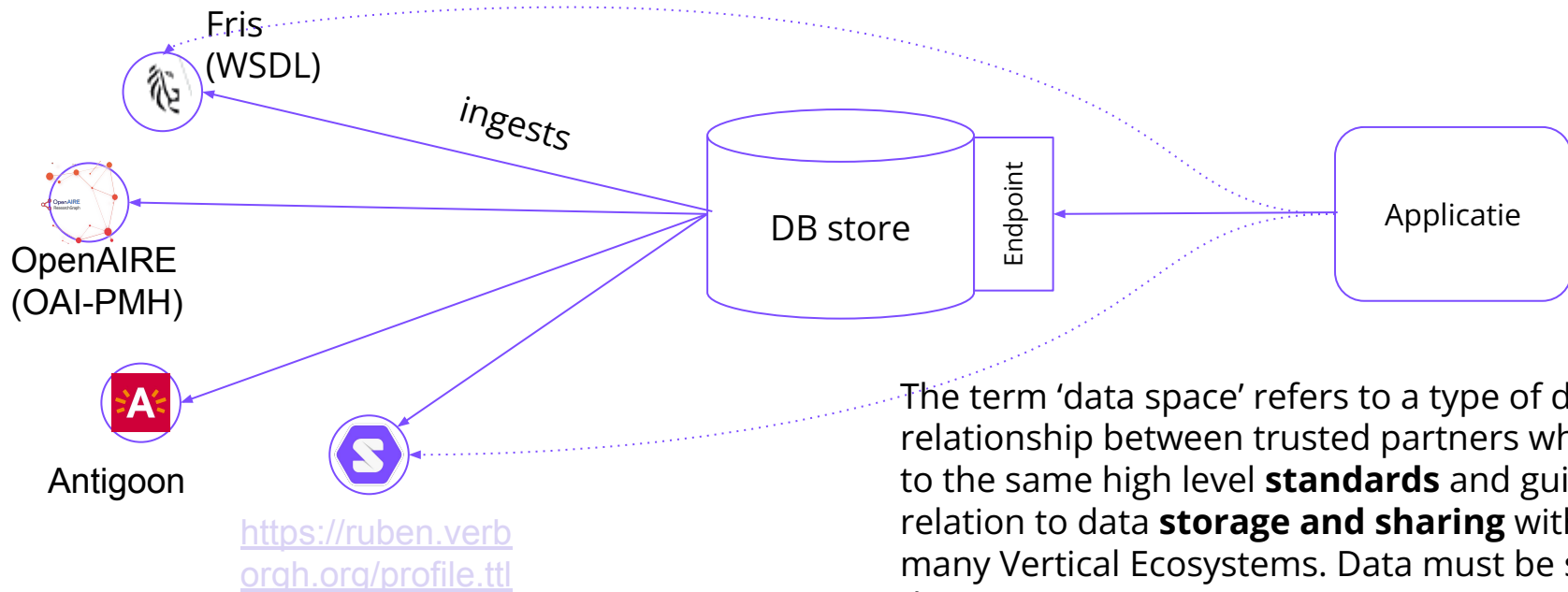
Knowledge graph
generation

Huidige situatie: applicatie bouwen



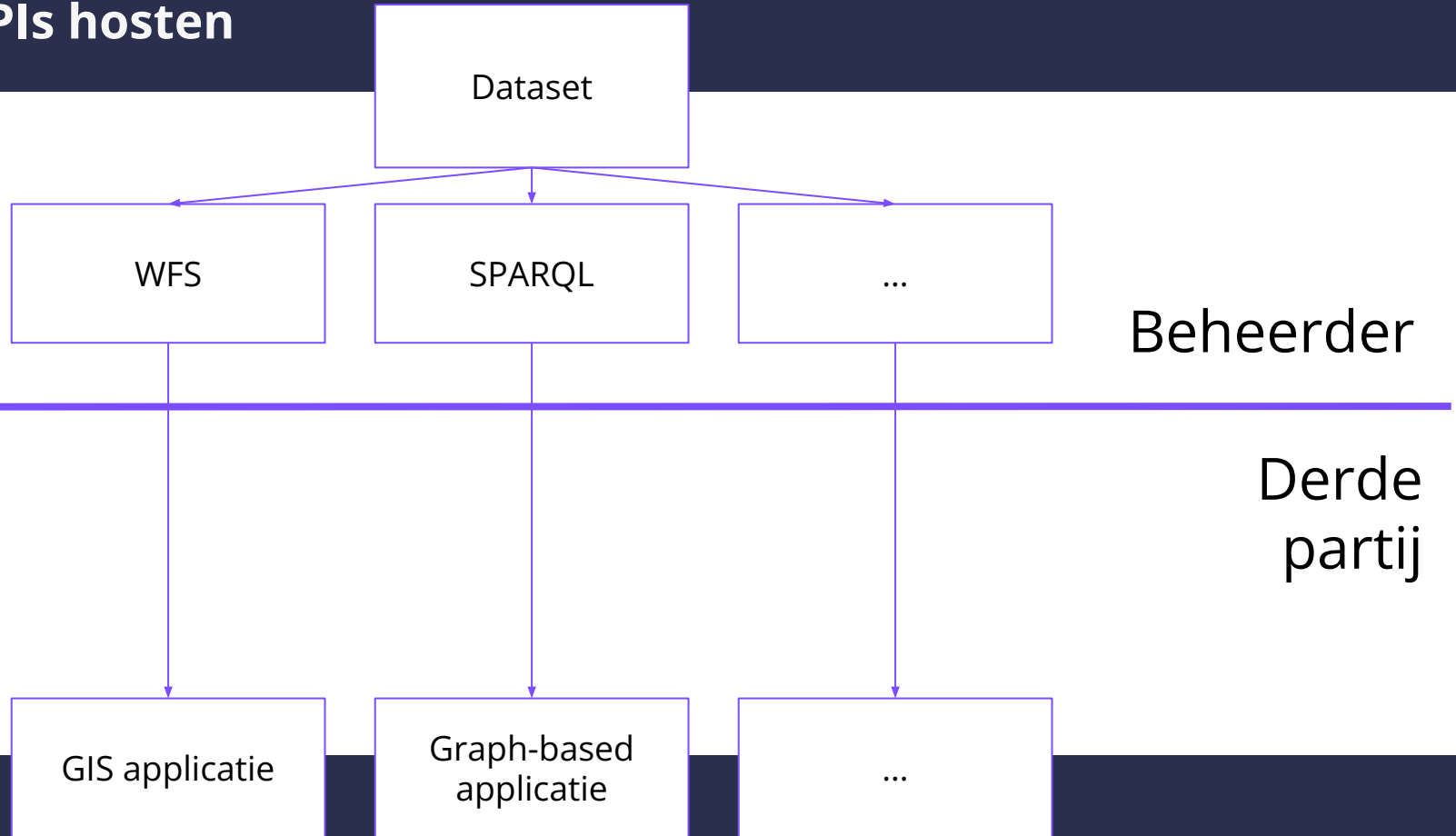
Wat is de beste API om dataset te publiceren?

