

Scalable Policy-aware Linked Data arChitecture for prlvacy, trAnsparency and compLiance (SPECIAL)

Sabrina Kirrane, WU

17 October 2019

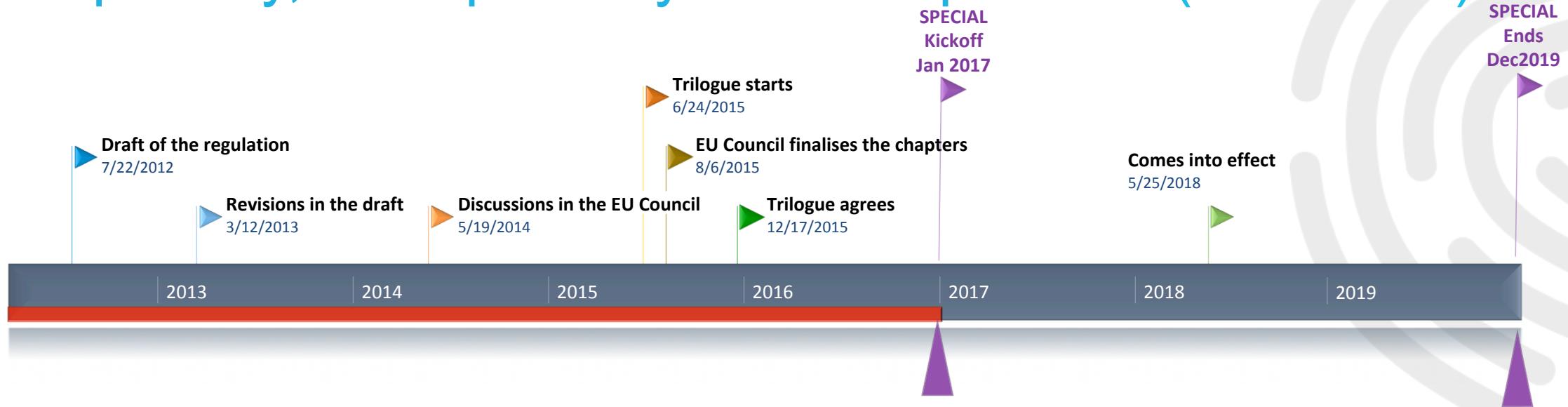
ETIS Meeting



Horizon 2020
European Union funding
for Research & Innovation



Scalable Policy-aware Linked Data arChitecture for prlvacy, trAnsparency and compLiance (SPECIAL)



Companies whose business models rely on personal data and for which the GDPR is both a challenge and an opportunity

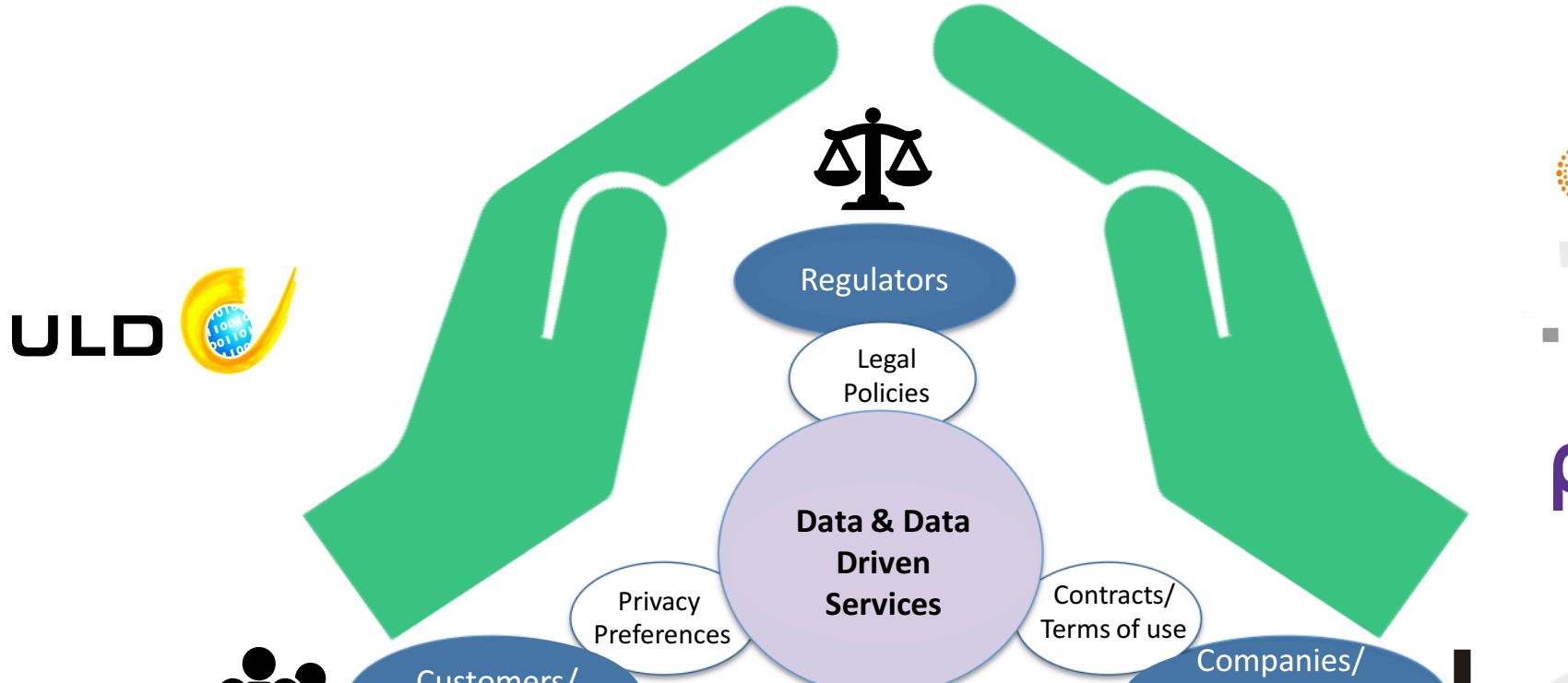


Data subjects who would like to declare, monitor and optionally revoke their (often not explicit) preferences on data sharing

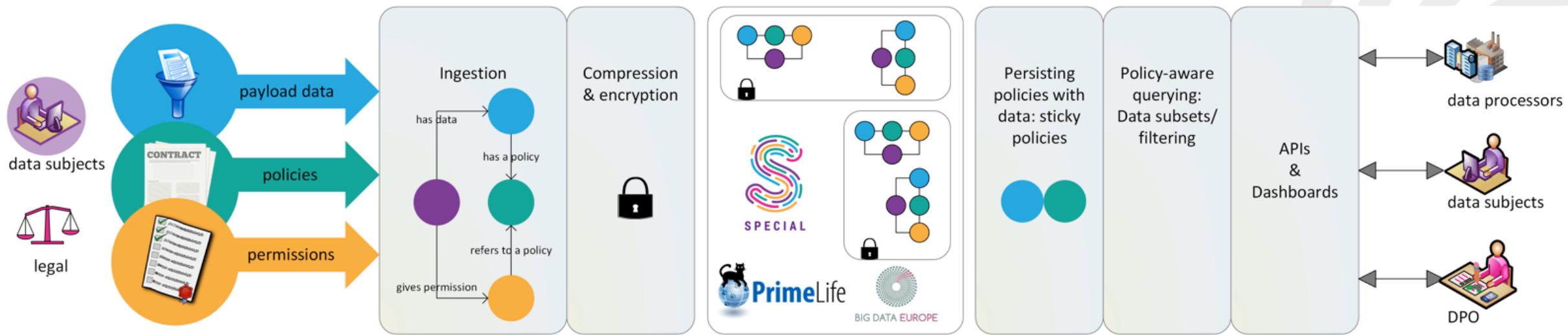


Regulators who can leverage technical means to check compliance with the GDPR

SPECIAL Aims



SPECIAL Technical Foundations



SPECIAL leverages past infrastructure and lessons learned

- ❖ **Big Data Europe** scalability and elasticity
- ❖ **PrimeLife** policy languages, access control policies, release policies and data handling policies
- ❖ The **Platform for Privacy Preferences Project** (P3P) and the **Open Digital Rights Language** (ODRL) vocabularies

The Proximus Use Case

A Tourist Recommender App



Proximus Use Case

- ❖ A Tourist Recommender APP based on Proximus personal data
- ❖ Personal data requested:
 - Location from APP or browser (not our network)
 - Television Viewing
 - Browsing history (simulated data)
- ❖ Prototype needs ‘Technology Readiness Level’ 4 = “Technology validated in Lab”



Events at the Belgian Coast at your fingertips

Sign up for free for intelligent tourist event recommendations tailored to you.

