

**GDPR + ML = ???**

# A Discussion on Applicability of GDPR to Advances in ML

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CSC1117 Machine Learning DCU  
Slides available at: <https://harshp.com/research/presentations>

# Harsh(vardhan J. Pandit)

## An Introduction

- Assistant Professor - ADAPT Centre - Dublin City University
- Postdoctoral Fellowship: knowledge graph for DPIA / GDPR
- PhD in Computer Science (2020) - Representation of activities involving personal data and consent for GDPR information
- Chair of W3C Community Groups: Data Privacy Vocabularies and Controls Community Group (DPVCG) and Consent (ConsentCG)
- Nominated Technical Expert by European Data Protection Board (EDPB)
- Member of National Standards Authority of Ireland (NSAI) committees for Cybersecurity/Privacy and AI at EU and ISO forums

# GDPR<sup>1</sup>

**World-Changing EU law that regulates Processing of Personal Data**

1. What is meant by Personal Data ?
2. What is meant by Processing ?
3. How is data is being processed? (what/how/where...)
4. Who is involved? (whose data, processed by whom)
5. How to check processing is following the rules of GDPR?

[1] <https://eur-lex.europa.eu/eli/reg/2016/679/oj>

# Personal Data

## Some “definitions” from across the globe

‘personal data’ means **any information relating to an identified or identifiable natural person** (‘data subject’); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person;

**GDPR Art.4(1)**

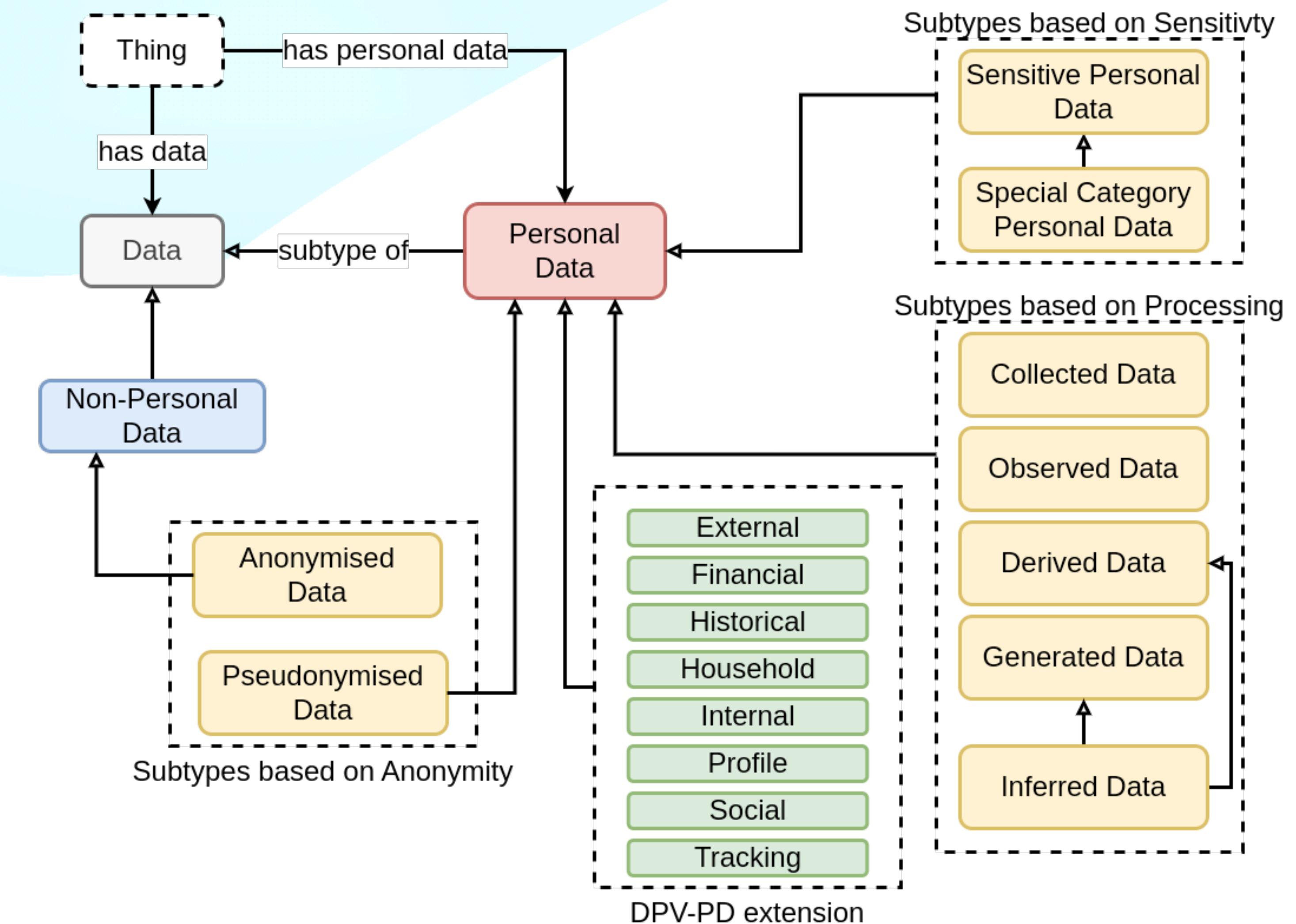
any information that (a) **can be used to identify the PII principal to whom such information relates, or**  
**(b) is or might be directly or indirectly linked to a PII principal**

**ISO 29100:2011**

“Personal information” means information that **identifies, relates to, describes, is reasonably capable of being associated with, or could reasonably be linked, directly or indirectly**, with a particular consumer or household.

**CCPA 1798.140 (o)(1)**

# Data Personal Data



# Personal Data

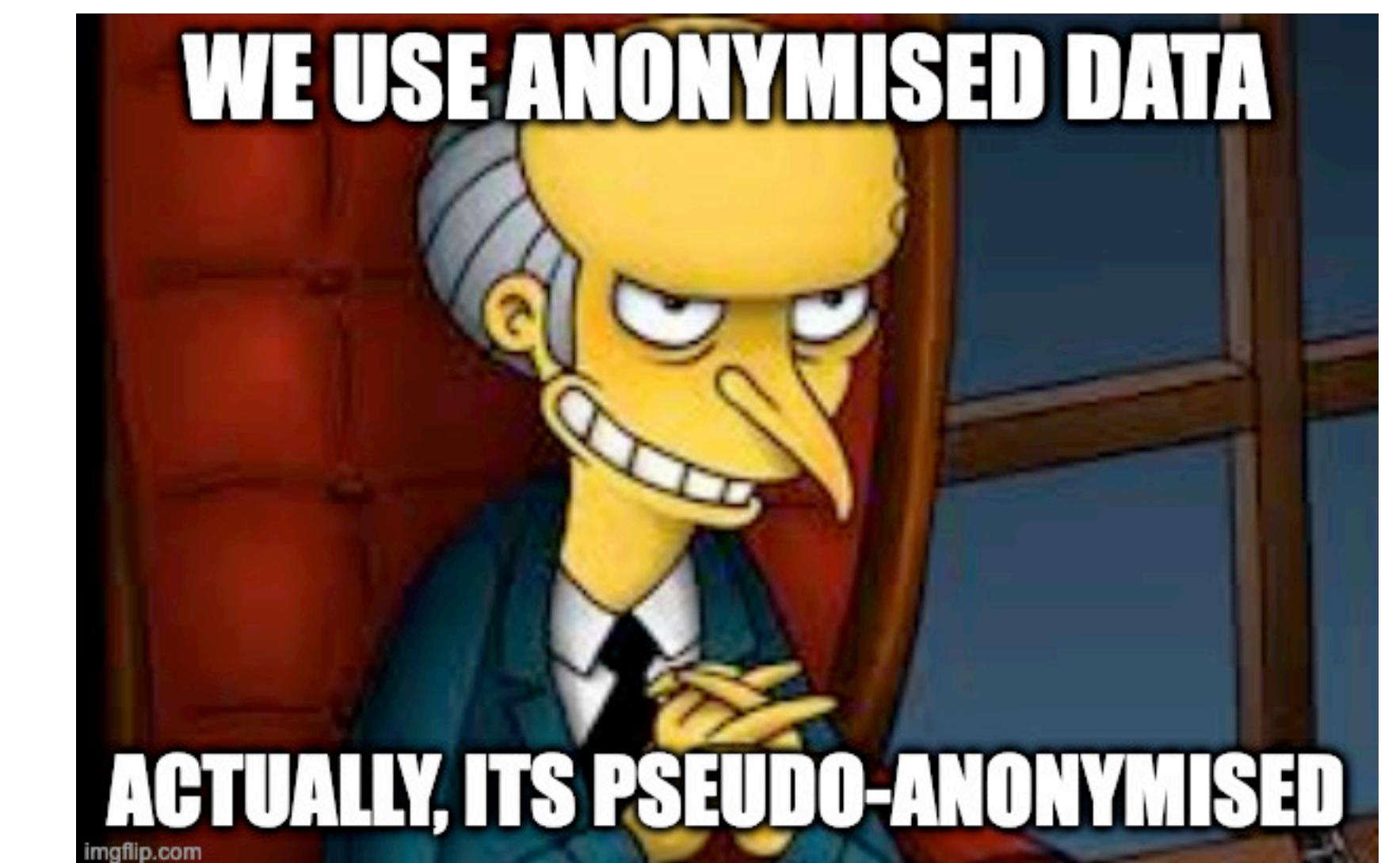
## Identifiers, and Identifiability

1. Identifiers: Harsh (name), xyz@email.com (email)
2. Non-identifiers: Black (hair), Brown (eyes), 1.66m (height), etc.
3. For a room full of people, combine non-identifier to uniquely identify a person (me) – thus creating an identifier !!!
4. Useful technique for **fingerprinting**, **profiling**, **tracking**