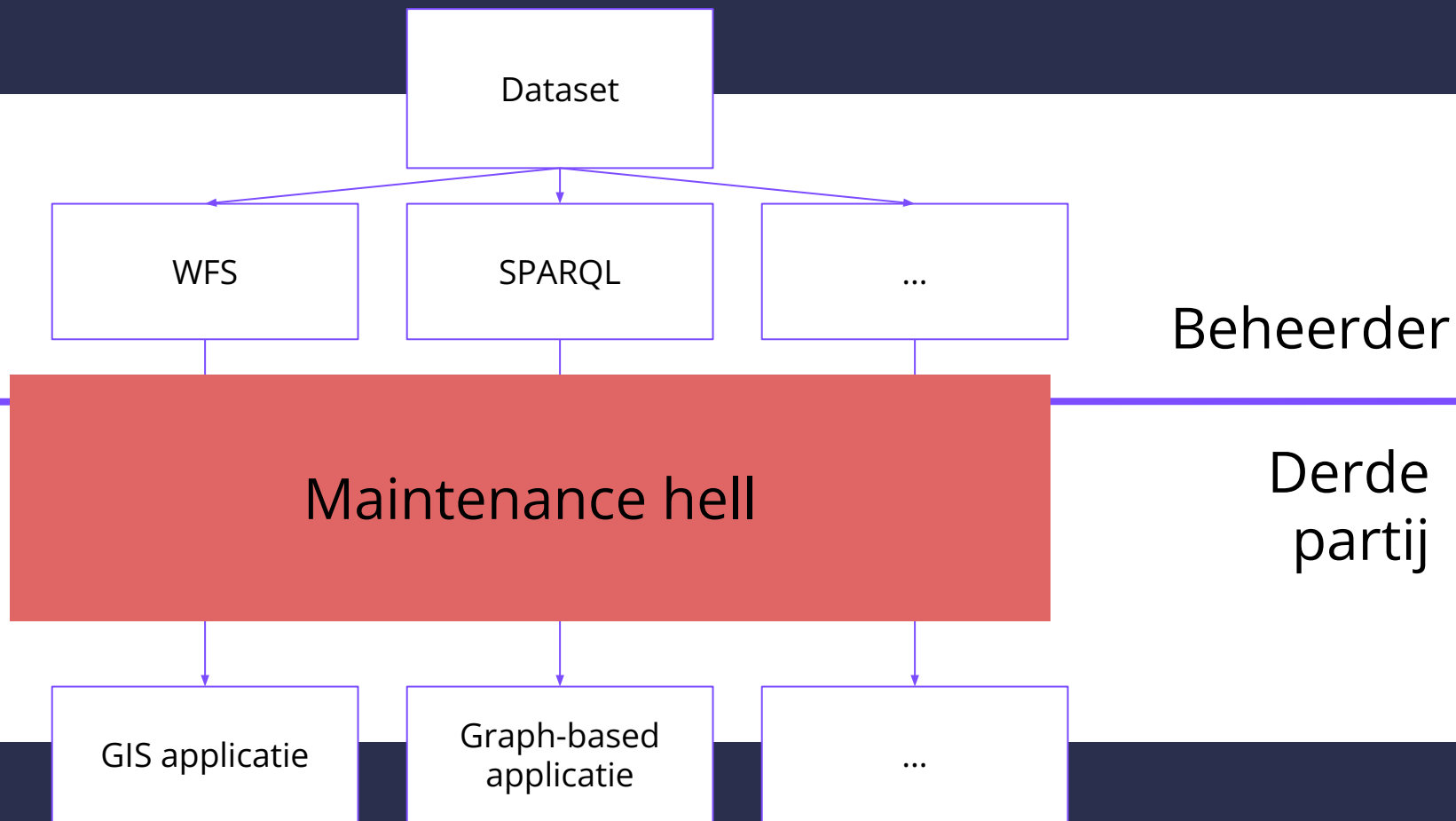
→ geautomatiseerde adoptie binnen data space*