At least one of the following data categories is needed to make recommendations among a large number of events.

Location

Television data

Browsing history

AGREE

A user interface section showing three dropdown menus for data categories. Each menu has a small purple icon: a location pin for 'Location', a television set for 'Television data', and a globe for 'Browsing history'. Below each menu is a small downward arrow. At the bottom right is a purple rectangular button with the word 'AGREE' in white capital letters.

Proximus Use Case

❖ Actors

- 15 Data Subjects (PXS employees / consultants)
- Personal Data from Data Subjects
- Proximus is Data Controller
- MS Azure is Data Processor

❖ Applications

- “Events Nearby” APP
- User Interface for Data Subject = Privacy Dashboard (prototype)
- Recommender Engine (simulated)



Events at the Belgian Coast at
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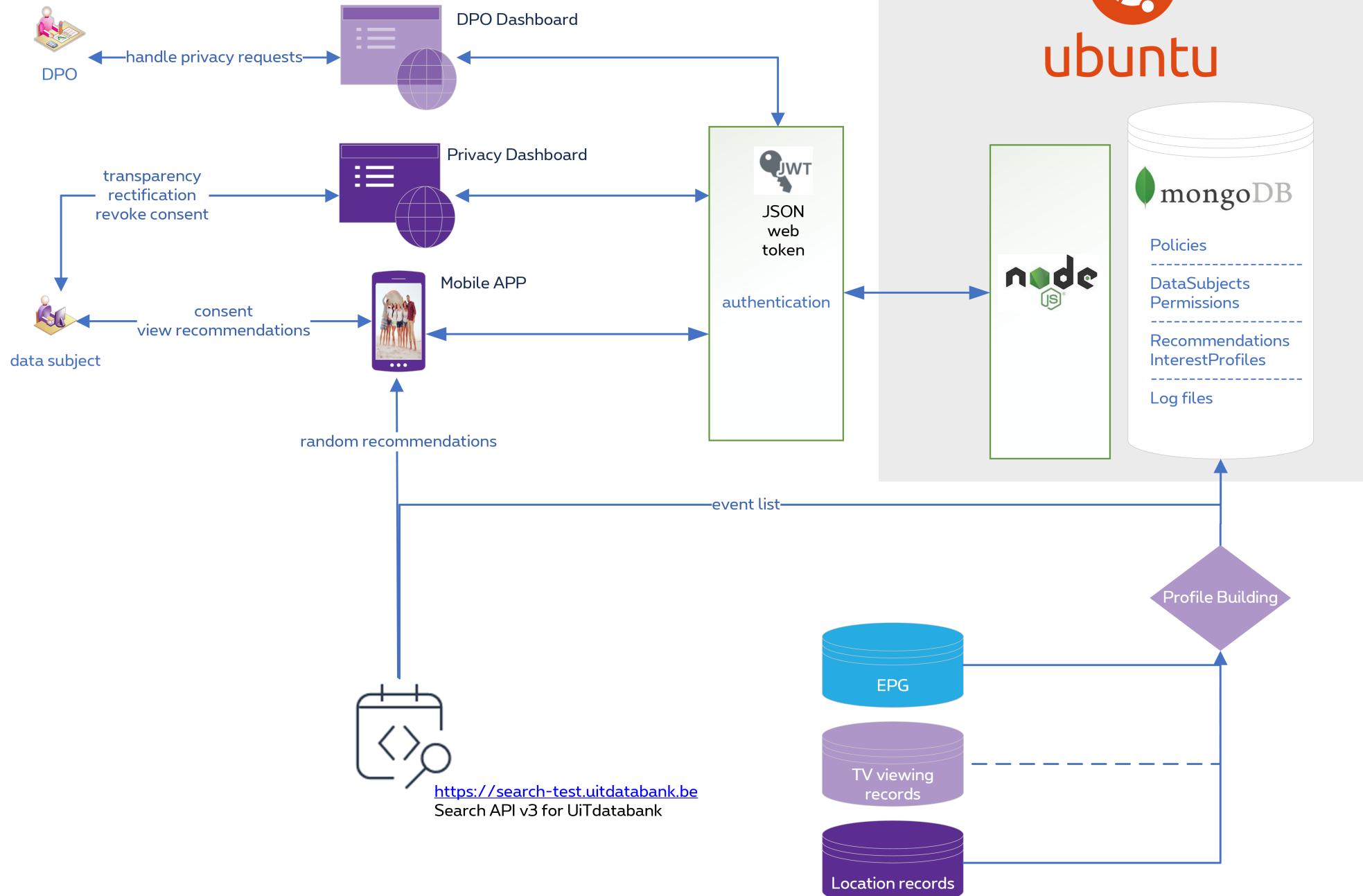
Location	
Television data	
Browsing history	

AGREE

The Proximus Use Case

The Architecture





The Proximus Use Case

The Mobile App



The Mobile App



Fill in in your userid,
pwd and press "login"



The Mobile App



Choose your privacy settings

You can benefit from better event recommendations by telling us what you're interested in. But you can also use our service without giving us any data.

General events

For general event recommendations we don't need personal data. However, it could happen that we inform you about events you're not interested in.

Personalized events

For personalized event recommendations we use your location information, TV and browsing behavior in order to inform you about events that interest you.

AGREE

You can choose either “general events” or “personalized events”. In the latter case, a dropdown box will open allowing you to choose in more detail, the personal data that you want to share.

Personalized events

For personalized event recommendations we use your location information, TV and browsing behavior in order to inform you about events that interest you.

Configure data

Below you can configure which data we can use to personalize your events recommendations.

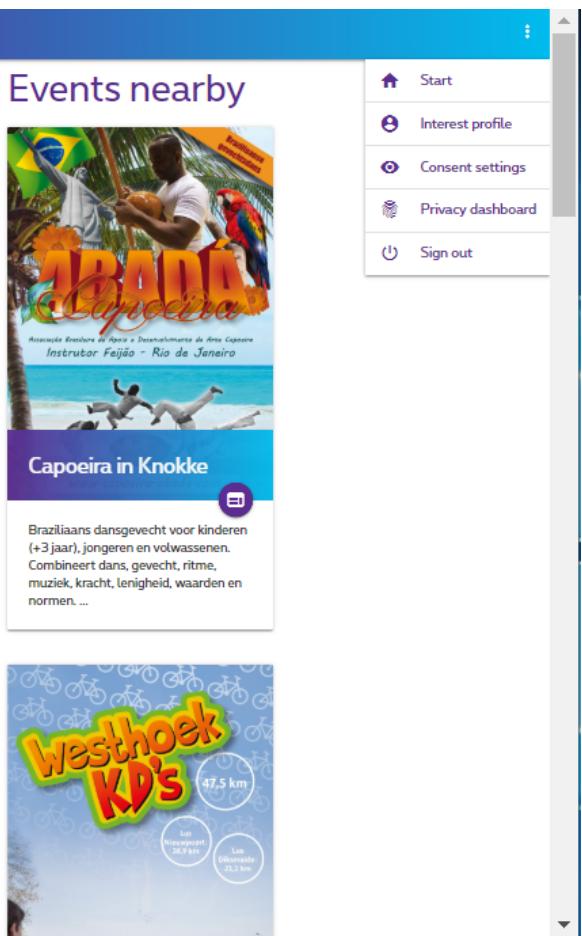
Location
Yes, I agree that Proximus uses my location data based on my smartphone.

Television data
Yes, I agree that Proximus uses my TV viewing records.

Browsing history
Yes, I agree that Proximus uses the categories of websites I visited.

The Mobile App

proximus



Interest profile

These are keywords that describe your interest.

Based on TV viewing	
Documentary	✓
Music	✓
History	✓
Gastronomy	✓
Movies	✓
Tourism	✓
Family	□
Based on visited places	
Brussels	✓
Berlin	✓
Vienna	✓
Based on browsing	
Privacy	✓
H2020	✓
GDPR	✓

Display Events based on the users interest profile

❖ Interest Profile

- Location from APP or browser (not our network)
- Television Viewing
- Browsing history (simulated data)

The Proximus Use Case

The Dashboard



The Privacy Dashboard



Sign in

To access your privacy dashboard please log in with your service credentials.

Your email

Password

SIGN IN

[I forgot my password.](#)

This privacy dashboard is provided by Proximus. You can find more on <https://www.proximus.be>. For further information, please contact privacy@proximus.be.

