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MODELLING DATA ENVIRONMENTS WITHIN PROV TO ASSIST ANONYMISATION DECISION-MAKING

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OUTLINE

- Introduce the ADF
- The criticality of Provenance
- PROV and how to represent Data Environments

THE ADF

- Output of the UK Anonymisation Network
  - Collaboration of:
    - University of Southampton
    - University of Manchester
    - Office for National Statistics
    - Open Data Institute
    - UK Information Commissioner's Office
- Born out of work in the early 2000's which led to the Data Environment Analysis Service with the Office for National Statistics.

HOW THE ADF WAS CREATED

- Four year process 2012-2016
- Series of multi stakeholder workshops
  - Answer the question what is anonymisation?
- Collation of thinking drawn into a book
- Drafts of the book reviewed by an international cross-sectoral panel of reviewers.
  - Hundreds of comments
  - Book published Summer 2016
  - Australian version published Autumn 2017

THE SECOND EDITION

- Review of the ADF took place in 2018/19
  - Input from our three advisory groups
    - User community
    - Legal group
    - Scientific expert
  - Changes for GDPR and National Legislation and further conceptual development.
  - New materials
    - Compact version (practitioner facing)
    - Short summary documents
    - Posters and leaflets

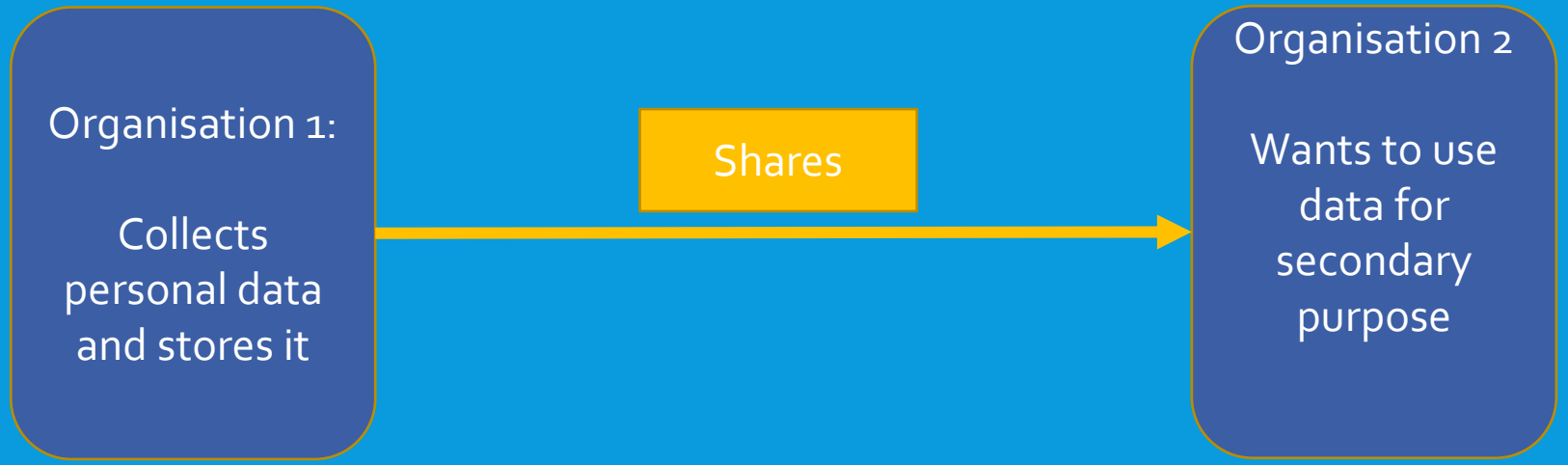
THE NEW ADF: 10 STEP PROCESS

1. Describe/capture the presenting problem
2. Sketch the data flow and Determine Your Responsibilities
3. Map the properties of the data environment(s)
4. Describe and map the data
5. Engage with stakeholders
6. Evaluate the data situation
7. Select and implement the processes you will use to assess and control disclosure risk
8. Maintain stakeholders' trust
9. Plan what to do if things go wrong
10. Monitor the evolving Data Situation

PROBLEM STATEMENT

Data situations are often dynamic in that data move between environments for both processing and use. Thus, understanding contextual risk, and how to manage that risk through anonymisation, requires an awareness of, and capacity to map, the data flows between environments.