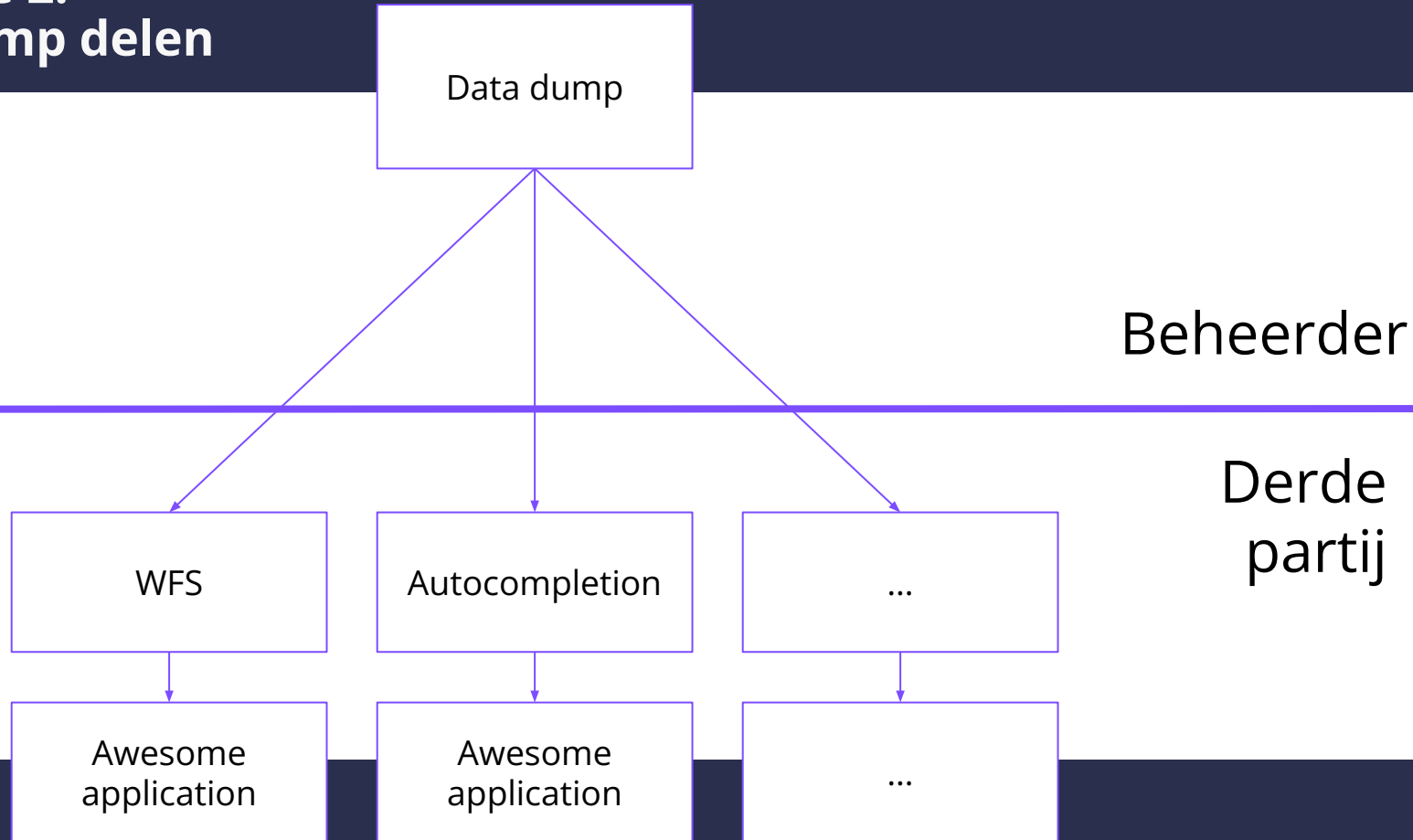
The term 'data space' refers to a type of data relationship between trusted partners who adhere to the same high level **standards** and guidelines in relation to data **storage and sharing** within one or many Vertical Ecosystems. Data must be stored at the **source**.

Methode 1: Query APIs hosten





Methode 2: Data dump delen



Data dump

Replication hell

Beheerder

Derde
partij

WFS

Autocompletion

...

Awesome
application

Awesome
application

...

Dataset bestaat uit DYNAMISCHE objecten

V1



Bed Lobkowitz - tentoonstelling Oude Vlaamse Kunst (1913)

V2



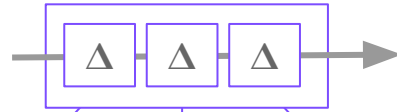
Bed Lobkowitz - collectie opstelling

V3



Bed Lobkowitz - tentoonstelling Piet Stockmans (1968)

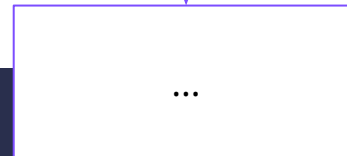
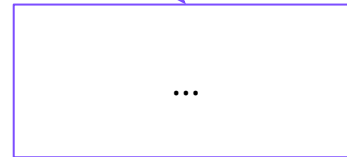
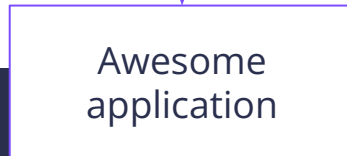
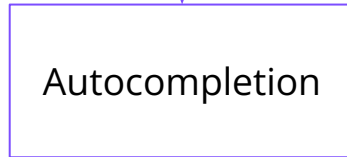
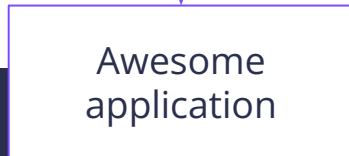
LDES = event sourcing on the Web