Fill in in your userid, pwd and press “login”

The Privacy Dashboard

The screenshot shows the Proximus Events Nearby - Privacy Settings dashboard. The left sidebar includes links for Home, About, My profile, About Proximus Events Nearby, Data, My data, Log, and Permissions. The main content area has a purple header "Proximus Events Nearby - Privacy Settings". It features three cards: "MY PROFILE" (with a person icon), "MY DATA" (with binary code), and "THIRD PARTIES" (with two people connected by a dashed circle). Below these are sections for "My profile", "My credentials" (with an '@' icon), and "My devices" (showing the number 3). A large speech bubble on the right side contains the text: "Using the dashboard you have access to:" followed by a bulleted list: ■ Privacy settings ■ Profile ■ Data processing ■ Data sharing.

Home

About

My profile

About Proximus Events Nearby

Data

My data

Log

Permissions

Proximus Events Nearby - Privacy Settings

Home

MY PROFILE

MY DATA

THIRD PARTIES

My profile

My credentials

My devices

3

Using the dashboard you have access to:

- Privacy settings
- Profile
- Data processing
- Data sharing

The Privacy Dashboard

Proximus Events Nearby - Privacy Settings



About Proximus Events Nearby

Controller(s):

Proximus SA

The Proximus Group (previously known as Belgacom Group) is the largest telecommunications company in Belgium, headquartered in Brussels. Proximus Group is primarily state owned, with the Belgian state holding 53.3% ... - [Learn more.](#)

Processor(s):

Microsoft Corporation

Microsoft Corporation is an American multinational technology company with headquarters in Redmond, Washington. It develops, manufactures, licenses, supports and sells computer software, consumer electronics, personal computers, and related services. Its ... - [Learn more.](#)

In the privacy settings you get information about the controller(s) and processor(s)

The Privacy Dashboard

Proximus Events Nearby - Privacy Settings

Activity log

Date	Data	Purpose	Processing	Storage	Recipient
> 10/10/2019 6:36:43 AM	Location	Telemarketing	Collect	Proximus SA	Microsoft Corporation
> 10/10/2019 6:33:52 AM	Location	Telemarketing	Collect	Proximus SA	Microsoft Corporation
▼ 10/9/2019 4:41:30 PM	Location	Telemarketing	Collect	Proximus SA	Microsoft Corporation

```
{  
  "_id": "5d9df19afe08640df05d03bc",  
  "user": "5d8330683283e80feb04fa01",  
  "process": "5d7a1f57756fb609aa30685d",  
  "data": "http://www.specialprivacy.eu/vocabs/data#Location",  
  "purpose": "http://www.specialprivacy.eu/vocabs/purposes#Telemarketing",  
  "processing": "http://www.specialprivacy.eu/vocabs/processing#Collect",  
  "storage": "http://www.specialprivacy.eu/vocabs/locations#OurServers",  
  "recipient": "http://www.specialprivacy.eu/vocabs/recipients#Ours",  
  "timestamp": 1570632090657,  
  "instanceData": {  
    "lat": "51.2147556",  
    "lon": "2.8901688",  
    "timestamp": 1570632090657  
  }  
}
```

The activity Log includes technical details of the personal data processing/sharing

The Privacy Dashboard

Proximus Events Nearby - Privacy Settings

My personal data



Your location information.

We have collected 60 locations.



Your TV viewing information.

We have collected 20 TV shows and movies you have watched.



Your browsing behavior information.

We have collected 6 websites you have visited.

One stop shop for your personal data:

- Location
- TV Viewing
- Browsing

The Privacy Dashboard



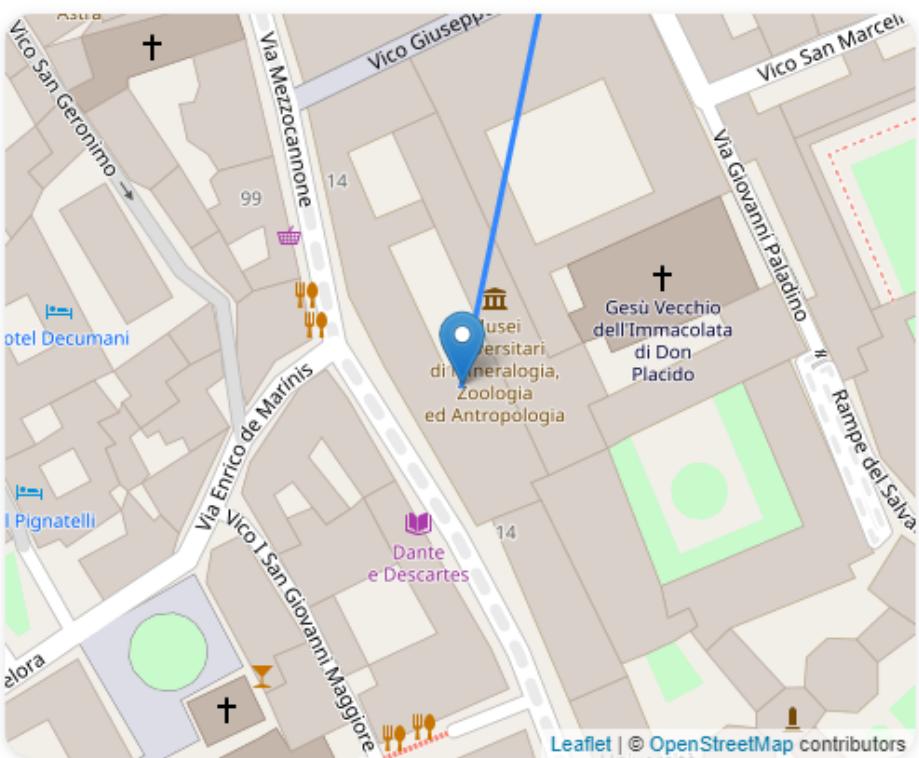
Your location information.

We have collected 60 locations.

Dates and addresses

Date	Address	⋮
5/15/2019 9:00:0...	Università Federico II - Plesso Mezzocannone 8, Via Mezzocannone, Rione Carità, Municipalità 2, Naples, NA, Campania, 80138, Italy	⋮
1/31/2019 9:00:0...	Wirtschaftsuniversität Wien, 1, Welthandelsplatz, Stuwerviertel, KG Leopoldstadt, Leopoldstadt, Vienna, 1020, Austria	⋮
10/29/2018 9:00:0...	Isle of Dogs, London Borough of Tower Hamlets, London, Greater London, England, United Kingdom	⋮
9/6/2018 9:00:00...	Nationalbibliothéik / Bibliothèque nationale, Avenue John F. Kennedy, European District South, Kirchberg, Luxembourg, Canton Luxembourg, 1855, Luxembourg	⋮
5/16/2018 9:00:0...	Ernst-Reuter-Platz, Charlottenburg, Charlottenburg-Wilmersdorf, Berlin, 10587, Germany	⋮

Rows per page: 5 ▾ 51-55 of 60 ⌂ ⌃ ⌄ ⌅ ⌆ ⌇



Location data can be displayed on a map
(e.g., here is a location in Naples)

The Privacy Dashboard



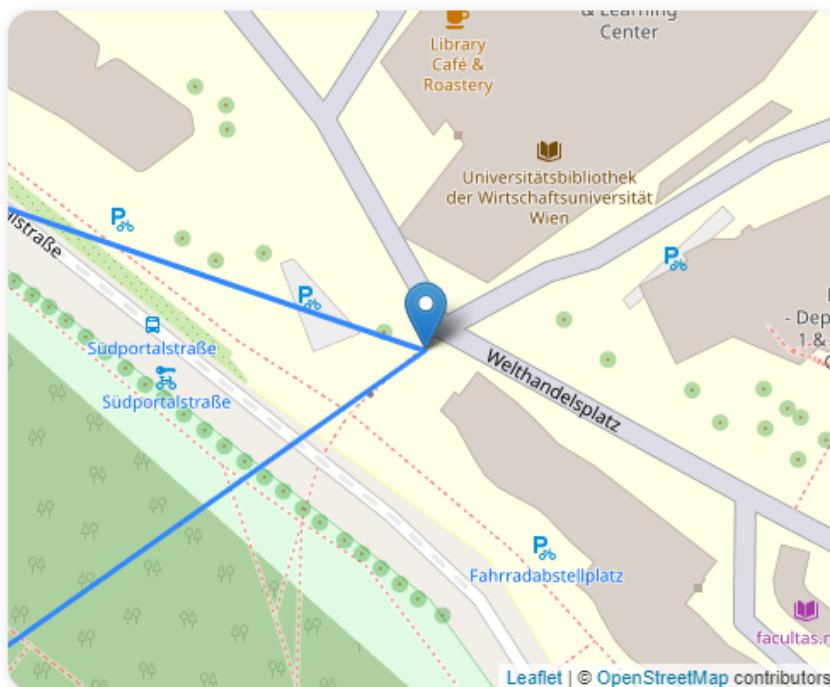
Your location information.

We have collected 60 locations.