SKETCH THE DATA FLOW: A SIMPLE EXAMPLE



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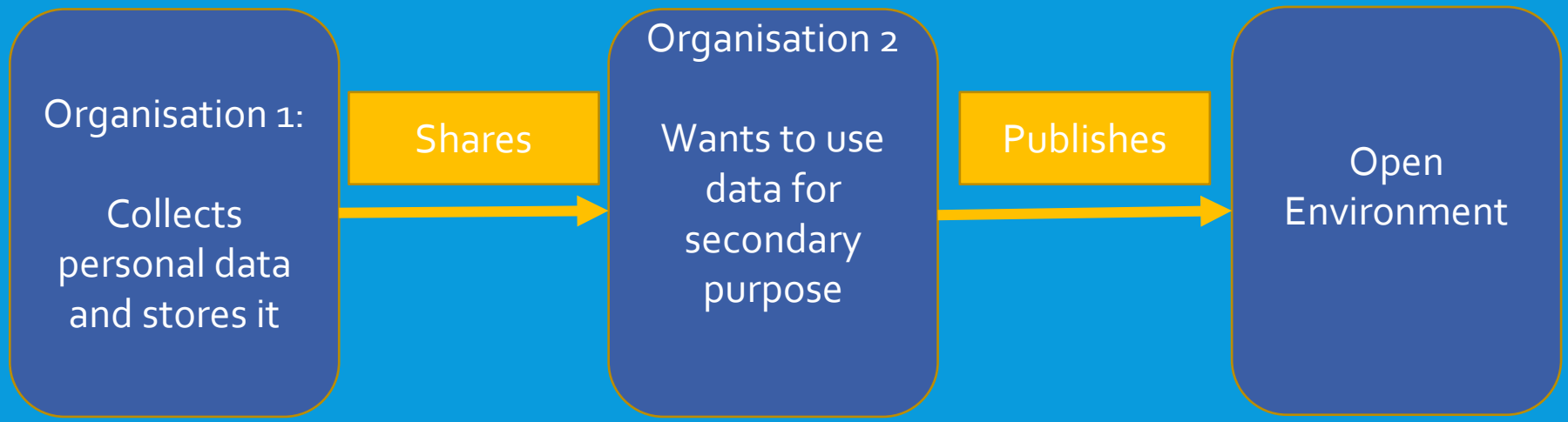
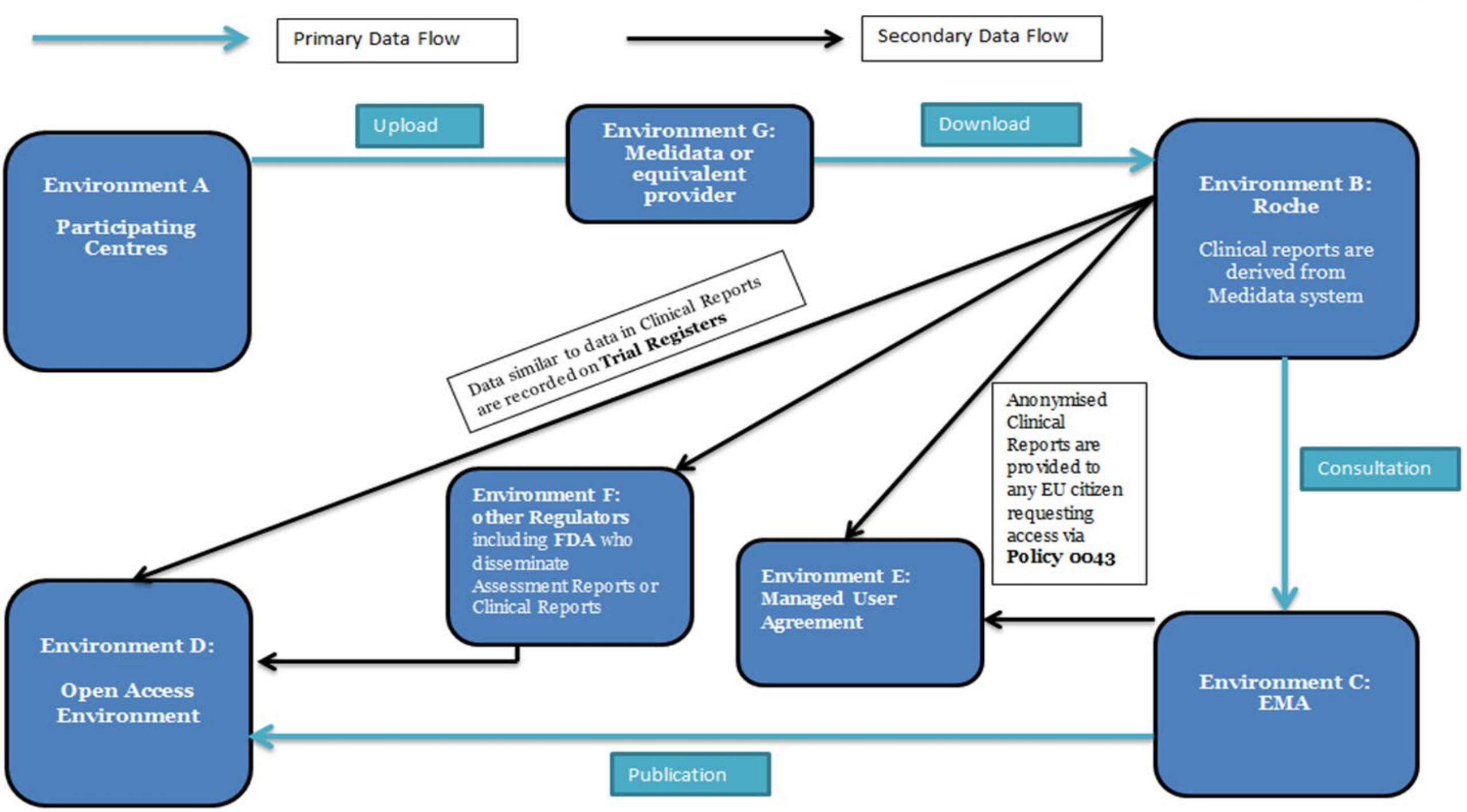