→ In-sync blijven met event source is core concern

Beheerder

Derde partij



The Linked Data Event Streams (LDES) specification

<https://w3id.org/ldes/specification>

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- 1 Introduction
- 2 Fragmenting and pagination
- 3 Retention policies
 - 3.1 Time-based retention policies
 - 3.2 Version-based retention policies
- Conformance
- References
 - Normative References

Linked Data Event Streams

Living Standard, 15 March 2021

This version:

<https://w3id.org/ldes/specification>

Issue Tracking:

[GitHub](#)

Editor:

Pieter Colpaert

(0) PUBLIC COMMENT To the extent possible under law, the editors have waived all copyright and related or neighboring rights to this work. In addition, as of 15 March 2021, the editors have made this specification available under the [Open Web Foundation Agreement Version 1.0](#), which is available at <http://www.openwebfoundation.org/legal/the-owf-1-0-agreements/owfa-1-0>. Parts of this work may be from another specification document. If so, those parts are instead covered by the license of that specification document.

Abstract

A Linked Data Event Stream is a collection of immutable objects (such as version objects, sensor observations or archived representations). Each object is described in RDF.

§ 1. Introduction

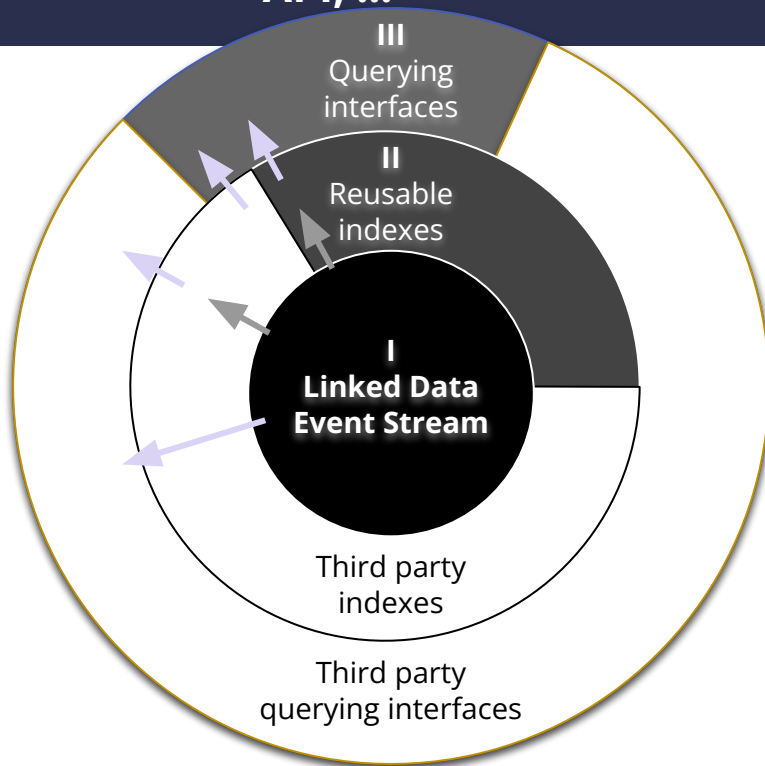
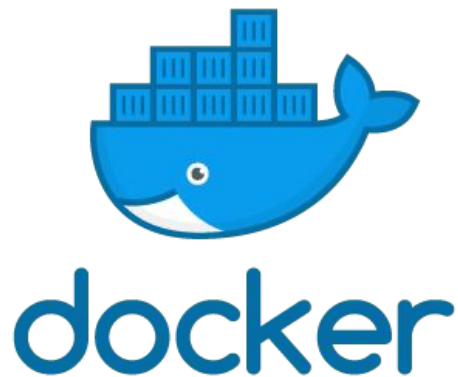
A Linked Data Event Stream (LDES) (`ldes:EventStream`) is a collection of immutable objects, each object being described using a set of RDF triples ([\[rdf-primer\]](#)).

This specification uses the [TREE specification](#) for its collection and fragmentation (or pagination) features, which in its turn is compatible to other specifications such as [\[activitystreams-core\]](#), [\[VOCAB-DCAT-2\]](#), [\[LDP\]](#) or [Shape Trees](#). For the specific compatibility rules, read the [TREE specification](#).

An `ldes:EventStream` is an `rdfs:subClassOf` the `tree:Collection` class. It extends the `tree:Collection` class by saying all of its members are immutable, and you can thus only add members to the collection.

Note: When a client once processed a member, it should never have to process it again. A Linked Data Event Stream client can thus keep a list (or cache) of already processed member IRIs. A reference implementation of a client is available as part of the Comunica framework on [NPM](#) and [Github](#).

Gebruikers willen nog steeds een SPARQL endpoint, GraphQL interface, OGC API, ...