Dates and addresses

Date	Address	⋮
4/18/2018 9:00:0...	Wirtschaftsuniversität Wien, 1, Welthandelsplatz, Stuwerviertel, KG Leopoldstadt, Leop 1020, Austria	Withdraw consent
1/18/2018 9:00:0...	Proximus, 27, Boulevard Koning Albert II - Koning Albert II ten-Noode - Sint-Joost-ten-Node - Sint-Joost-ten-Node, Brussels-Capital, 1000, Belgium	Rectify
10/30/2017 9:00:0...	Wirtschaftsuniversität Wien, 1, Welthandelsplatz, Stuwerviertel, KG Leopoldstadt, Leop 1020, Austria	Erase
5/8/2017 9:00:00...	Euler, Ampere, Route des Lucioles, Sophia Antipolis 2, Les Lucioles, Biot, Grasse, Maritime Alps, Provence-Alpes-Côte d'Azur, Metropolitan France, 06410, France	
1/15/2017 9:00:0...	Nationalbibliothéik / Bibliothèque nationale, Avenue John F. Kennedy, European District South, Kirchberg, Luxembourg, Canton Luxembourg, 1855, Luxembourg	

Rows per page: 5 ▾ 56-60 of 60 ⏪ ⏴ ⏵ ⏶ ⏷ ⏸



You can choose to withdraw consent, rectify or erase data for existing locations

The Privacy Dashboard



Your location information.

We have collected 61 locations.

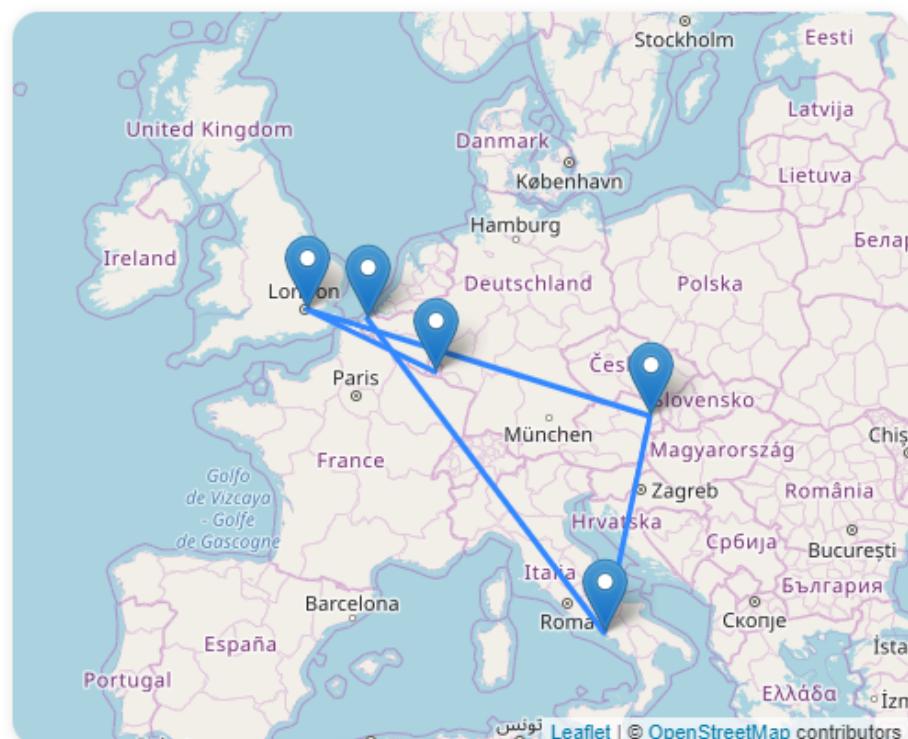
Dates and addresses

Date	Address	⋮
9/20/2019 3:29:0...	Vredesstraat, Nieuwe Koerswijk, Oostende, Ostend, West Flanders, Flanders, 8400, Belgium	⋮
5/15/2019 9:00:0...	Università Federico II - Plesso Mezzocannone 8, Via Mezzocannone, Rione Carità, Municipalità 2, Naples, NA, Campania, 80138, Italy	⋮
1/31/2019 9:00:0...	Wirtschaftsuniversität Wien, 1, Welthandelsplatz, Stuwerviertel, KG Leopoldstadt, Leopoldstadt, Vienna, 1020, Austria	⋮
10/29/2018 9:00:0...	Isle of Dogs, London Borough of Tower Hamlets, London, Greater London, England, United Kingdom	⋮
9/6/2018 9:00:00...	Nationalbibliothéik / Bibliothèque nationale, Avenue John F. Kennedy, European District South, Kirchberg, Luxembourg, Canton Luxembourg, 1855, Luxembourg	⋮

Rows per page: 5 ▾

51-55 of 61

◀ < > ▶



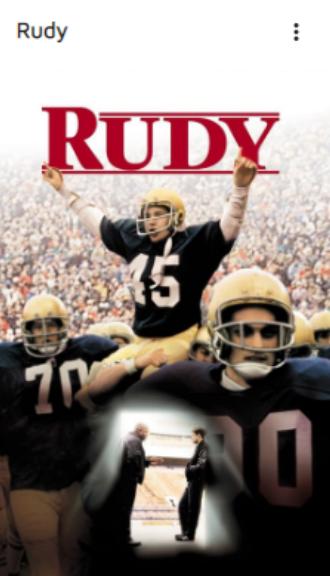
It is also possible to have a broader view...

The Privacy Dashboard



Your TV viewing information.

We have collected 20 TV shows and movies you have watched.

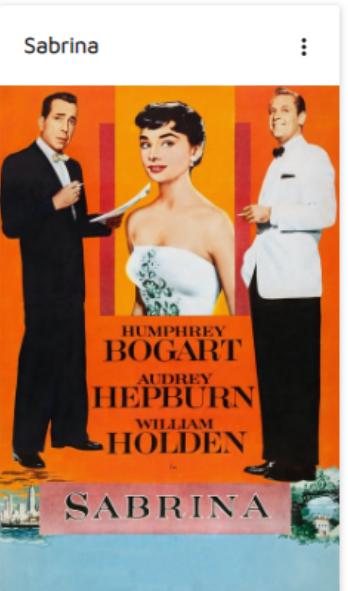


Rudy grew up in a steel mill town where most people ended up working, but wanted to play football at Notre Dame instead. There were only a couple of problems. ...

Watched on: 10/21/2017
12:52:55 PM
For: 23.9 minutes
From IP: 162.48.248.28



...
Watched on: 10/21/2017
12:52:55 PM
For: 23.9 minutes
From IP: 162.48.248.28



Linus and David Larrabee are the two sons of a very wealthy family. Linus is all work -- busily running the family corporate empire, he has no time for a ...

Watched on: 10/21/2017
12:52:55 PM
For: 23.9 minutes
From IP: 162.48.248.28



Rigoletto is a jester in the court of the Duke of Mantua. He has a hunch-back and he's rather unattractive, but he's good at his job of humiliating the courtiers ...

Watched on: 10/21/2017
12:52:55 PM
For: 23.9 minutes
From IP: 162.48.248.28

The same applies for TV viewing data.....

The Privacy Dashboard

Proximus Events Nearby - Privacy Settings

Permissions & policies

More Policy Configure

 The controller is able to collect your location data for telemarketing purposes. It is stored in the controller's or processor's servers and was shared with the controller, legal entities that act as the controller's agent or vice versa. I consent

```
{ "application": "38895e56-554f-4ca0-ab1c-4716482d2882", "data": "http://www.specialprivacy.eu/vocabs/data#Location", "purpose": "http://www.specialprivacy.eu/vocabs/purposes#Telemarketing", "processing": "http://www.specialprivacy.eu/vocabs/processing#Collect", "storage": "http://www.specialprivacy.eu/vocabs/locations#OurServers", "recipient": "http://www.specialprivacy.eu/vocabs/recipients#Ours", "label": "Location and places.", "consent": true, "dataString": "location", "purposeString": "telemarketing", "processingString": "collect", "storageString": "the controller's or processor's servers", "recipientString": "the controller, legal entities that act as the controller's agent or vice versa" }
```

>  The controller is able to collect your audiovisual activity data for telemarketing purposes. It is stored in the controller's or processor's servers and was shared with the controller, legal entities that act as the controller's agent or vice versa. I consent

>  The controller is able to collect your online activity data for telemarketing purposes. It is stored in the controller's or processor's servers and was shared with the controller, legal entities that act as the controller's agent or vice versa. I consent

Consent Policies are available in both human readable and machine readable formats

The Proximus Use Case

The DPO Dashboard



The DPO Dashboard

Proximus privacy settings

✉️ ⚡

?