Primary Data Flow
Secondary Data Flow
Upload
Environment G: Medidata or equivalent provider
Download
Environment A
Participating Centres
Environment B: Roche
Clinical reports are derived from Medidata system
Data similar to data in Clinical Reports are recorded on Trial Registers
Anonymised Clinical Reports are provided to any EU citizen requesting access via Policy 0043
Consultation
Environment F: other Regulators including FDA who disseminate Assessment Reports or Clinical Reports
Environment E: Managed User Agreement
Environment D:
Open Access Environment
Environment C: EMA
Publication

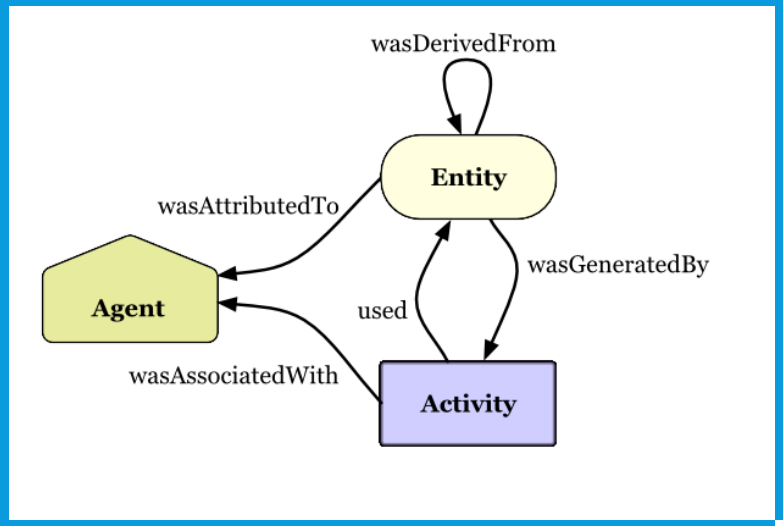
PROVANON PROJECT

- Aspiration
  - To (semi-)automate the capture and processing of provenance information
    - to enable anonymisation decision making
    - And other purposes – e.g. ethics applications
  - Need a machine-interpretable way to express both anonymisation and relevant provenance concepts.
  - RP4 Provenance model
    - Retrospective
    - Prospective
    - Prescriptive
    - Proscriptive
    - Permitted