**Datasetbeheerder kan deze aanbieden met lagere prioriteit
of gebruikers zetten deze zelf op**

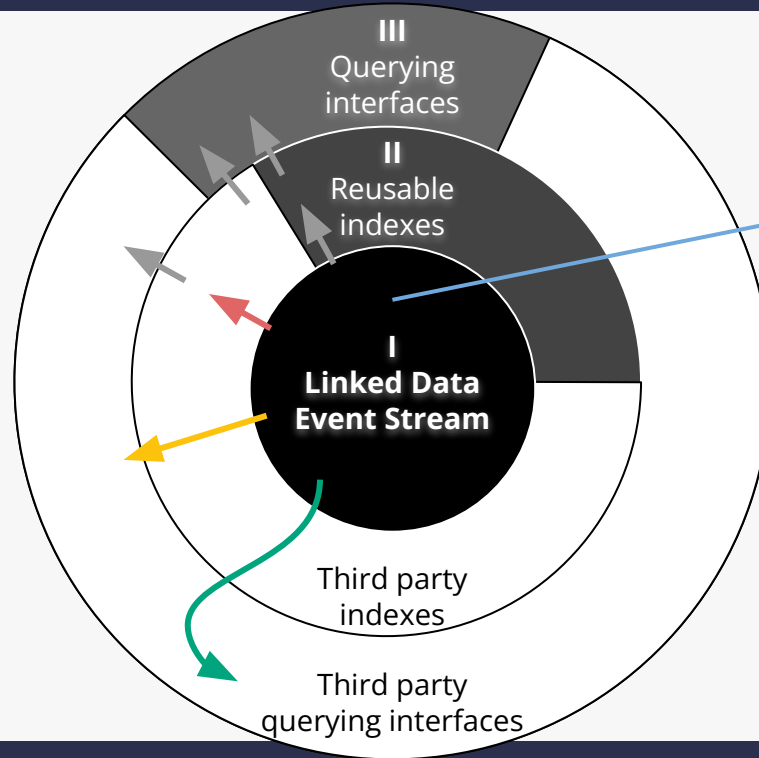
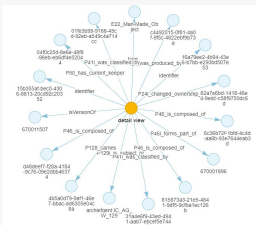
Collections of Ghent ecosystem

Indexed by substring

door IDLab

SPARQL endpoint &
Subject pages

door stad Gent



Voor alle objecten,
termen en personen
van een instelling [1]

door District09

Search API (GraphQL)

door Inuits

Greenmov - Blue Bike LDES

root node

leaf node

← → ↻ 🔒 treecg.github.io/Blue-Bike-to-OSLO

```
<_:20220908T0813502ett1 a <https://w3id.org/tree#
<https://w3id.org/tree#node> <https://treecg.g
<https://w3id.org/tree#path> <http://purl.org/
<https://w3id.org/tree#value> "2022-09-08T08:1
_:20220908T0821352ett1 a <https://w3id.org/tree#
<https://w3id.org/tree#node> <https://treecg.g
<https://w3id.org/tree#path> <http://purl.org/
<https://w3id.org/tree#value> "2022-09-08T08:2
_:20220908T0833332ett1 a <https://w3id.org/tree#
<https://w3id.org/tree#node> <https://treecg.g
<https://w3id.org/tree#path> <http://purl.org/
<https://w3id.org/tree#value> "2022-09-08T08:3
_:20220908T0855212ett1 a <https://w3id.org/tree#
<https://w3id.org/tree#node> <https://treecg.g
<https://w3id.org/tree#path> <http://purl.org/
<https://w3id.org/tree#value> "2022-09-08T08:5
```

← → ↻ 🔒 treecg.github.io/Blue-Bike-to-OSLO/history/20220908T081350.ttl

```
<https://blue-bike.be/resourcereports/103#2022-09-08T10:11:03>
<http://purl.org/dc/elements/1.1/date> "2022-09-08T10:11:03"
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<https://purl.eu/ns/mobility/passenger-transport-hubs#Mobilit
<https://blue-bike.be/resourcereports/vervoermiddel/103#202
<https://purl.eu/ns/mobility/passenger-transport-hubs#locatio
<https://purl.eu/ns/mobility/passenger-transport-hubs#number>
<https://purl.eu/ns/mobility/passenger-transport-hubs#propuls
<https://purl.eu/ns/mobility/passenger-transport-hubs#service
<https://purl.eu/ns/mobility/passenger-transport-hubs#status>

<https://blue-bike.be/resourcereports/104#2022-09-08T10:11:57>
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<http://purl.org/dc/terms/type> <https://blue-bike.be/resource
<https://purl.eu/ns/mobility/passenger-transport-hubs#Mobilit
<https://blue-bike.be/resourcereports/vervoermiddel/104#202
<https://purl.eu/ns/mobility/passenger-transport-hubs#locatio
<https://purl.eu/ns/mobility/passenger-transport-hubs#number>
<https://purl.eu/ns/mobility/passenger-transport-hubs#propuls
<https://purl.eu/ns/mobility/passenger-transport-hubs#service> <https://blue-bike.be/#me>;
<https://purl.eu/ns/mobility/passenger-transport-hubs#status> <https://blue-bike.be/resource
```

class OSLO-Passenger Transport Hubs

ResourceReport

- + location: Location [0..*]
- + meansOfTransport: MeansOfTransport [0..*]
- number: Integer
- + propulsion: PropulsionType [0..*]
- reportTime: DateTime
- service: MobilityService [0..*]
- + status: ResourceStatus [0..*]
- + type: ResourceType [0..*]

Voorspellen fietsbeschikbaarheden

Welcome to GreenMov

Check the predictions of bikes availability at your station of arrival

Ok let's go



New search

Nearest station



1.5 Kms

Antwerpen-Centraal
Koningin Astridplein 27

Availability of bikes

25 /50

Fri 14 Oct 10:00

New Search

Later

Current

From

Departure point

To

Destination

Time of departure

Fri 14 Oct 16:22

Confirm

Select a Train

From: Antwerpen-Central

To: Gent-Sint-Pieters

Date: Fri 14 Oct 16:22

IC 438 - To Brussel & Kortrijk

15:00 - 15:40 (40min)

IC 438 - To Brussel & Kortrijk

16:00 - 16:40 (40min)

IC 438 - To Brussel & Kortrijk

16:20 - 17:00 (40min)

IC 438 - To Brussel & Kortrijk

16:30 - 17:00 (40min)