# Q: When is Personal Data not ‘Personal’ anymore?

**Ans: When it is (completely) anonymised**

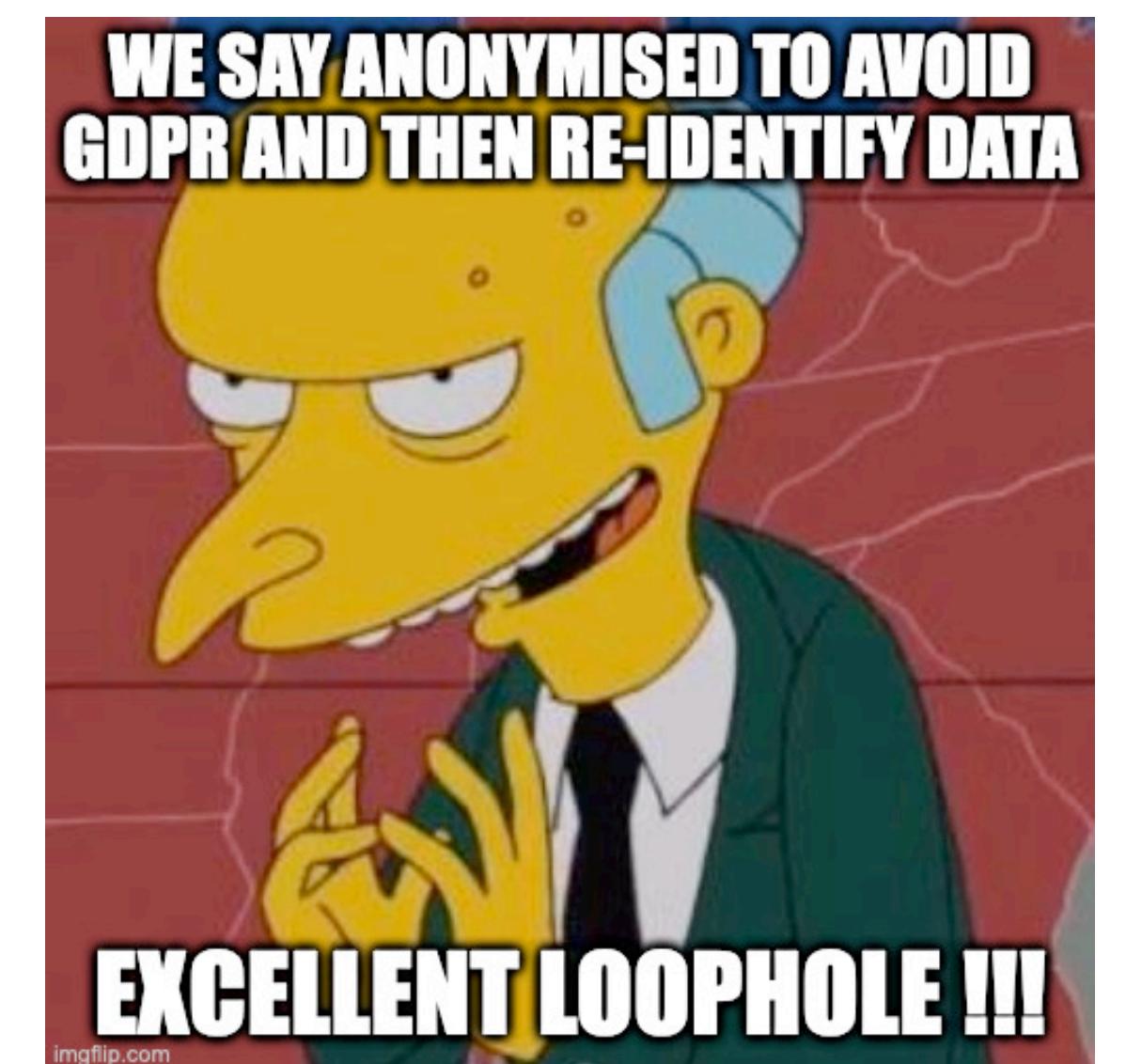
- Anonymisation is the removal of (some) ‘identifying’ attributes from data
- Merely using “**anonymisation**” does not produce anonymised data
- It produces ‘**pseudo-anonymised**’ data, which is still personal data
- ‘Completely anonymised’ if it is **not identifiable**
- E.g.
  - Your exact location = personal data
  - approx. house = still personal data
  - approx. area = still personal data, but less
  - City = still personal data, but lesser
  - Country = anonymised, kind of



# Q: When is Anonymised Data not Anonymised?

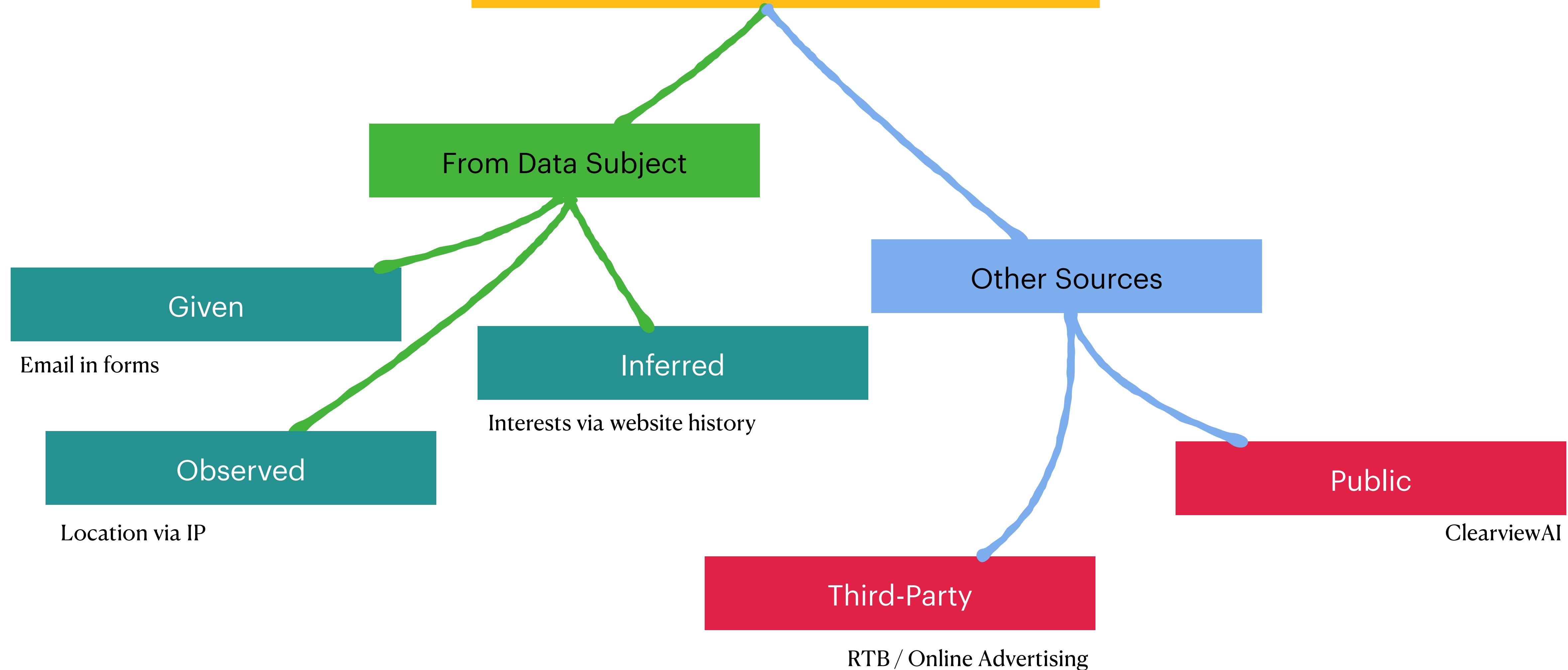
**Ans: When it is possible to 're-identify' using any (practical) means possible**

- Data is anonymised, i.e. all identifiers like names and emails are removed
- But using a 'combination' of remaining data points, a person is still identified
- Since **re-identification** is possible, its not '**fully anonymised**'
- 'Exploits'
  - Aggregated location – person's routines are unique
  - Voting and voters data
  - Fingerprinting - browser configurations, preferences
  - GDPR applies to all the above since it is 'personal data'



# Personal Data

ISO 29184:2020



# Personal Data: Sensitive, and Special

**Special category personal data is to GDPR what Ferrero Rocher is to chocolates**

## Sensitive:

- data that merits additional security
- older term used widely

## Special:

- requires additional/specific legal permissions
- newer term introduced in GDPR



# GDPR Prohibits

**Processing of Special Categories of Personal Data  
and**

**Requires additional obligations via legal basis in Article. 9**

racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation shall be prohibited

## GDPR Article 4(11)

‘processing’ means **any operation or set of operations which is performed on personal data** or on sets of personal data, whether or not by **automated means**, such as collection, recording, organisation, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction;

Notable alignment with ‘common’ terms used in documents, interfaces, etc.

collect, store, use, share, delete

# Systematic Monitoring Evaluation & Scoring Matching & Combining Automated Decision Making Innovative Use of New Technologies