PROV

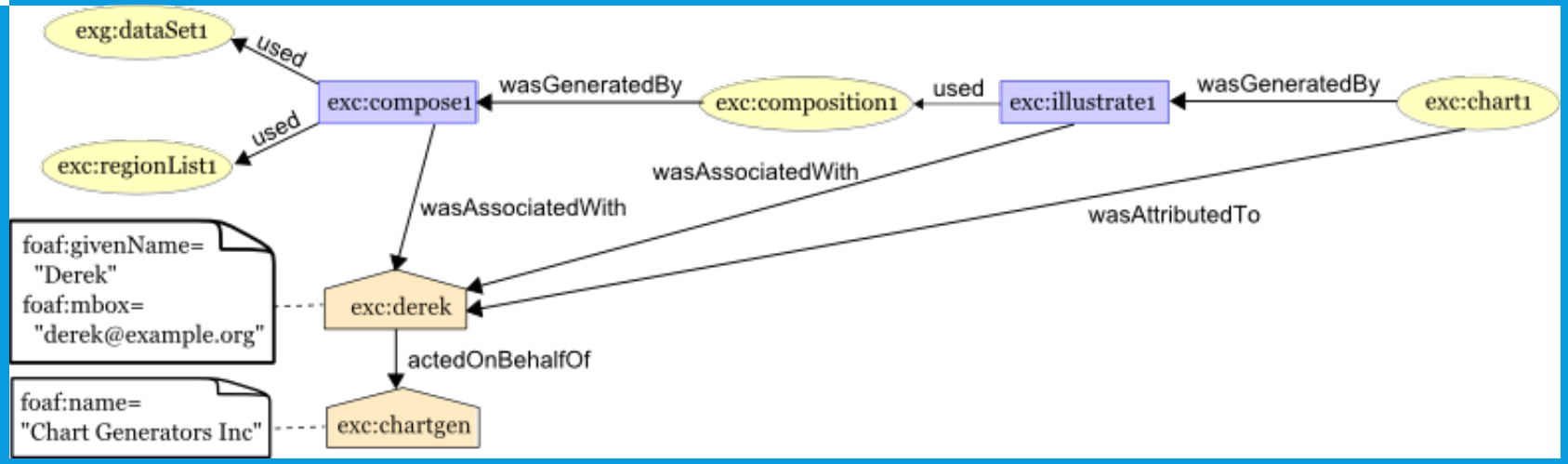
- **PROV** is an interoperability standard
  - which defines amongst other things a data model to represent provenance information.
  - Can be used for may things from food to art to.. data..
  - It's has an associated coding language

AN EXAMPLE PROV GRAPH



The core concepts and relationships supported by PROV
Taken from the PROV primer
https://www.w3.org/TR/2013/NOTE-prov-primer-20130430/

Used to create graphs describing what happened to the data and processes



WHAT PROPERTIES DO WE NEED?

- A specification of those requirements is as follows:
  - R1: The data environment construct
  - R2: Nesting data environments within data environments
  - R3: Attaching attributes to data environments
  - R4: Relationships between data environments
  - R5: Annotation of relational constructs
  - R6: Representation of agents, data and processes in data environments
  - R7: Data governance instruments: contracts
  - R8: Access and control (direct and indirect)

WHAT'S MISSING FROM PROV

- Data Environments!