Results



1.5 Kms

Arrival: Gent-Sint-Pieters
Koningin Maria Hendrikaplein

35

/50

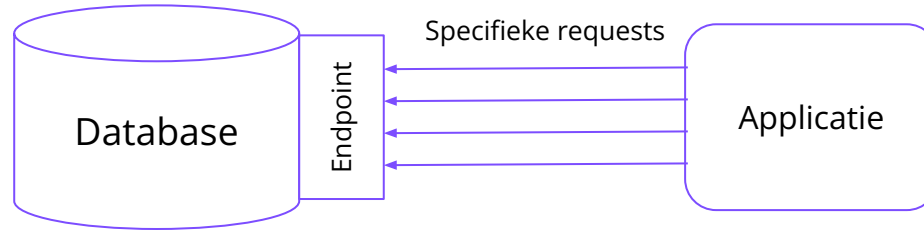
bikes available on average

Fri 14 Oct 16:40


FLANDERS

<https://green-mov.eu/>

Applicatie: hardcodeer niet 1 specifieke API



There is an infinite number of APIs—is this the right one?

1. **Low evolvability**

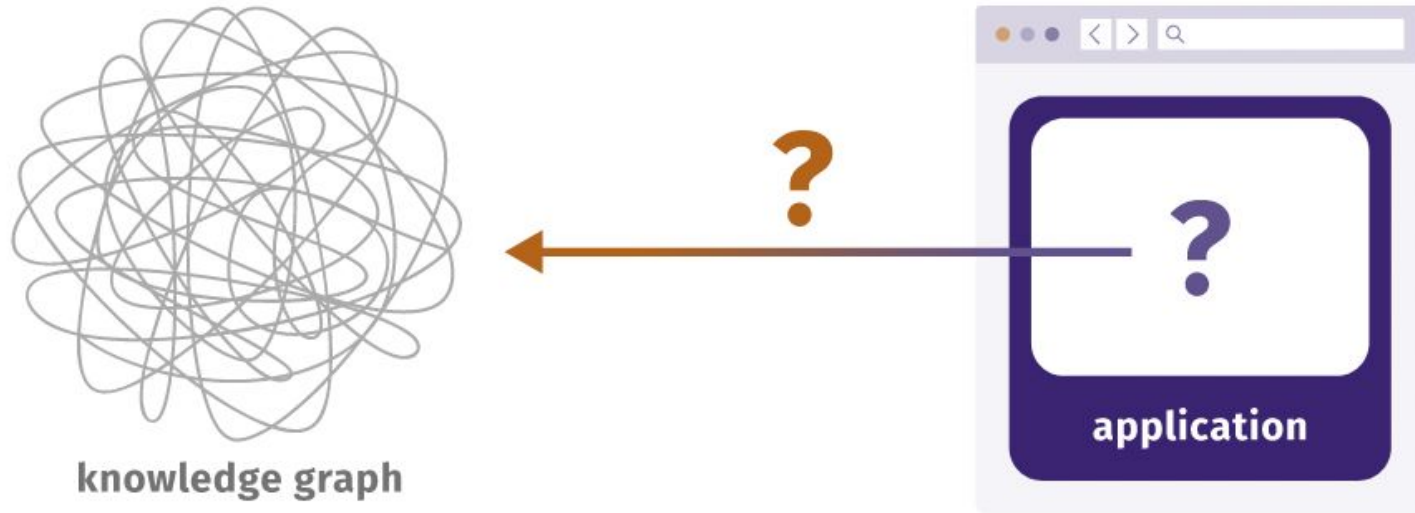
Storage provider cannot change querying APIs once an app coded against it

2. **Low scalability**

Successful apps will run more queries without any benefit for the storage provider

3. **Querying a closed world**

Solid: scheiding tussen data en applicatie



Apps and services appear similarly, but they blend data from many sources.

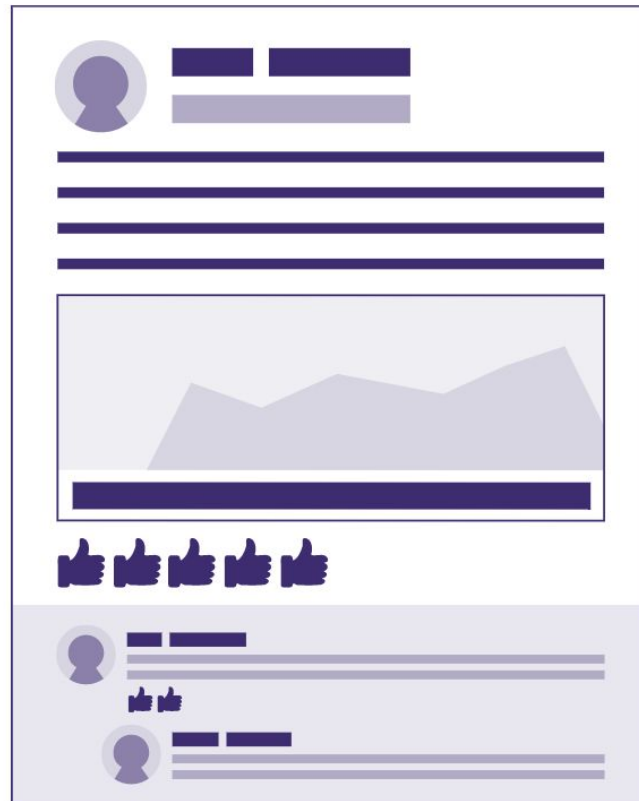
Author's name and latest profile picture
stored in author's personal data pod