## GDPR Article.35 Data Protection Impact Assessments

# GDPR applies before Processing starts

## Common Misinterpretations

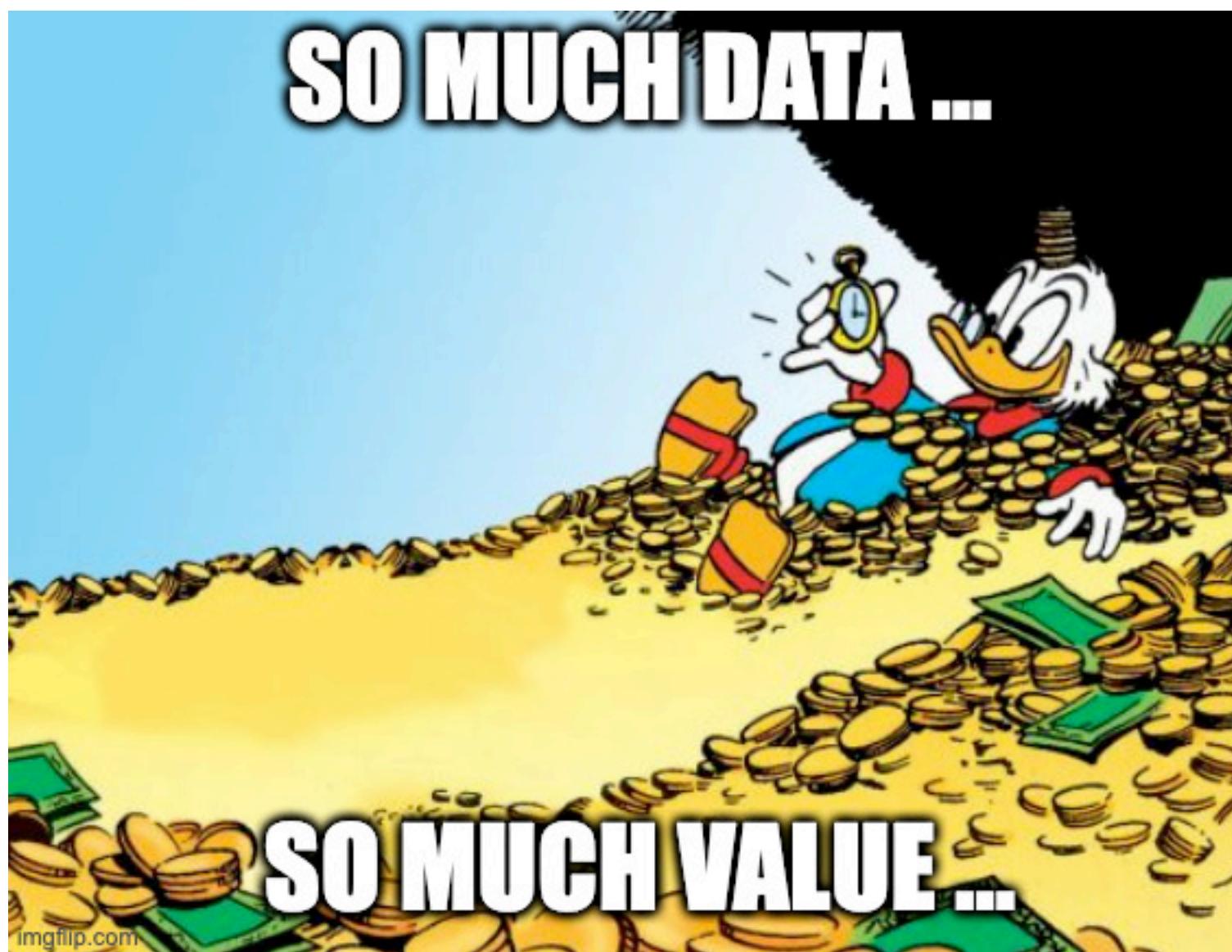
- Data collected but ‘anonymised’ is not subject to GDPR
- If data isn’t shared, nothing needs to be declared
- Collecting anonymised data and attaching an identifier to it
- Hiding things that require transparency and permission
  - Scale and scope of processing
  - Involvement of special categories
  - Involvement of any automated decision making
  - Creating, sharing, using - profiling



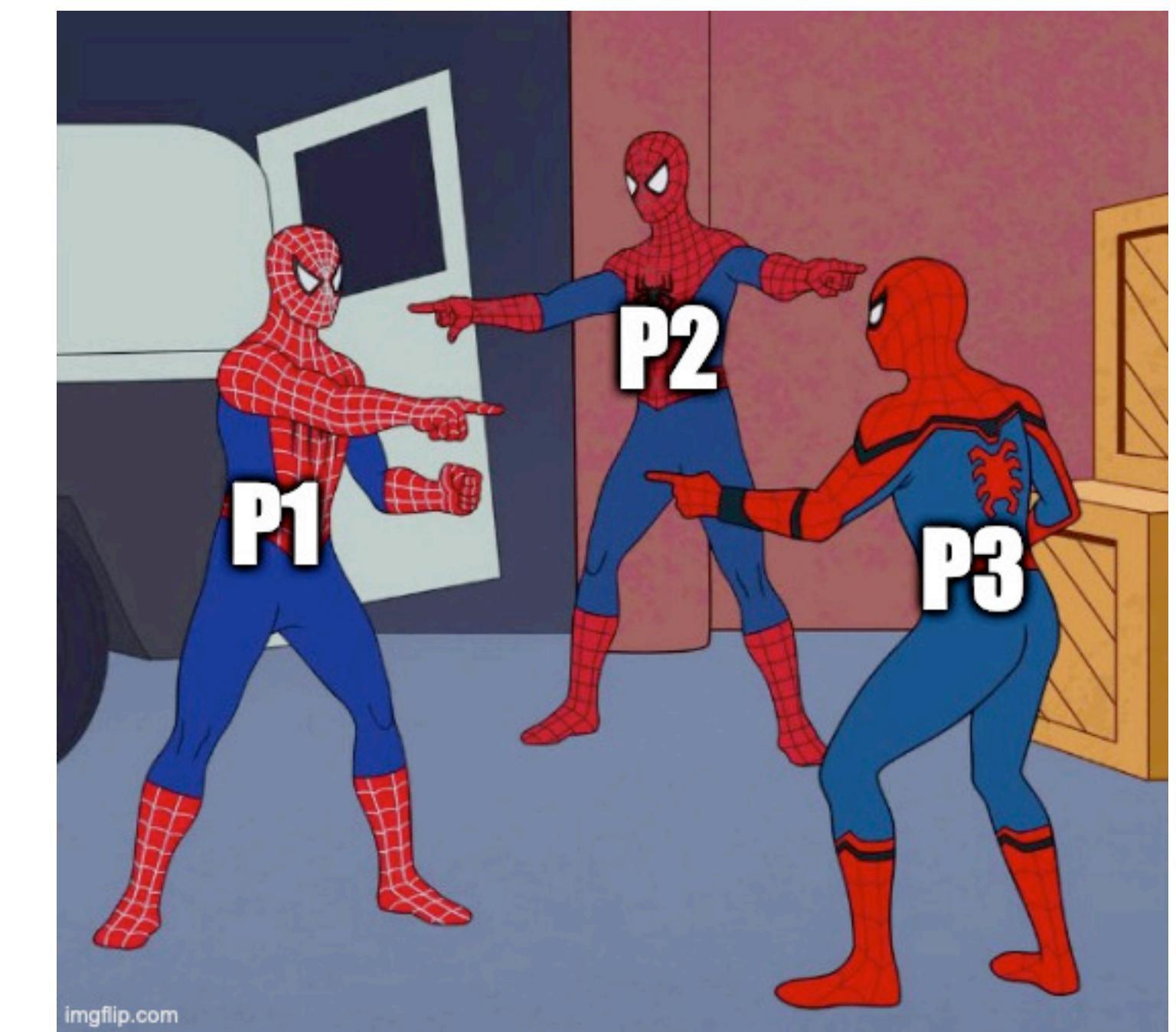
# All Processing in GDPR \*must\* be towards a Goal