TWO CANDIDATES

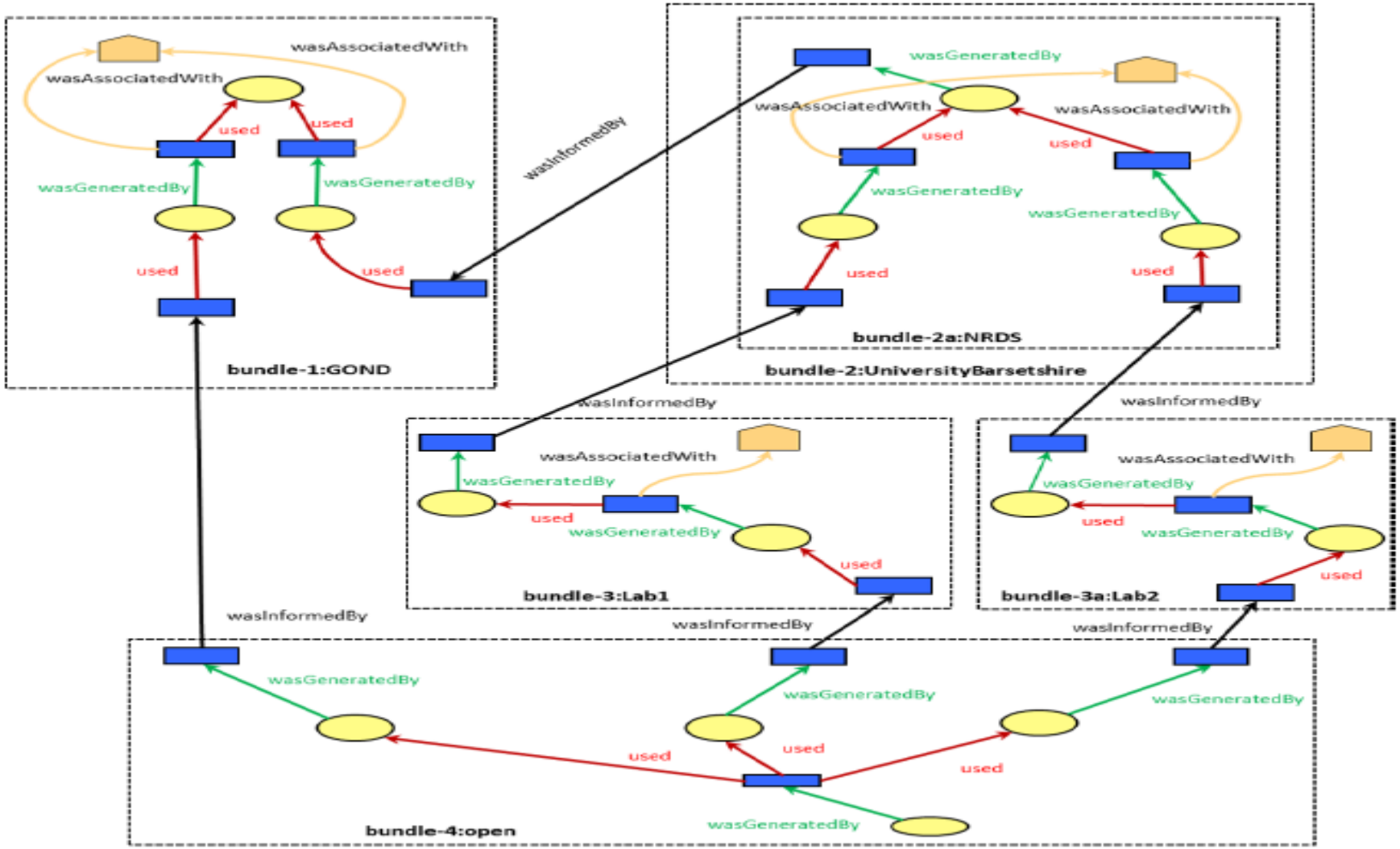
- Namespaces
  - inspired by the WWW architecture and was designed to make objects interoperable across technologies and platforms.
  - In PROV-DM, Namespaces are a Uniform Resource Identifier (URI)
  - A provenance graph can contain multiple - possibly many - Namespaces.
- Bundles
  - Are entities which provide provenance information regarding the creation and modification of a group of entities.
  - can contain entities, activities, agents, and the relationships between them.
  - can also support entities with attributes.

EVALUATION

Representation requirements	Support			
	Bundle	Namespace	Namespace+	Bundles+
Data Environment Construct	✓	✓	✓	✓
Data Environments within Data Environments	-	✓	✓	✓
Attaching Attributes to Data Environments	-	-	✓	✓
Relationships between Data Environments	✓	-	✓	✓
Annotation of relational constructs	-	-	✓	✓
Representation of agents, data and processes within Data Environments	✓	✓	✓	✓
Data governance instruments: contracts	-	-	✓	✓
Access and control	✓	✓	✓	✓

Requirements analysis for representing data environments

BUNDLES + REPRESENTATION



CONCLUSIONS

- By extending PROV we are able to represent data environments in machine readable way.
- This provides us with a **language** for reasoning about anonymisation decision making.
- In related work we are building an approach to processing data governance instruments (policies, contracts, agreements, regulations, privacy statements, laws etc..) in a systematic way as an additional piece of the jigsaw…