Work-related opinion about an article
stored in data pod of author's company

Discussed article title and photo
stored in news website's data pod

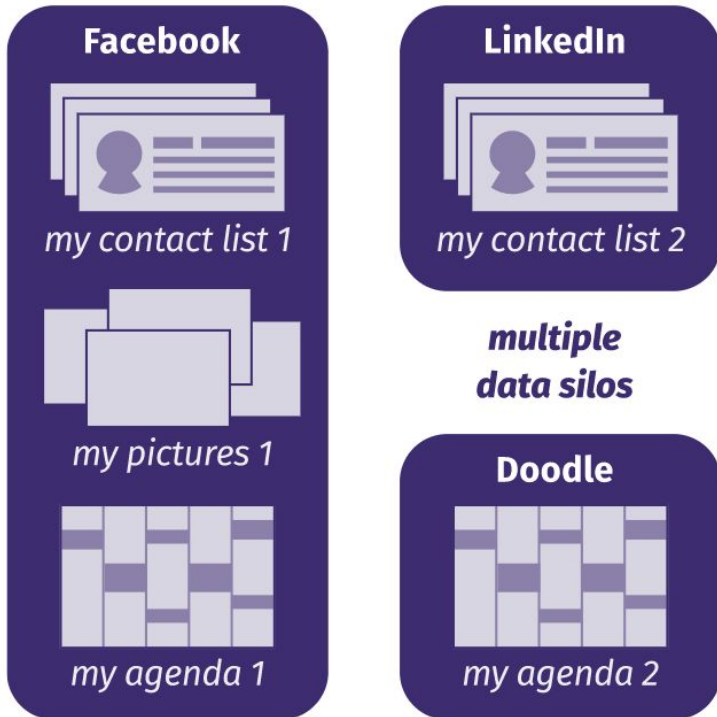
Likes on this post
each one in different individuals' data pods

Comments on this post
each one in different individuals' data pods

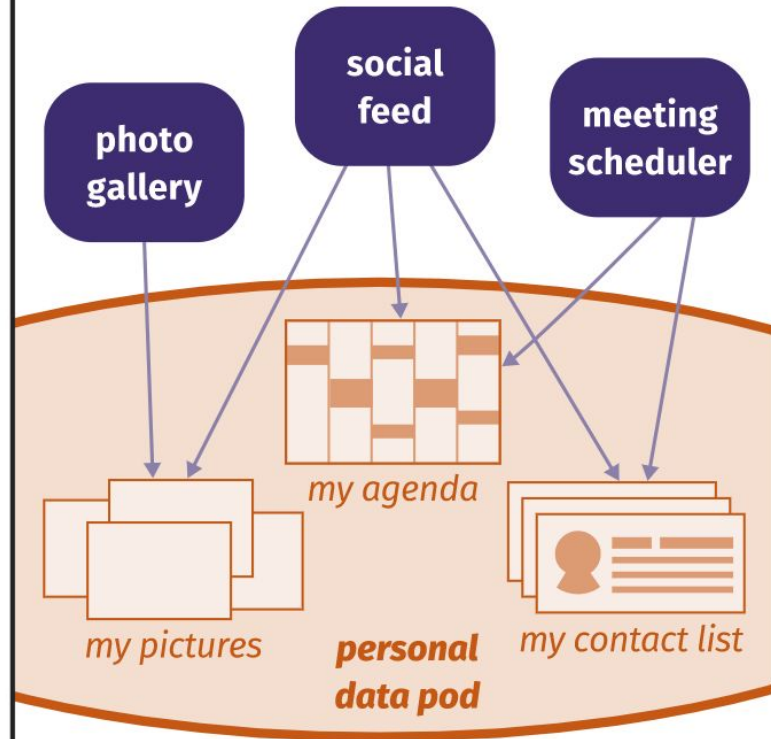


A person can grant apps and people access to very specific parts of their data.