Implied when a 'Purpose' is necessary as per Article.5

Every Processing \*must\* have a Purpose



Purposes must be separate from other matter, including other purposes



Purposes must be \*specific\* and \*unambiguous\*

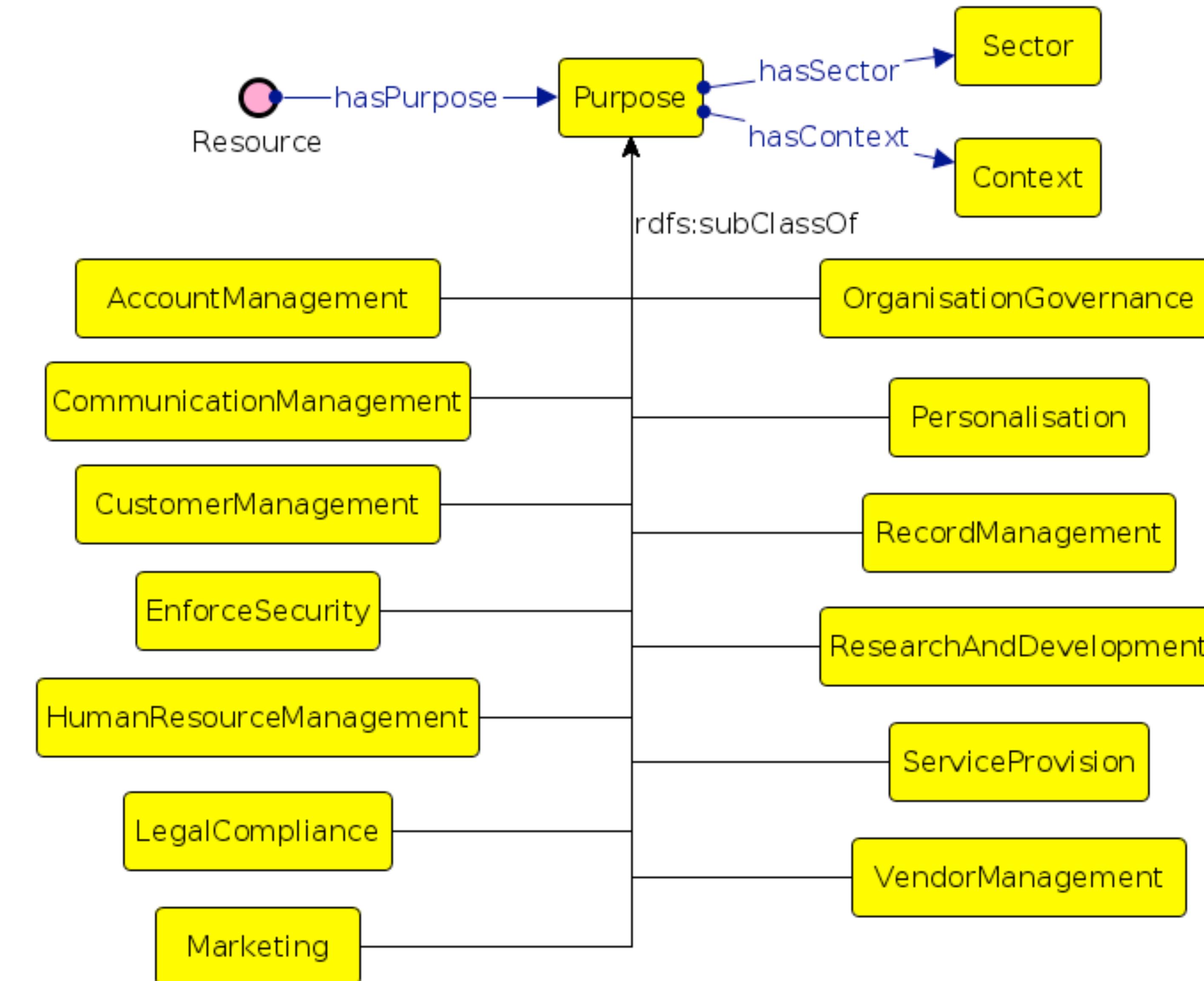
Purposes are intended to be human-readable and human-comprehensible

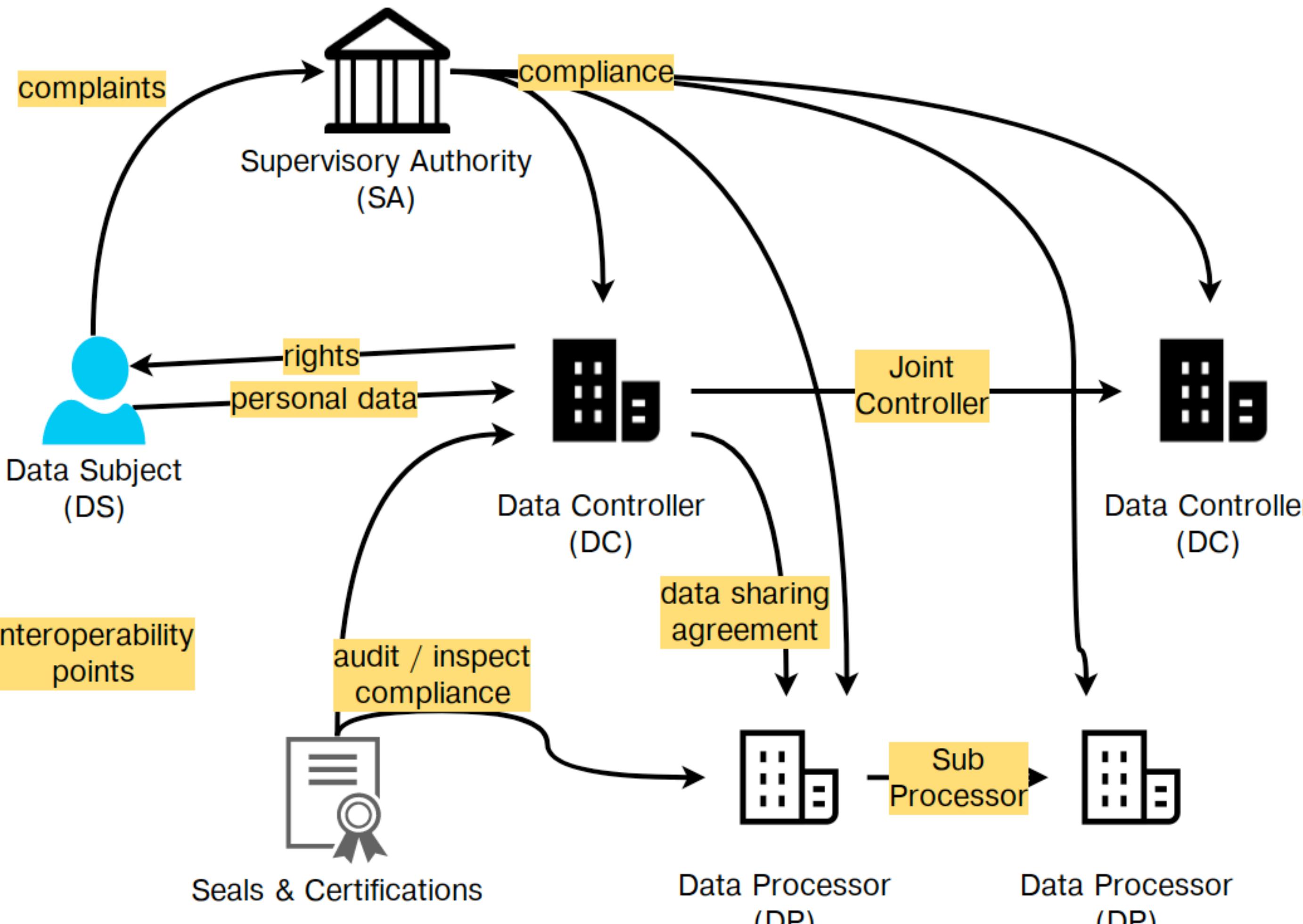
Purposes should not be broad and abstract

Purposes should be specific and contextual to their use-case

Purposes can be grouped or categorised, but not replaced, e.g. with Marketing for 'Sending new product emails'

Purposes don't have to necessarily benefit the data subject e.g. service optimisation





GDPR Data Interoperability Model,

EURAS Annual Standardisation Conference (EURAS) 2018,

Harshvardhan J. Pandit\*, Declan O'Sullivan , Dave Lewis

<https://harshp.com/research/publications/010-gdpr-data-interoperability-model>

Data Controllers are responsible for deciding the 'purpose'

Data Controllers may not even 'touch' the data they 'control'

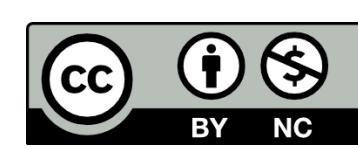
Data Controllers can 'team up' to become Joint (Data) Controllers

Processors only act on 'orders' given (explicitly) by Controllers

Processors can appoint other (sub-)Processors, still governed by instructions from Controllers

Processors deciding/ processing on their own become Controllers

Data Protection Authorities (DPA) are empowered by GDPR to enforce its obligations on all entities



# GDPR's principles providing a framework for 'responsibility'

## **Principles (Article.5)**

lawfulness, fairness and transparency  
purpose limitation  
data minimisation  
accuracy  
storage limitation  
integrity and confidentiality  
accountability

## **A12-A22 Rights**

Transparency (A.12)  
Notice (A.13, A.14) ;  
Object to Processing  
Rectification of Data  
Erasure (Right to be Forgotten)  
Restriction of Processing  
Right of Access  
Data Portability

## **Consent (Article.7)**

Informed  
Freely Given  
Unambiguous  
Balance of Power(s)  
Right to Withdraw  
Explicit Consent (e.g. for Article.9)

## **A77 Right to complaint**

Any Data Subject can  
complaint to their Supervisory  
Authority (DPA)  
If DPA is in a different country  
than the company, then the  
DPA will 'lease' and 'co-operate'  
with the DPA of that country

# “AI” is just another technology...

How does GDPR apply? → if personal data is involved

When can personal data be involved? Input/output?

Problems? Accuracy, transparency, principles, *consent*

When can it be misused? Jobs? Assessments? Decisions?

# Overview of Personalisation Issues

## Key takeaways

- What data is ‘used’ ??? → Transparency
- What data is ‘needed’? What is ‘necessary’? → Data Minimisation
- What are the sources of ‘data’ ? → Transparency
- Is any data ‘sensitive’ ? Is it ‘special’ ? → Ethical Concerns
- Is data (input/output) ‘accurate’ → Accountability
- Is the output configurable ? → Privacy by Design / Default
- Understand distinctions between *Privacy* vs *Security* vs *Identifiability* vs *Control*

# What the current state of the art?

- (1) when and how an AI model can be considered as ‘anonymous’;
- (2) how controllers can demonstrate the appropriateness of legitimate interest as a legal basis in the development and
  - (3) deployment phases; and
- (4) what are the consequences of the unlawful processing of personal data in the development phase of an AI model on the subsequent processing or operation of the AI model.

## EDPB opinion on AI models: GDPR principles support responsible AI

18 December 2024

EDPB

Brussels, 18 December - The European Data Protection Board (EDPB) has adopted an [opinion\\* on the use of personal data for the development and deployment of AI models](#). This opinion looks at 1) when and how AI models can be considered anonymous, 2) whether and how legitimate interest can be used as a legal basis for developing or using AI models, and 3) what happens if an AI model is developed using personal data that was processed unlawfully. It also considers the use of first and third party data.