Data Protection Officer view

Erasure of personal data
From: testing2@testing.com
Received: 8/21/2019, 12:56:12 AM
Respond until: 9/20/2019, 12:56:12 AM
Personal Data: Location

I hereby request erasure of my location data.

▶ SEND MESSAGE ✗ DECLINE ✓ APPROVE

Rectification of personal data
From: testing3@testing.com
Received: 8/21/2019, 12:54:32 AM
Respond until: 9/20/2019, 12:54:32 AM
Personal Data: TV

I hereby request rectification of my TV viewing data.

▶ SEND MESSAGE ✗ DECLINE ✓ APPROVE

The initial idea was to have the DPO's approve/decline requests, however the team are currently looking into automating this process.

The new DPO dashboard will only have statistical information.



Data Value Chains

SPECIAL Technical Foundations

Data & Data Driven Services

The World Wide Web



Information Management: A Proposal

Tim Berners-Lee, CERN

March 1989, May 1990

This proposal concerns the management of general information about accelerators and experiments at CERN. It discusses the problems of loss of information about complex evolving systems and derives a solution based on a distributed hypertext system.

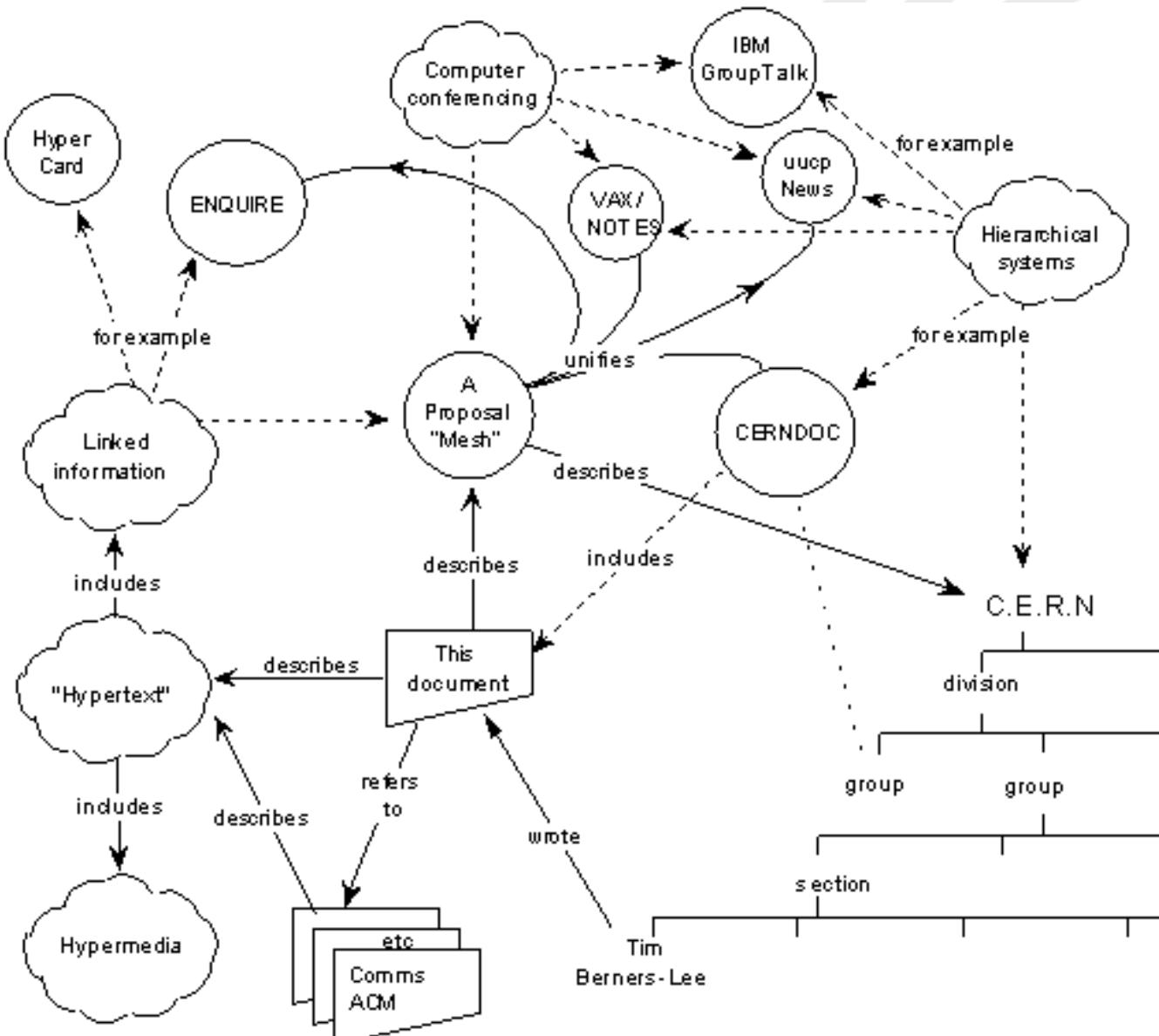
Overview

Many of the discussions of the future at CERN and the LHC era end with the question - "Yes, but how will we ever keep track of such a large project?" This proposal provides an answer to such questions. Firstly, it discusses the problem of information access at CERN. Then, it introduces the idea of linked information systems, and compares them with less flexible ways of finding information.

It then summarises my short experience with non-linear text systems known as "hypertext", describes what CERN needs from such a system, and what industry may provide. Finally, it suggests steps we should take to involve ourselves with hypertext now, so that individually and collectively we may understand what we are creating.

1989 The original proposal for the Web

<https://www.w3.org/History/1989/proposal.html>

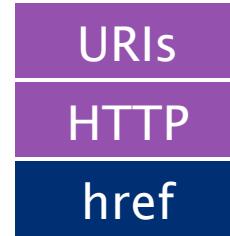


Data & Data Driven Services

How can we ensure Interoperability?



- Globally Unique identifiers
- A common protocol
- **Links between Documents**



Home



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SKYPE: sabrinakirrane
ORCID: [0000-0002-6955-7718](#)
SCOPUS: [53979829800](#)

Technology and society are constantly evolving. Although we can't predict what the future holds we can certainly influence it!

About me

I'm a senior postdoctoral researcher at the Vienna University of Economics and Business, where I am also a member of the recently founded Research Institute for Cryptoeconomics. In addition, I am the Founding Director of the [Privacy and Sustainable Computing Lab](#), which was setup in September 2015, and the Scientific/Technical Co-ordinator of the [SPECIAL H2020 project](#), which kicked off in January 2017.

SPECIAL ABOUT PUBLICATIONS ALLIANCES RESOURCES MEMBERS

Home / About / Fact Sheet

Fact Sheet

>Last Updated: 29 August 2018

Name	Scalable Policy-aware linked data architecture for privacy, transparency and compliance
EC project N°:	731601
Call:	Information and Communication Technologies Call (H2020-ICT-2016-2017)
Funding scheme:	RIA over 3 years - 9 partners from 6 countries
Duration:	36 months from January 2017 to December 2019
Total EC Funding:	3,991,389 €