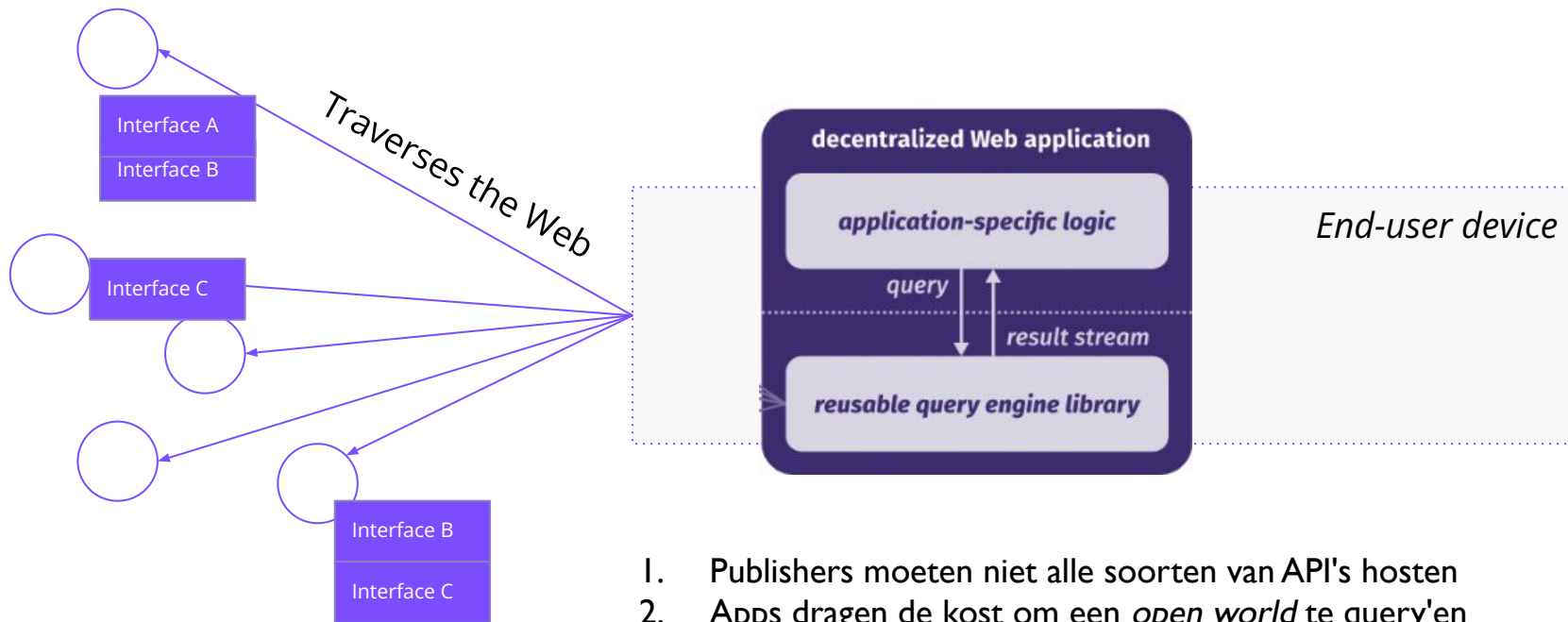
centralized Web applications



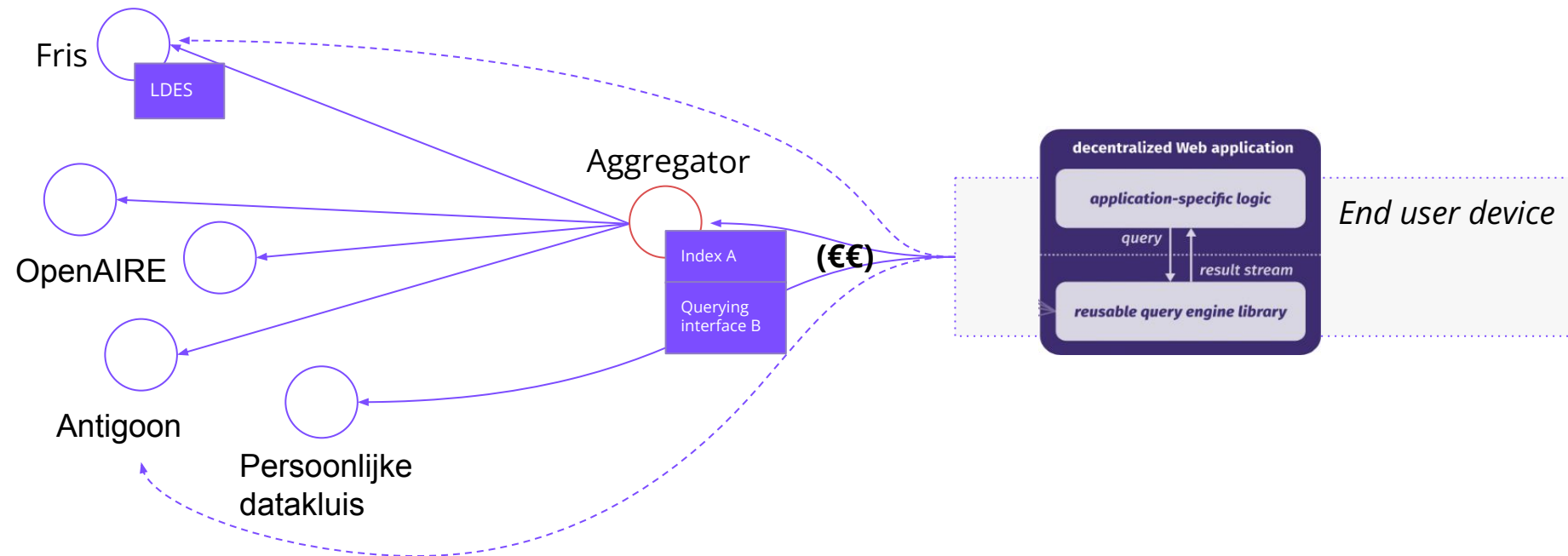
decentralized Web applications



Architectuur om slimmere applicaties te bouwen



Aggregator om sneller antwoorden te krijgen



The Solid Data Stack is a future-oriented strategy.

What?

How?

Where?

Application	<i>banking app, calendar app, list component, automated client...</i>	Read/write data presentation for end users, or automated processes
Representation	<i>Turtle, JSON-LD, Turtle-star, N3, ontologies, shapes</i>	Domain-agnostic formatting of data in ontologies, and shapes
Organization	<i>Pods, Shape Trees, LDES (will include caches, indexes...)</i>	Domain-aware data layout within or across locations
Access	<i>LDP, SPARQL, VC, TPF...</i>	Exposing data in a partitionable and secure way
Management	<i>LDN, Websockets, type indexes (and future technologies)</i>	Data consistency in both local and remote systems
Logical Storage	<i>quadstore, filesystem, API, legacy system...</i>	Data layout enabling specific kinds of lookups
Physical Storage	<i>hard drive, sensor...</i>	Raw hardware-based data access

Software

The Community Solid Server

For

1. researching storage utility functionality
2. building use case driven aggregators



Comunica

The querying engine over heterogeneous interfaces



Who are we talking to: the community

Partners (Datanutsbedrijf, Digita, Konsolidate, DataVillage...)

Target audience - think about clusters in the data ecosystem

- manage my career
- manage my family
- manage my health
- manage my home
- manage my mobility
- media, telco's

Interested?

Contact: **esther.delooof@ugent.be**

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