The opinion was requested by the Irish Data Protection Authority (DPA) with a view to seeking Europe-wide regulatory harmonisation. To gather input for this opinion, which deals with fast-moving technologies that have an important impact on society, the EDPB organised a stakeholders' event and had an exchange with the EU AI Office.

**EDPB Chair Talus said:** “AI technologies may bring many opportunities and benefits to different industries and areas of life. We need to ensure these innovations are done ethically, safely, and in a way that benefits everyone. The EDPB wants to support responsible AI innovation by ensuring personal data are protected and in full respect of the General Data Protection Regulation (GDPR).”

[https://www.edpb.europa.eu/news/news/2024/edpb-opinion-ai-models-gdpr-principles-support-responsible-ai\\_en](https://www.edpb.europa.eu/news/news/2024/edpb-opinion-ai-models-gdpr-principles-support-responsible-ai_en)

# Salient Points

- claims of an AI model's anonymity should be assessed on a case-by-case basis. For an AI model to be considered anonymous, both (1) the likelihood of direct (including probabilistic) extraction of personal data regarding individuals whose personal data were used to develop the model and (2) the likelihood of obtaining, intentionally or not, such personal data from queries, should be insignificant, taking into account 'all the means reasonably likely to be used' by the controller...
- analysing the necessity of the processing for the purposes of the legitimate interest(s) pursued (also referred to as "necessity test"); and (3) assessing that the legitimate interest(s) is (are) not overridden by the interests or fundamental rights and freedoms of the data subjects (also referred to as "balancing test").



# The EU AI Act



New Rules for  
**- AI Systems  
- GPAI Models**

[General Purpose AI]

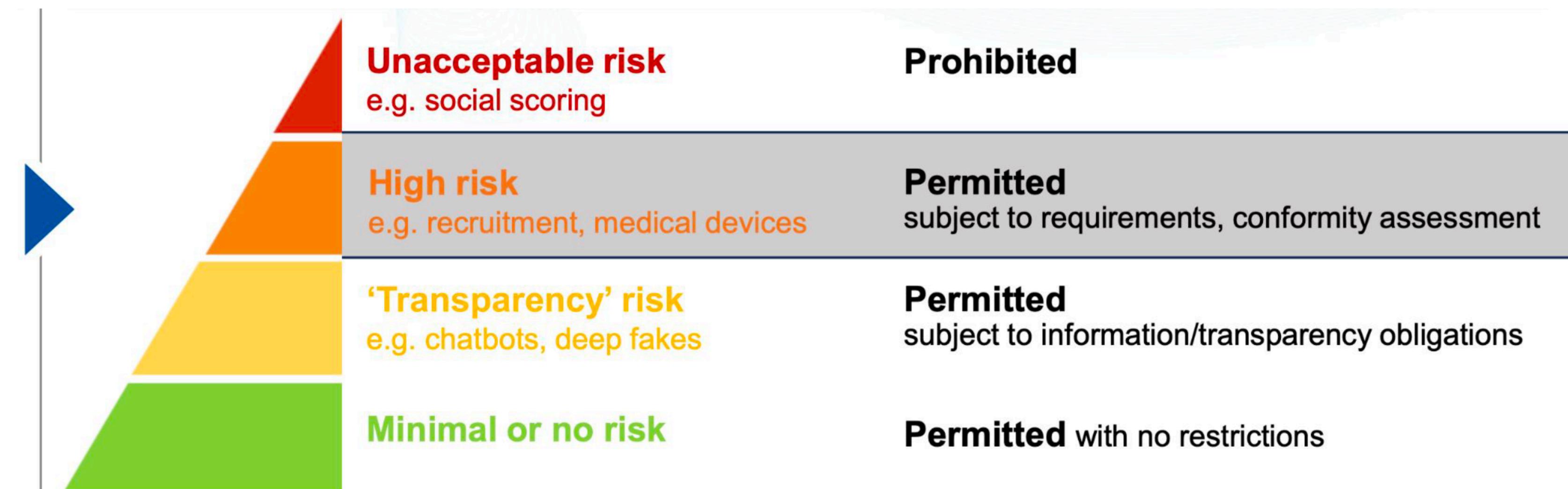
Promotes human-centric & trustworthy AI

Protects against harmful effects of AI on  
**- Health  
- Safety  
- Fundamental Rights**



AI Cards | Delaram Golpayegani et al. | Annual Privacy Forum | 4 Sep. 2024 | delaram.golpayegani@adaptcentre.ie

# AI Systems Risk-Based Classification



From the EU AI Office webinar on risk management in the AI Act and related standards, 30 May 2024



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# AI Act → GenAI

- AI Act specifically address Generative AI or GenAI
- It requires transparency for specific models
- Requires transparency
- Requires risk assessment
- Requires clarification on what the model can / cannot do, or is intended to do

# Existing approaches

## Datasheets and Model cards

- Good to start with -  
they tell you what info to consider
- BUT - they are not complete
- - not structured
- - not formally defined
- - not “usable” to audit
- - often incomplete
- - unclear legality

<https://arxiv.org/pdf/1803.09010>

### Datasheets for Datasets

TIMNIT GEBRU, Black in AI  
JAMIE MORGENTERN, University of Washington  
BRIANA VECCHIONE, Cornell University  
JENNIFER WORTMAN VAUGHAN, Microsoft Research  
HANNA WALLACH, Microsoft Research  
HAL DAUMÉ III, Microsoft Research; University of Maryland  
KATE CRAWFORD, Microsoft Research

<https://arxiv.org/pdf/1810.03993>

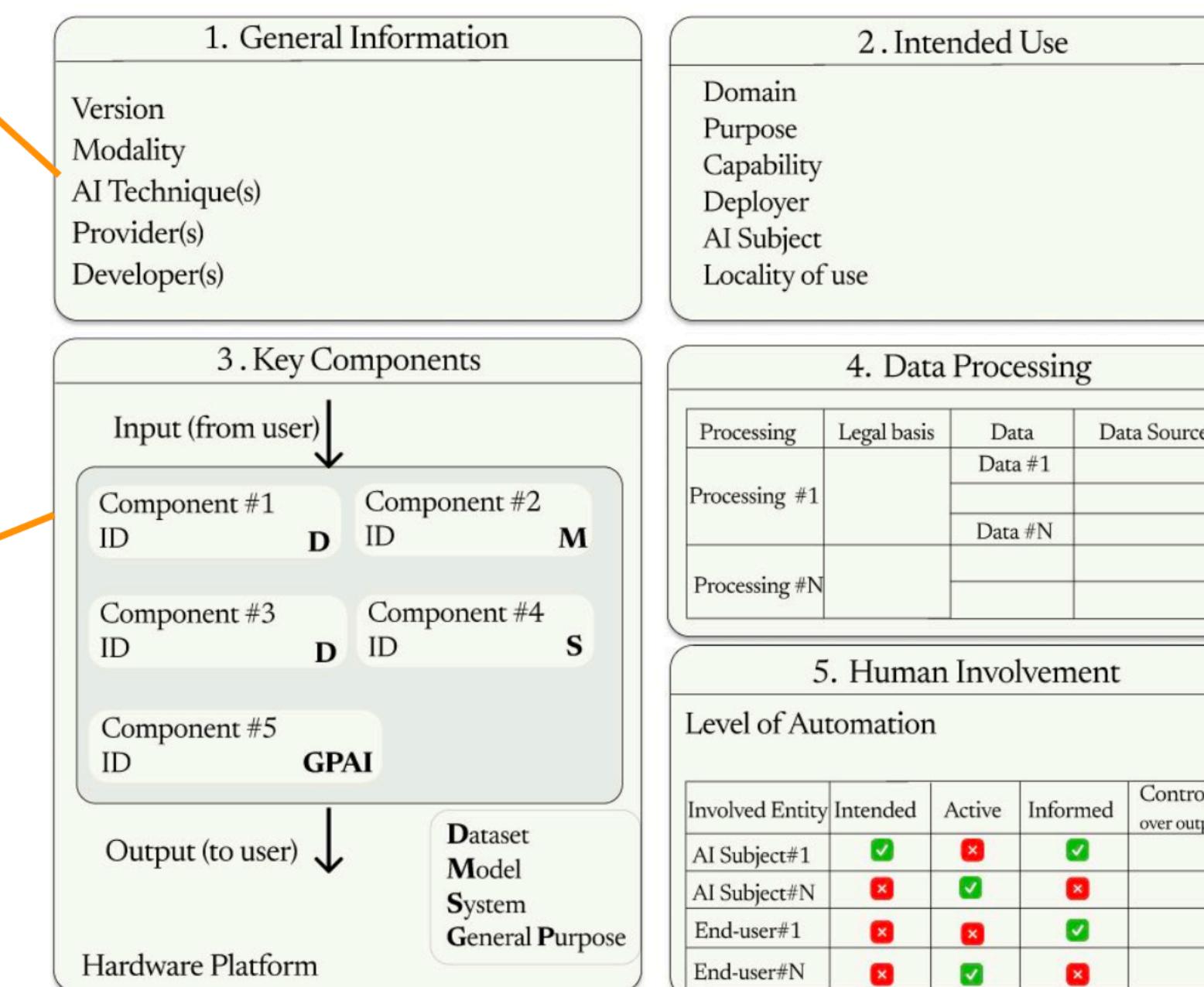
### Model Cards for Model Reporting

Margaret Mitchell, Simone Wu, Andrew Zaldivar, Parker Barnes, Lucy Vasserman, Ben Hutchinson, Elena Spitzer, Inioluwa Deborah Raji, Timnit Gebru  
{mmitchellai,simonewu, andrewzaldivar,parkerbarnes,lucyvasserman,benhutch,espitzer,tgebru}@google.com  
deborah.raji@mail.utoronto.ca

# AI Cards (II)



1. General Information about the system



3. Information about the incorporating components

2. Intended use of the AI system using 6 concepts

4. Information about processing of data (including info about legal basis and source of data)

5. Involvement of humans and level of automation

# AI Cards (III)



6. High-level summary of risk management

Impact on ↓	Risk			Measures					
	Likeli.	Severity	Residual	Org.	Tech.	Monit.	Secur.	Transp.	Log.
Health & Safety	High	V. High	Med.	✗	✓	✗	✓	✗	✓
Fundamental Rights	V. High	High	High	✓	✗	✓	✗	✓	✗
Society	Med.	Med.	Low	✗	✓	✗	✓	✗	✓
Environment	Low	Low	Low	✓	✗	✓	✗	✓	✗

7. Illustration of key qualities of the AI system



Impact on ↓	Likeli.	Severity	Residual	Org.	Tech.	Monit.	Secur.	Transp.	Log.
Health & Safety	High	V. High	Med.	✗	✓	✗	✓	✗	✓
Fundamental Rights	V. High	High	High	✓	✗	✓	✗	✓	✗
Society	Med.	Med.	Low	✗	✓	✗	✓	✗	✓
Environment	Low	Low	Low	✓	✗	✓	✗	✓	✗

Changed Entity	Change Frequency	Purpose of Change
Data		
Model		
...		