Data & Data Driven Services

The Semantic Web & Intelligent Agents

W3C®

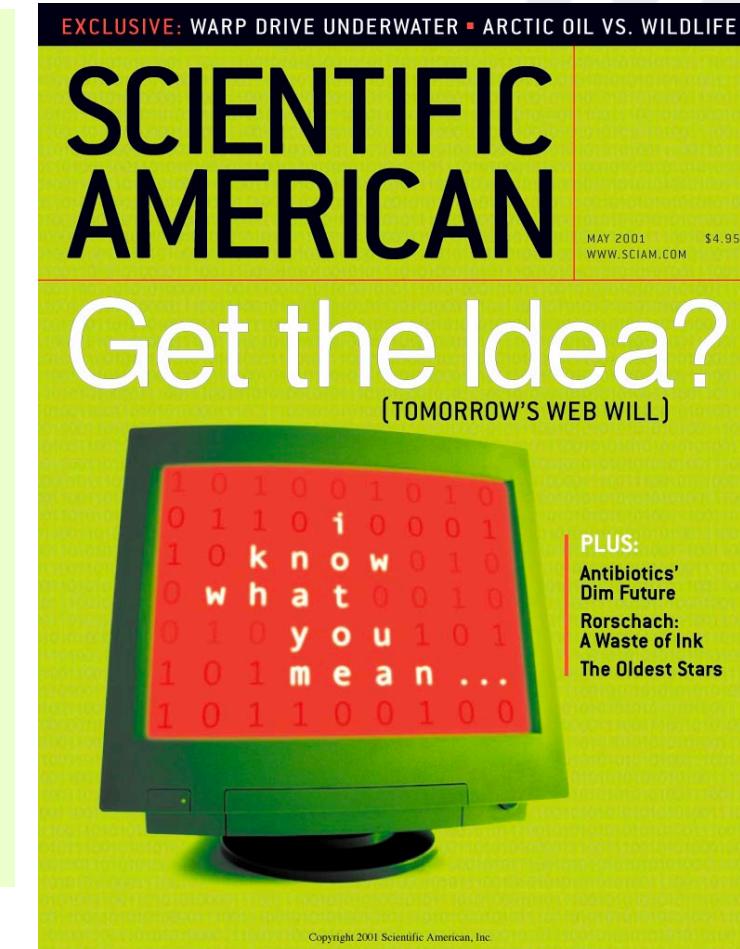
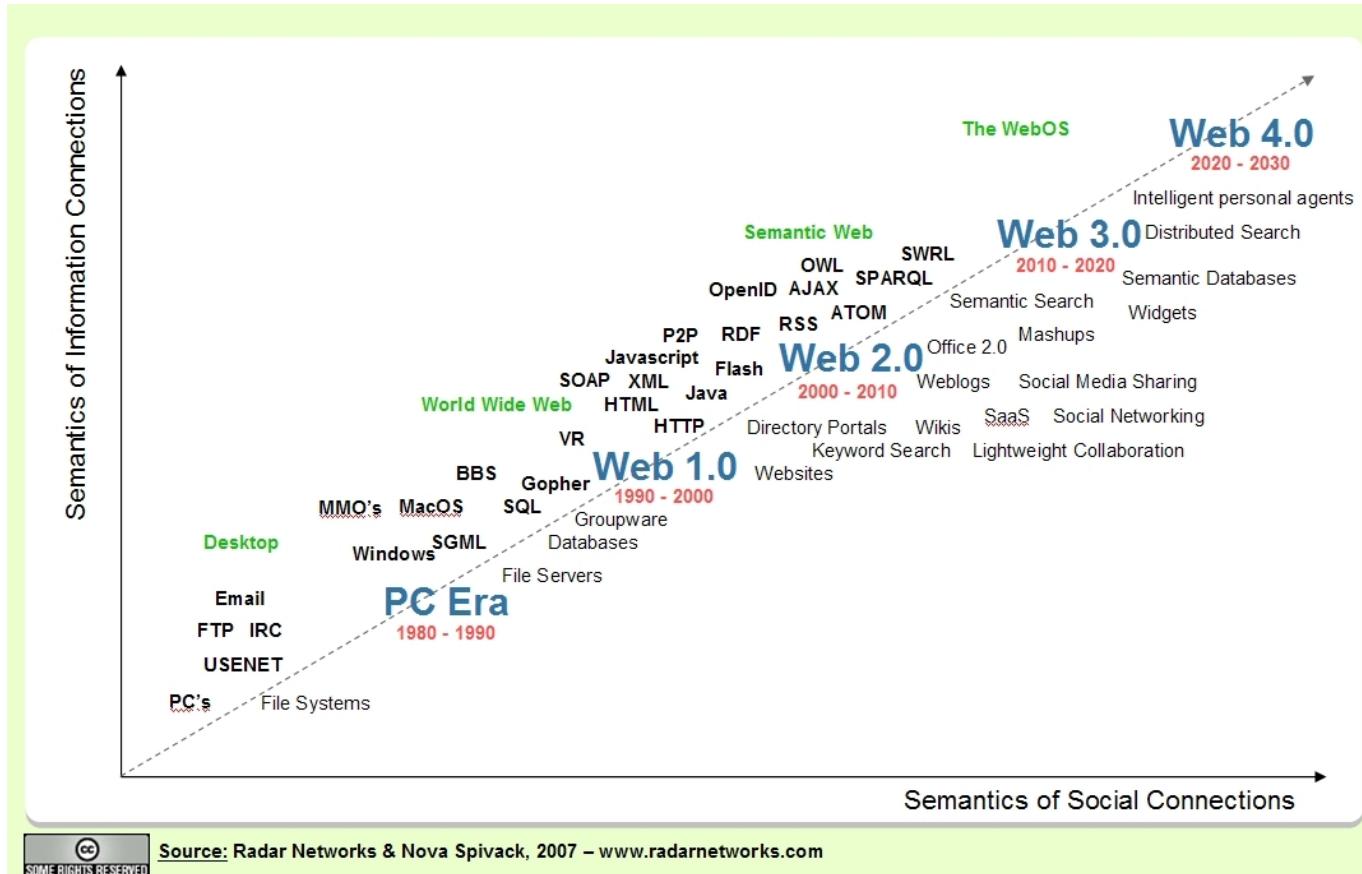


Image by Radar Networks; Nova Spivak
<http://memebox.com/futureblogger/show/824>

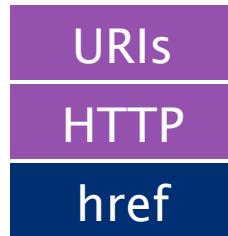
2001 The Semantic Web
<https://www.scientificamerican.com>

Data & Data Driven Services

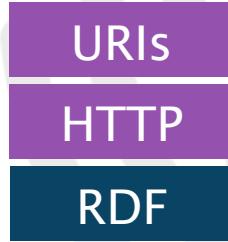
How can we ensure Interoperability?



- Globally Unique identifiers
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- Globally Unique identifiers
- A common protocol
- **Typed Links between Entities**



www.sabrinakirrane.com#me

foaf: workplaceHomepage

<https://www.wu.ac.at/en/Infobiz/>

Home



EMAIL: sabrinakirrane@gmail.com, sabrina.kirrane@wu.ac.at
SKYPE: sabrinakirrane
ORCID: [0000-0002-6955-7718](http://orcid.org/0000-0002-6955-7718)
SCOPUS: 53979829800

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FOAF Vocabulary Specification 0.99

Namespace Document 14 January 2014 - Paddington Edition

This version: <http://xmnlis.com/foaf/spec/20140114.html> (rdf)
Latest version: <http://xmnlis.com/foaf/spec/> (rdf)
Previous version: <http://xmnlis.com/foaf/spec/20100809.html> (rdf)
Authors: Dan Brickley, Libby Miller
Contributors: Members of the FOAF mailing list (foaf-dev@lists.foaf-project.org) and the wider RDF and Semantic Web developer community. See acknowledgements.
Copyright © 2000-2014 Dan Brickley and Libby Miller

This work is licensed under a [Creative Commons Attribution License](#). This copyright applies to the FOAF Vocabulary Specification and accompanying documentation in RDF. Regarding underlying technology, FOAF uses W3C's [RDF](#) technology, an open Web standard that can be freely used by anyone.

Abstract

This specification describes the FOAF language, defined as a dictionary of named properties and classes using W3C's RDF technology.



WU Institute for Information Business



Institute for Information Business

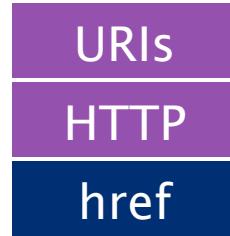


Data & Data Driven Services

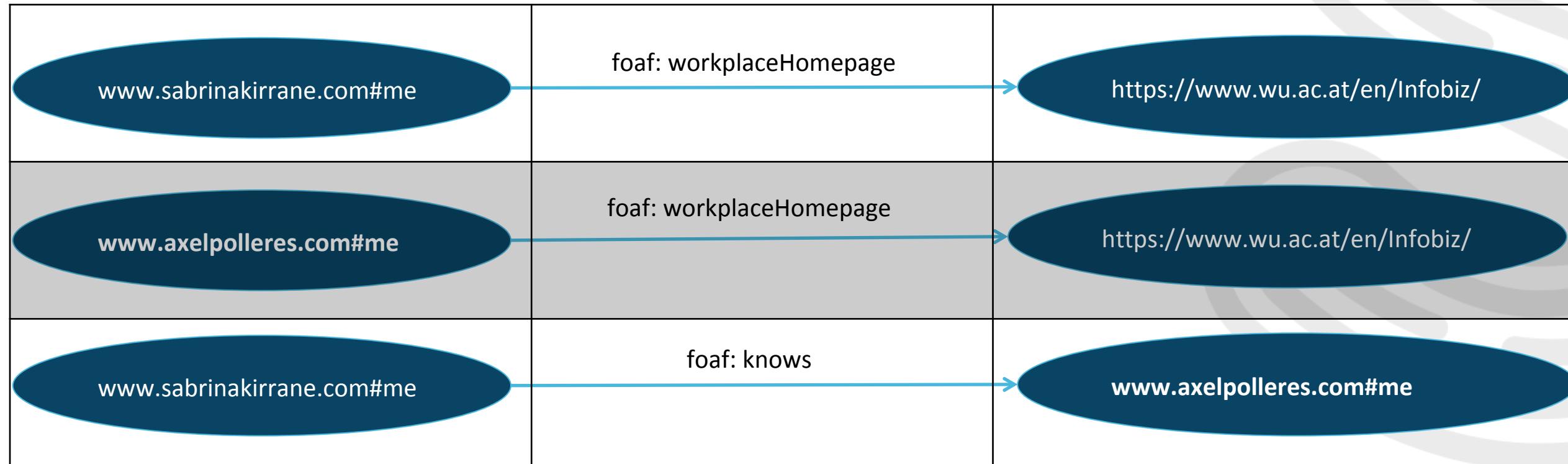
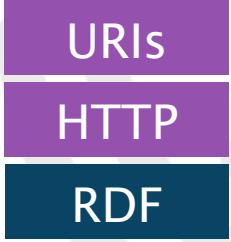
How can we ensure Interoperability?