Regulations	
Standards	
Codes of conduct	

8. List of pre-determined changes

8. Regulation & Certification information

# Example: An AI-Based Student Proctoring System

Human-readable  
description

Proctify is intended to be used in the education domain, for detecting suspicious behaviour of students during online exams in universities. Facial behaviour analysis and video analysis are used for detecting suspicious behaviour



Machine-readable  
specification

```
ex:proctify
    airo:isAppliedWithinDomain ex:education ;
    airo:hasPurpose ex:detecting_suspicious_bahviour_during_online_exam
    airo:hasCapability ex:facial_behaviour_analysis ;
    airo:hasCapability ex:video_analysis ;
    airo:isUsedBy ex:university ;
    airo:hasAISubject ex:student ;
```

<https://delaramglp.github.io/aicards/example/>



AI Cards | Delaram Golpayegani et al. | Annual Privacy Forum | 4 Sep. 2024 | delaram.golpayegani@adaptcentre.ie

## AI Cards: Proctify

<https://raw.githubusercontent.com/DelaramGlp/airo/main/usecase/proctify.ttl>

Card's Version 1.2.3  
Card's Date (Issued) 2024-04-23  
Card's Language Eng  
Card's Publisher AIEduX  
Contact Info proctify@aiedux.org



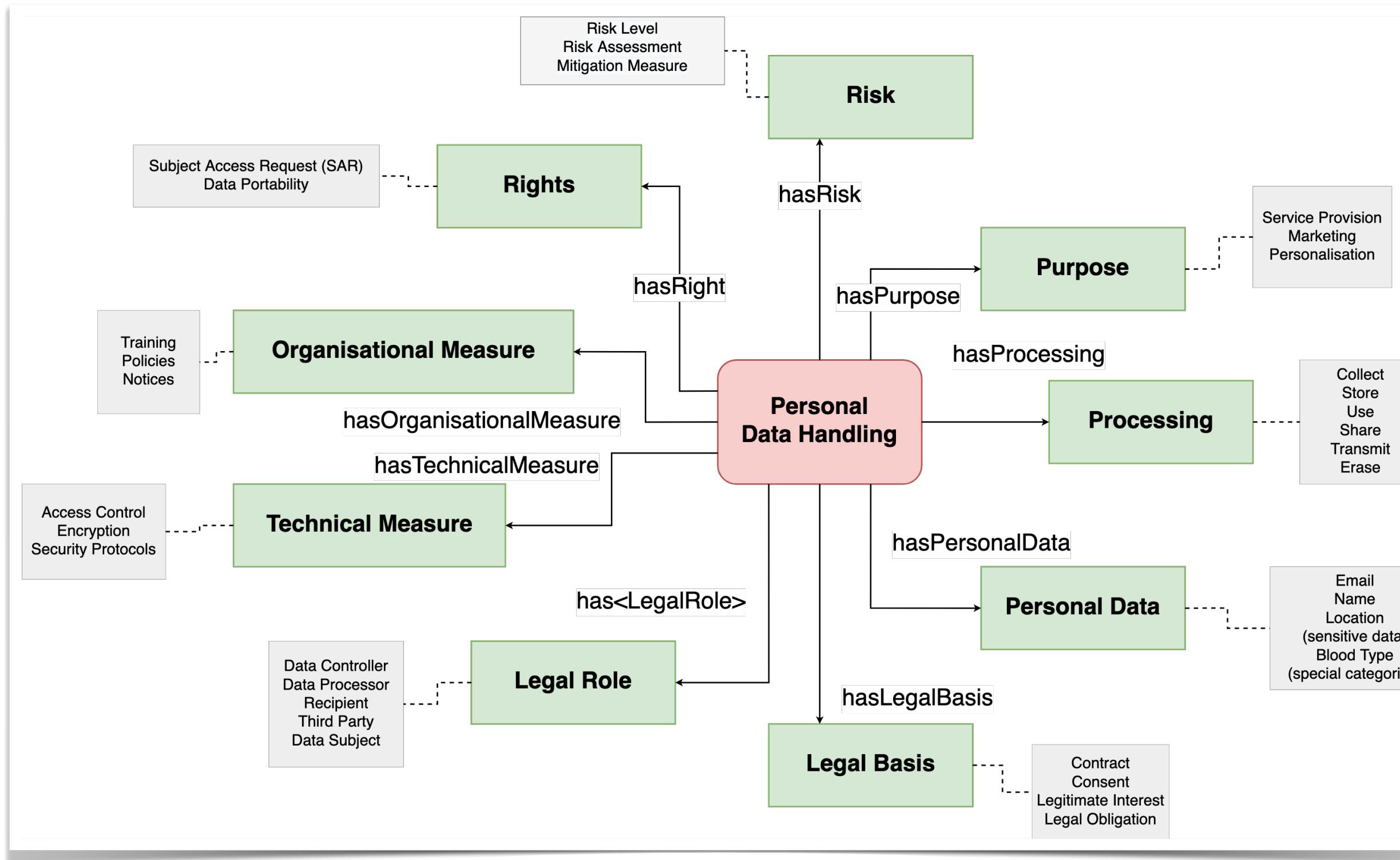
1. General Information				2. Intended Use															
Version: 1.2				Domain: Education															
Modality: Software				Purpose: Detecting suspicious behaviour during online exam															
AI Technique(s): ML>>ANN>>Deep learning				Capability: Facial behaviour analysis, video analysis															
Provider(s): AIEduX				Deployer: University															
Developer(s): AIEduX				AI Subject: Students															
				Locality of Use: Educational institution in EU															
3 . Key Components				4 . Data Processing															
				<table border="1"> <thead> <tr> <th>Processing</th><th>Legal basis</th><th>Data</th><th>Data Source</th></tr> </thead> <tbody> <tr> <td>Processing of input video</td><td>Informed consent</td><td>Facial&gt;&gt; Biometrics</td><td>User input</td></tr> <tr> <td>Behaviour analysis (ML model)</td><td>Informed consent</td><td>Facial&gt;&gt; Biometrics</td><td>SusBehaved dataset contributors</td></tr> </tbody> </table>				Processing	Legal basis	Data	Data Source	Processing of input video	Informed consent	Facial>> Biometrics	User input	Behaviour analysis (ML model)	Informed consent	Facial>> Biometrics	SusBehaved dataset contributors
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5. Human Involvement																			
Level of Automation: Partial automation																			
Involved Entity	Intended	Active	Informed	Control over output															
Student	✓	✓	✓	ex-post challenge															
Occupant (of the room)	✗	✗	✗	No opt-out															
Instructor	✓	✓	✓	Correct															
6. Risk Profile																			
Impact on ↓		Risk		Measures															
Likeli.	Severity	Residual	Org.	Tech.	Monit.	Secur.	Transp.												
Health & Safety	Med.	V. High	Low	✓	✓	✓	✗												
Fundamental Rights	High	V.High	Low	✓	✓	✓	✓												
Society	Low	Med.	Med.	✓	✓	✗	✗												
Environment	Low	Low	Low	✓	✗	✗	✗												
7. Quality																			
8. Pre-determined Changes																			
Changed Entity	Frequency	Purpose																	
Susbhaved model	2 Month	Improve performance																	
Mitigation measures	2 Week	Mitigate newly identified risks																	
9. Compliance & Certification																			
Regulations	[EU, GDPR]																		
Standards	[ISO/IEC 27001:2022]																		
Codes of conduct	[EU, use of AI and data in teaching and learning for educators]																		

# What am I working on?

**Privacy Risks, GDPR, Legal Compliance, Semantics**

# Machine-Readable Metadata for Automated Approaches

## Data Privacy Vocabulary (DPV) <https://w3id.org/dpv>



The Data Privacy Vocabulary (DPV) reflects ~5 years of efforts in creating an open resource providing concepts related to personal data processing, privacy, data protection, and GDPR