- Globally Unique identifiers
- A common protocol
- **Links between Documents**



- Globally Unique identifiers
- A common protocol
- **Typed Links between Entities**

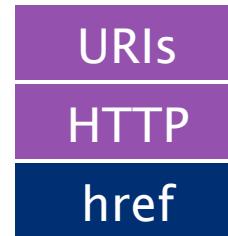


Data & Data Driven Services

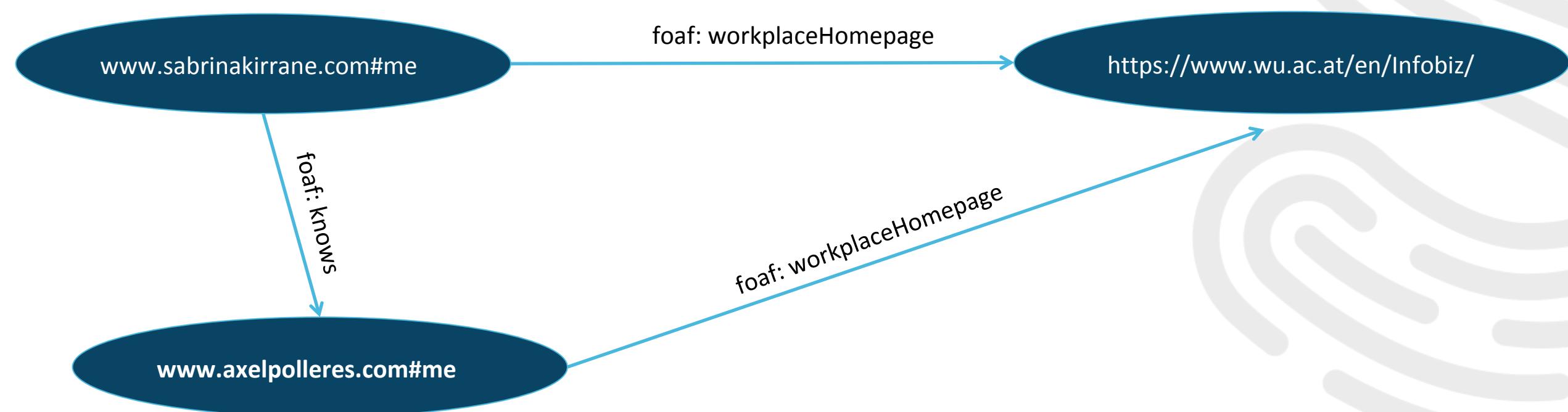
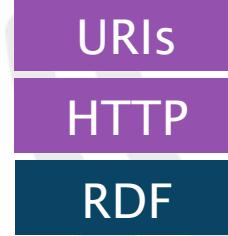
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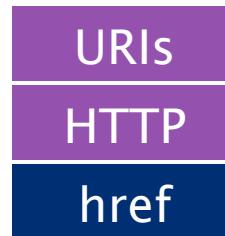


Data & Data Driven Services

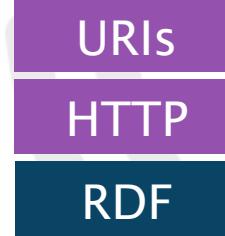
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- Globally Unique identifiers
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- **Typed Links between Entities**



www.sabrinakirrane.com#me

foaf: workplaceHomepage

https://www.wu.ac.at/en/Infobiz/

- Common data model for encoding data (**triples**)
- Common ways of serialising data (**syntaxes**) ++
- Well-defined languages for saying what terms mean (**semantics**)
- Common ways to query data (**query languages**)

www.axelpolleres.com#me

foaf: knows

foaf: workplaceHomepage

Data & Data Driven Services

Distributed Data Sources



The European Data Portal homepage features a search bar with "Search site content..." and a magnifying glass icon. Below it is a map of Europe with national flags. The main menu includes "What we do", "Data", "Providing Data", "Using Data", and "Resources". A sidebar on the left offers "Search Datasets" with a keyword search input and a "SPARQL Search" button, and "Browse Datasets by Categories" with icons for Agriculture, Fisheries, Forestry & Foods; Energy; Transport; Economy & Finance; Government & Public Sector; and Justice, Legal System & Public Safety.

<https://www.europeandataportal.eu/en/homepage>

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Search site content...

❖ When it comes to datasets this is just the tip of the iceberg....

European Data Portal > Home

What we do ▾ Data ▾ Providing Data ▾ Using Data ▾ Resources ▾

Search with SPARQL-Query

Search for metadata in the European Data Portal triple store using SPARQL queries.

The SPARQL manager sends user defined SPARQL queries to the Virtuoso SPARQL query engine.

SPARQL specifications can be found on the [W3C web site](#). Please note that this is a tool for SPARQL experts.

Prefixes

```
1 SELECT (count(*) AS ?count) WHERE { ?s a dcat:Dataset } } LIMIT 100
```

Please note that this is a tool for SPARQL experts.

Thank you / contact details



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Backup Slides



Usage policy language

Syntax and expressivity

- Usage policy language, which can be used to express both the data subjects' **consent**, data controllers usage requests, fragments of the **GDPR**, and business policies
- The foundation of the policy language was the **Minimal Core Model (MCM)**
- We propose a new policy language that extensively **re-uses standards** based privacy-related vocabularies
- We are able to leverage existing **Web Ontology Language (OWL)** based reasoners out of the box

Figure 1.1: SPECIAL's Usage Policy Language Grammar

```
UsagePolicy :='ObjectUnionOf' '(' BasicUsagePolicy BasicUsagePolicy { BasicUsagePolicy } ')'  
| BasicUsagePolicy  
  
BasicUsagePolicy :='ObjectIntersectionOf' '(' Data Purpose Processing Recipients Storage ')'  
  
Data :='ObjectSomeValueFrom' '(' 'spl:hasData' DataExpression ')'  
  
Purpose :='ObjectSomeValueFrom' '(' 'spl:hasPurpose' PurposeExpression ')'  
  
Processing :='ObjectSomeValueFrom' '(' 'spl:hasProcessing' ProcessingExpression ')'  
  
Recipients :='ObjectSomeValueFrom' '(' 'spl:hasRecipient' RecipientExpression ')'  
  
Storage :='ObjectSomeValueFrom' '(' 'spl:hasStorage' StorageExpression ')'  
  
DataExpression :='spl:AnyData' | DataVocabExpression  
  
PurposeExpression :='spl:AnyPurpose' | PurposeVocabExpression  
  
ProcessingExpression :='spl:AnyProcessing' | ProcessingVocabExpression  
  
RecipientsExpression :='spl:AnyRecipient' | 'spl:Null' | RecipientVocabExpression  
  
StorageExpression :='spl:AnyStorage' | 'spl:Null' |  
'ObjectIntersectionOf' '(' Location Duration ')'  
  
Location :='ObjectSomeValueFrom' '(' 'spl:hasLocation' LocationExpression ')'  
  
Duration :='ObjectSomeValueFrom' '(' 'spl:hasDuration' DurationExpression ')'  
| 'DataSomeValueFrom' '(' 'spl:durationInDays' IntervalExpression ')'
```

Usage policy language SPECIAL resources

The SPECIAL Usage Policy Language

version 0.1

Unofficial Draft 06 April 2018



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Abstract

This document specifies usage policy language of SPECIAL, both the data subjects' consent and the data usage policies by a computer, so as to automatically verify that the usage

The ontology defined in this document is publicly available

Vocabulary .../langs/usage-policy#

Bert Bos Last Updated: 17 April 2018

You can [download this ontology as an OWL file.](#)

The following is the formulation in functional syntax of the Usage Policy Language Ontology with identifier