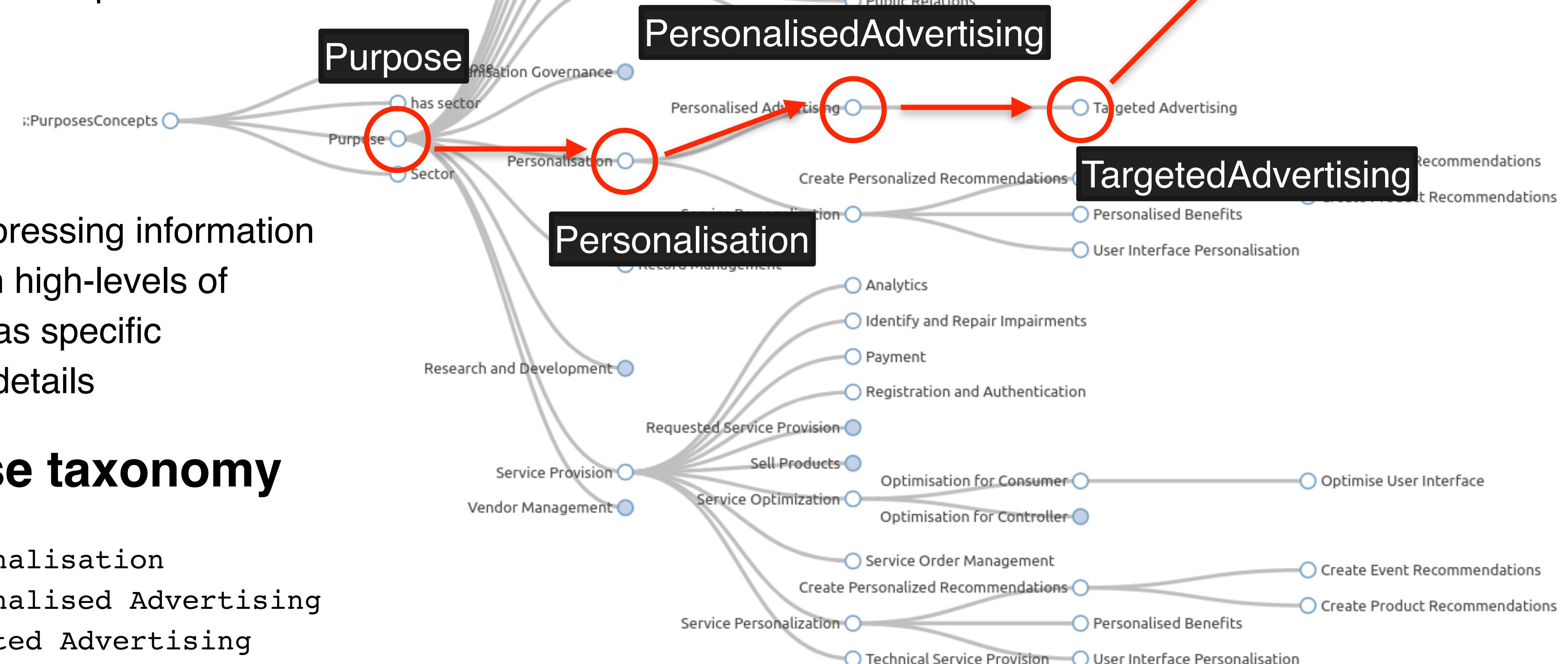
DPV's taxonomies provide semantic interoperability, which enables new, innovative, smart, and automated solutions

Demonstrated usefulness for important use-cases, e.g. ROPA, consent, compliance checking

We're looking to the future! DGA / ePR / AI-Act / Data Spaces

# DPV Taxonomies

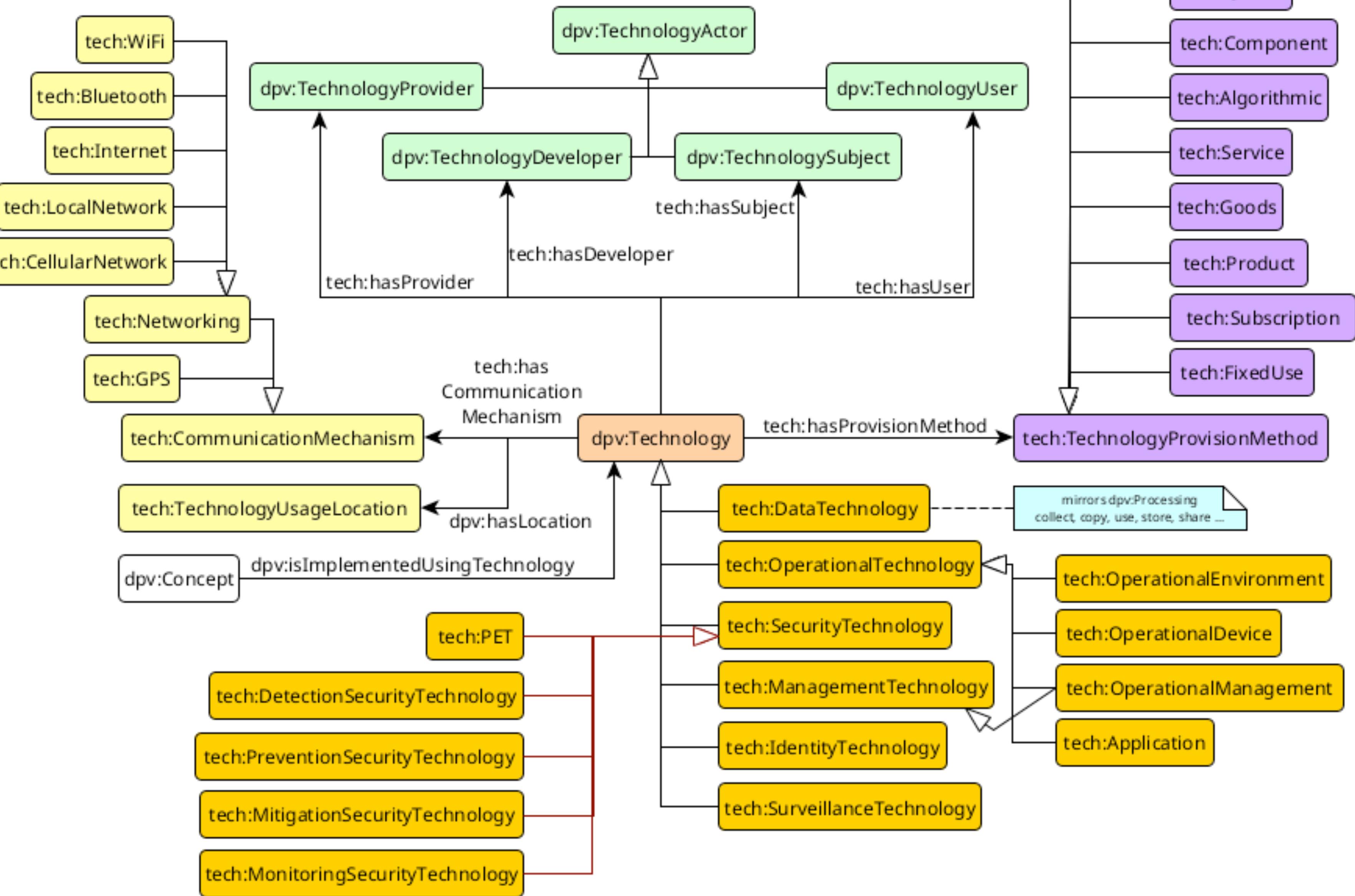
DPV provides rich hierarchical trees in top-down fashion that go from abstract to more specific concepts



## E.g. Purpose taxonomy

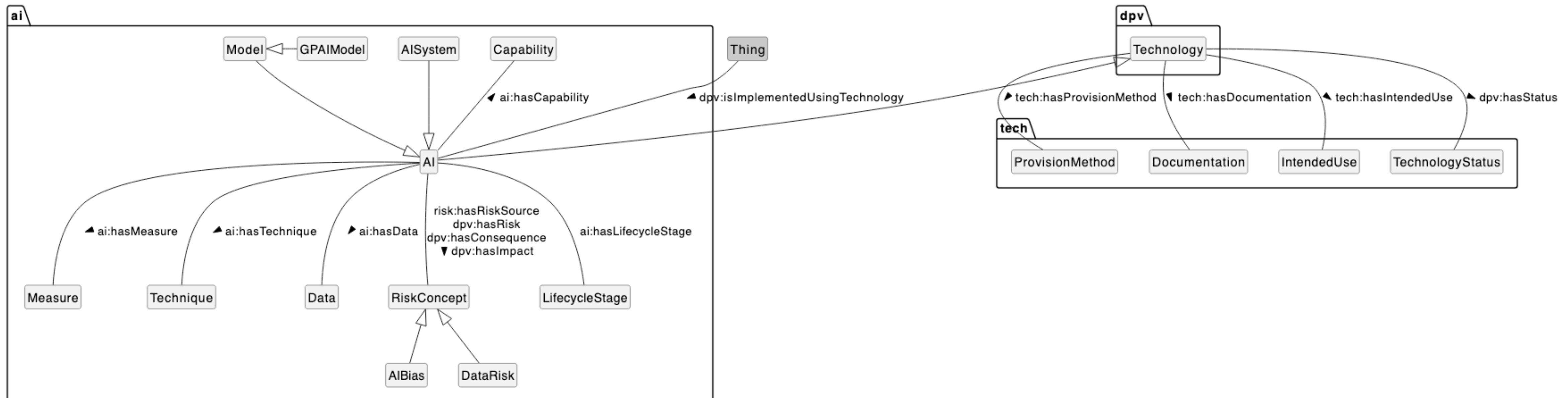
- Purpose → Personalisation
- Personalised Advertising
- Targeted Advertising