<http://www.specialprivacy.eu/langs/usage-policy#>

The documentation can be found in [Policy Language V1 \(deliverable D2.1\)](#).

```
# NAMESPACE DEFINITIONS
Prefix(spl:=<http://www.specialprivacy.eu/langs/usage-policy#>)
Prefix(owl:=<http://www.w3.org/2002/07/owl#>)
Prefix(rdf:=<http://www.w3.org/1999/02/22-rdf-syntax-ns#>)
Prefix(xml:=<http://www.w3.org/XML/1998/namespace>)
Prefix(xsd:=<http://www.w3.org/2001/XMLSchema#>)
Prefix(rdfs:=<http://www.w3.org/2000/01/rdf-schema#>)

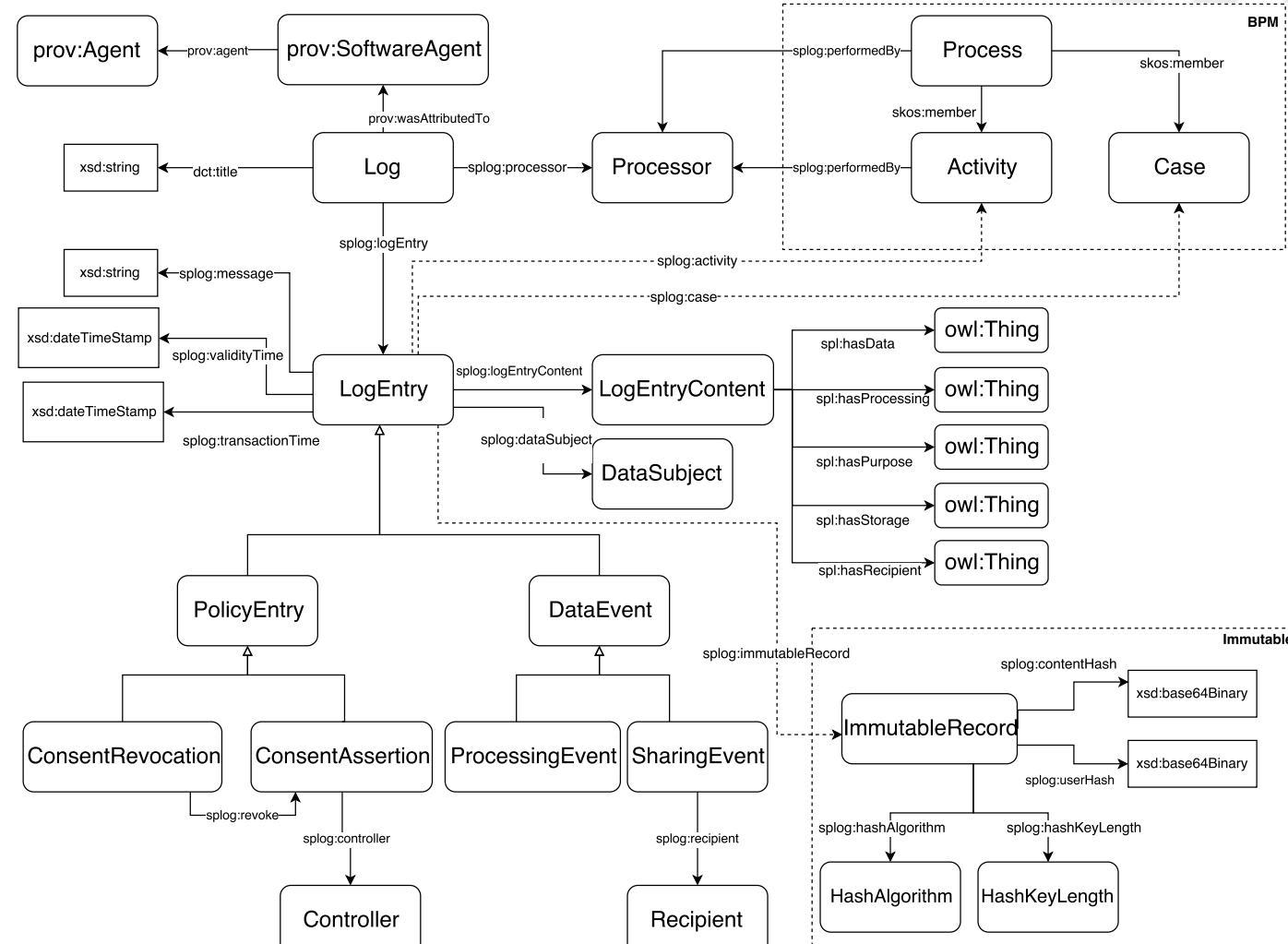
# ONTOLOGY IRI AND ITS VERSION

Ontology( <http://www.specialprivacy.eu/langs/usage-policy-ontology>
<http://www.specialprivacy.eu/langs/usage-policy-ontology/1.0>
```

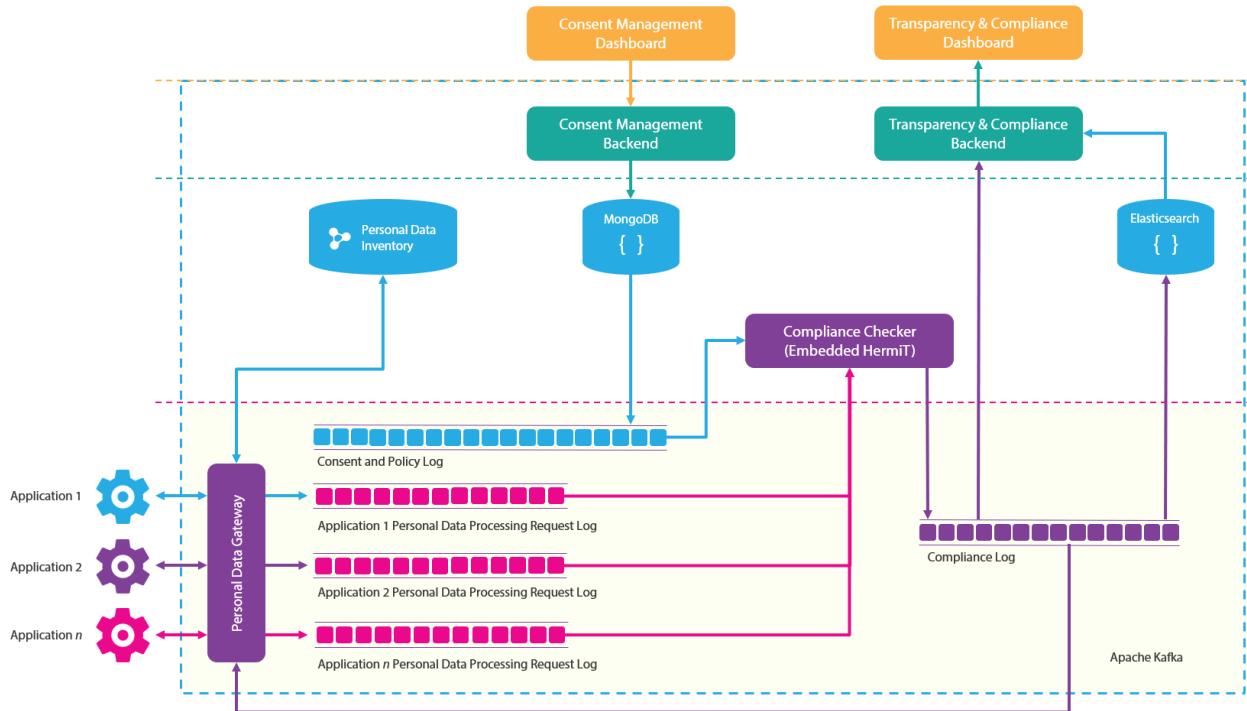
- Detailed in [D2.1 Policy Language V1](#)
- Available for download via the SPECIAL website <https://www.specialprivacy.eu/langs/usage-policy>
- An unofficial *draft specification* has been published online <http://purl.org/specialprivacy/policylanguage>
- Feeds into the standardisation efforts conducted in the [W3C Data Privacy Vocabularies and Controls Community Group](#)

Provenance/event information SPECIAL resources

- Development of a **log vocabulary** that reuses well-known vocabularies such as **PROV** for representing provenance metadata
- Demonstrate how provenance can be used to support transparency in data value chains



Transparency and compliance checking platforms



- Data processing and sharing event logs are stored in the **Kafka** distributed streaming platform, which in turn relies on Zookeeper for configuration, naming, synchronization, and providing group services.
- We assume that consent updates are infrequent and as such usage policies and the respective vocabularies are represented in a **Virtuoso triple store**.
- The compliance checker, which includes an embedded **Hermit reasoner**, uses the consent saved in Virtuoso together with the application logs provided by Kafka to check that data processing and sharing complies with the relevant usage control policies.
- As logs can be serialized using JSON-LD, it is possible to benefit from the faceting browsing capabilities of **Elasticsearch** and the out of the box visualization capabilities provided by **Kibana**.