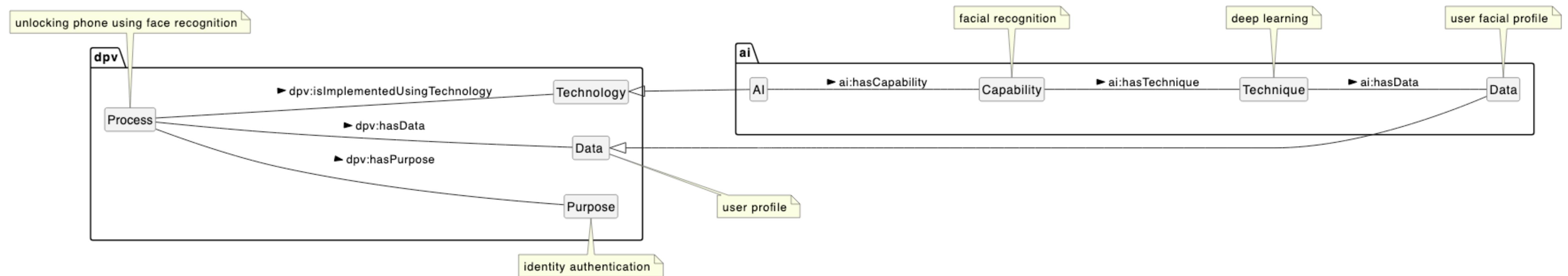
## Use-Case Instances



# A 'Model' of Technologies

DPV TECH extension  
<https://w3id.org/dpv/tech>





# Risk Extension

version 2.1

Draft Community Group Report 01 February 2025

Latest published version:

<https://w3id.org/dpv/risk>

Latest editor's draft:

<https://dev.dpvcg.org/risk>

— --

Concept	Roles				CIA model		
	Risk Source	Risk	Consequence	Impact	Confidentiality	Integrity	Availability
risk:Bias	✓	✓	✓				
risk:CognitiveBias	✓	✓	✓				

## § 3.4.1 Risk Matrix 3x3

Likelihood ↓ Severity →	Low	Moderate	High
High	RM3x3S1L3	RM3x3S2L3	RM3x3S3L3
Moderate	RM3x3S1L2	RM3x3S2L2	RM3x3S3L2
Low	RM3x3S1L1	RM3x3S2L1	RM3x3S3L1

4. **risk:TechnicalRiskConcept:** Risk concepts, including any potential risk sources, consequences, or impacts, that are technical in nature or relate to a technical or technological process [go to full definition](#)

a. **risk:Bias:** Bias is defined as the systematic difference in treatment of certain objects, people, or groups in comparison to others [go to full definition](#)

-

1. **risk:CognitiveBias:** Bias that occurs when humans are processing and interpreting information [go to full definition](#)

+

2. **risk:DataBias:** Bias that occurs when data properties that if unaddressed lead to systems that perform better or worse for different groups [go to full definition](#)

-

A. **risk:DataAggregationBias:** Bias that occurs when aggregating data covering different groups of objects has different statistical distributions that introduce bias into the data [go to full definition](#)

B. **risk:DataProcessingBias:** Bias that occurs due to pre-processing (or post-processing) of data, even though the original data would not have led to any bias [go to full definition](#)

C. **risk:InformativenessBias:** Bias that occurs when the mapping between inputs present in the data and outputs are more difficult to identify for some group [go to full definition](#)

D. **risk:SimpsonsParadoxBias:** Bias that occurs when a trend that is indicated in individual groups of data reverses when the groups of data are combined [go to full definition](#)

E. **risk:StatisticalBias:** Bias that occurs as the type of consistent numerical offset in an estimate relative to the true underlying value, inherent to most estimates [go to full definition](#)

+

b. **risk:DataRisk:** Risks and risk concepts related to data [go to full definition](#)

-

1. **risk:DataBias:** Bias that occurs when data properties that if unaddressed lead to systems that perform better or worse for different groups [go to full definition](#)

+

2. **risk:DataInaccurate:** Concept representing data being inaccurate [go to full definition](#)

3. **risk:DataIncomplete:** Concept representing data being incomplete [go to full definition](#)

4. **risk:DataInconsistent:** Concept representing data being inconsistent [go to full definition](#)

# Challenges e.g. Provide vocabulary to specify purposes and permissions related to AI training #82

<https://github.com/w3c/dpv/issues/82>

## 1. new:TrainingByStrategy

- new:SupervisedTraining that uses ai:SupervisedLearning with new:LabelledData - where contextual information involves provenance of labelled data such as its source, who created the labels and its categorisation as sensitive etc.;
- new:UnsupervisedTraining that uses ai:UnsupervisedLearning with new:UnlabelledData - where contextual information involves provenance of unlabelled data such as its source;
- new:ReinforcementTraining that uses ai:ReinforcementLearning by using new:Feedback that act as new:Reward or new:Punishment - where contextual information involves the algorithm deciding the feedback;
- new:SelfSupervisedLearning that uses new:UnlabelledData - where contextual information involves provenance of unlabelled data.

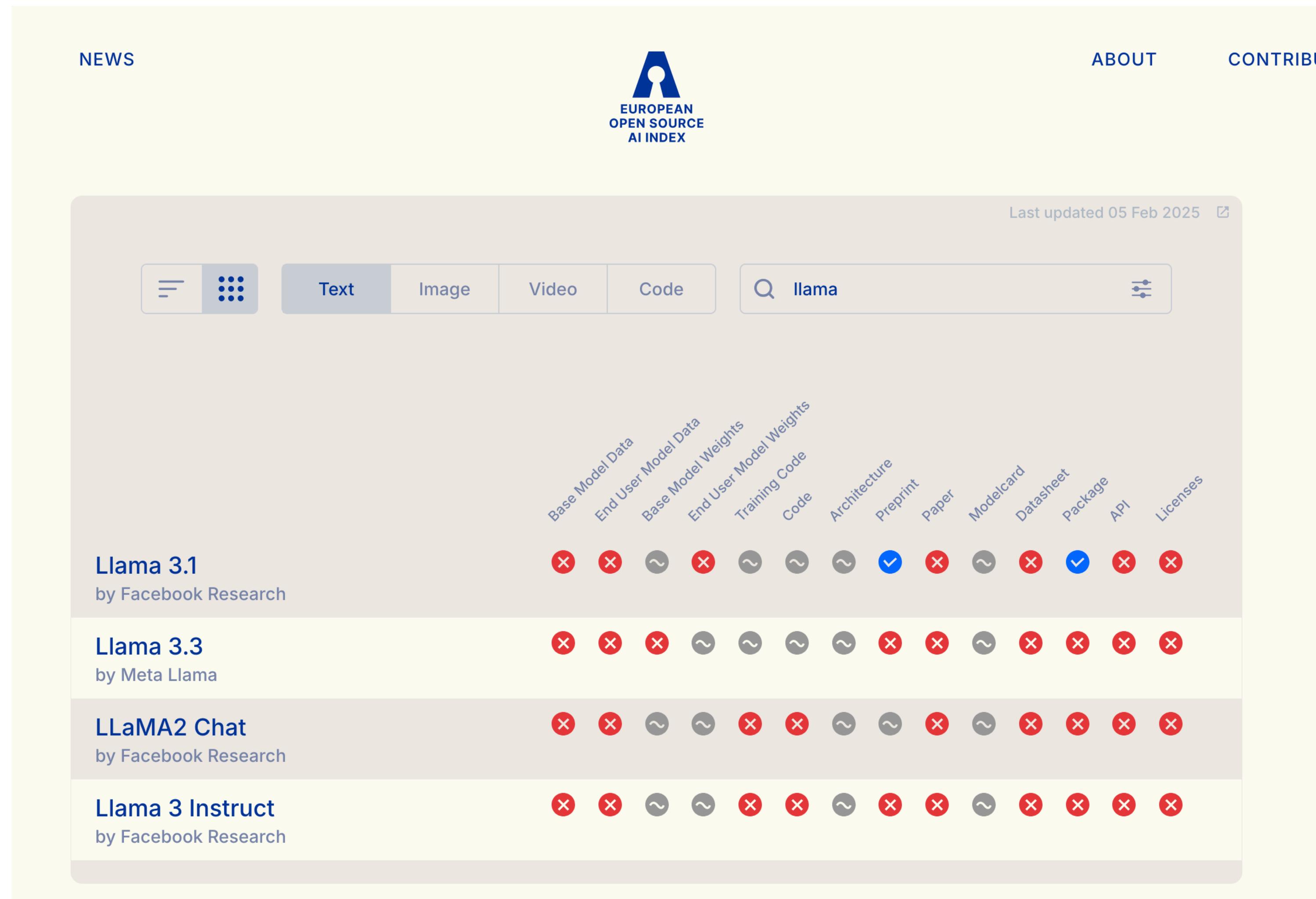
## 2. new:TrainingByAdapting

- new:TransferLearning reuse a trained model for a new task in another model;
- new:FineTuning where a trained model is refined using new data - in particular for a specific domain or use-case;
- new:FewShotTraining where a trained model is given a few labelled data points to learn from - where the sample is small and not specific enough to be considered fine tuning.

## 3. new:TrainingByFrequency

- new:StaticTraining where the model is trained once;
- new:PeriodicTraining where the model is trained periodically;
- new:ContinuousTraining where the model is trained continuously e.g. as new data arrives;
- new:IncrementalTraining where the model is trained in increments that are small and do not cause a full or significant retraining;
- new:FederatedTraining where the model is trained in a federated manner e.g. locally on device;

<https://www.osai-index.eu/the-index?type=text&view=grid>



European Open Source AI Index

# In conclusion...

- Many unknowns
- We're still figuring out how to *describe AI / ML technologies* in line with laws
- ML and Personal Data is a complicated affair
- Several important issues exist, but aren't being solved
- Existing approaches don't fix stuff
- Risks/Harms are a challenge that *MUST* be taken into account and addressed
- Lots of work to be done ...

~ end of slides ~