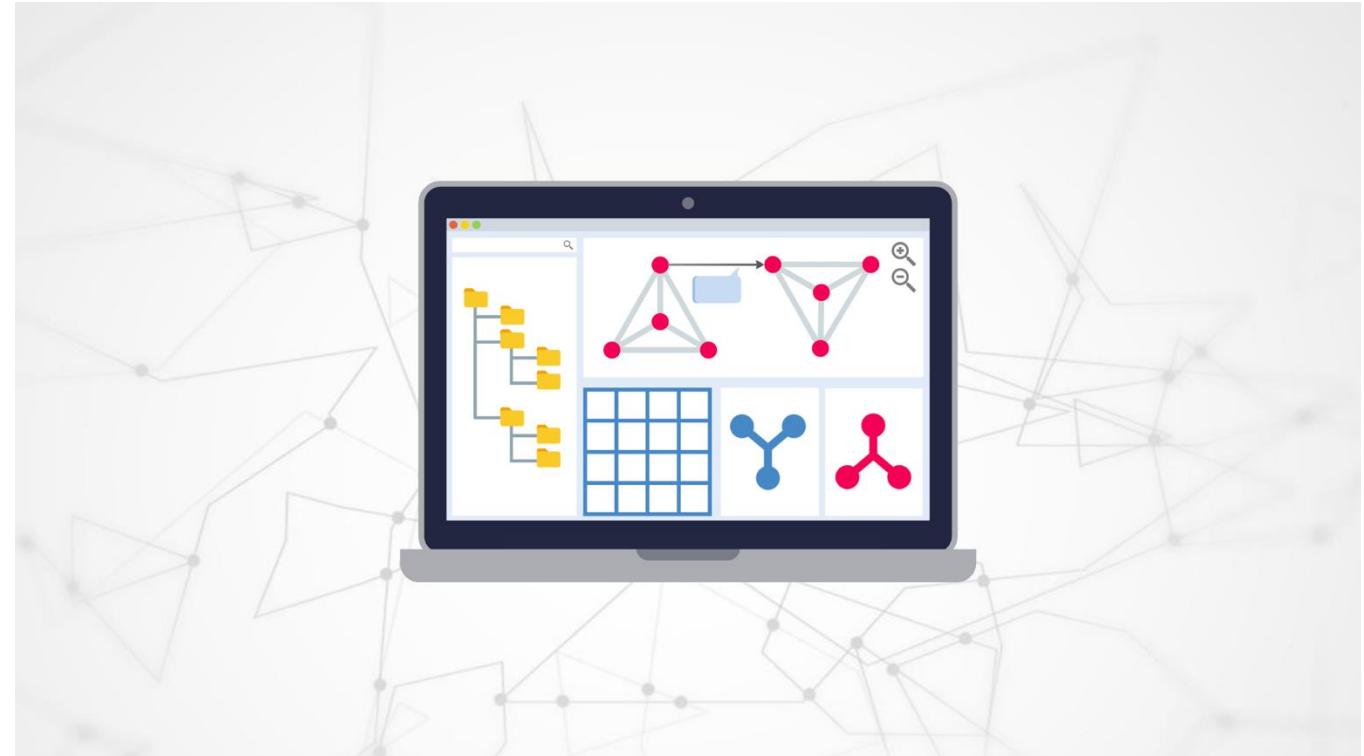


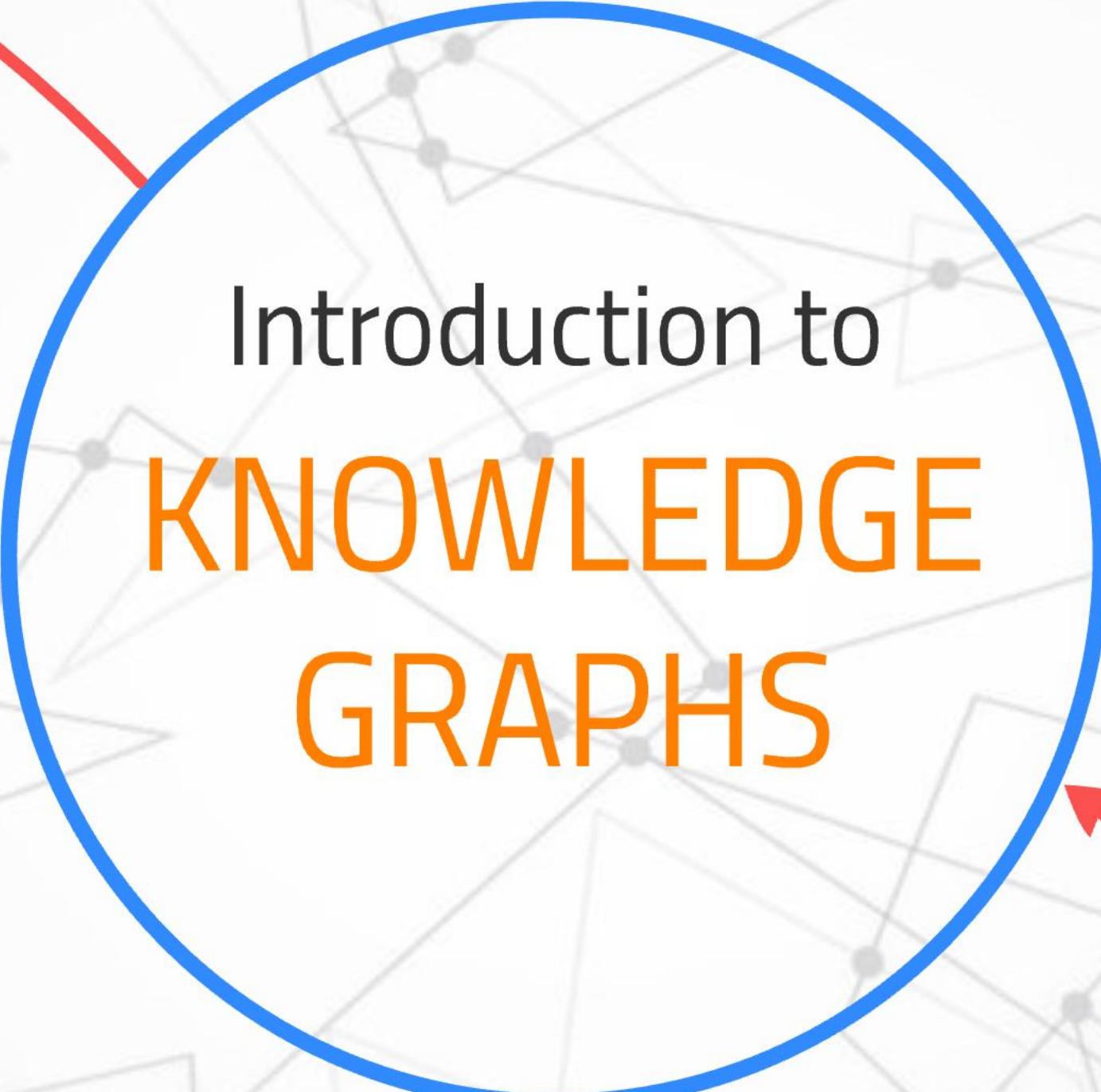
# Knowledge Graph for Beginners

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graftilo

# 01 Introduction



# Introduction to **KNOWLEDGE GRAPHS**

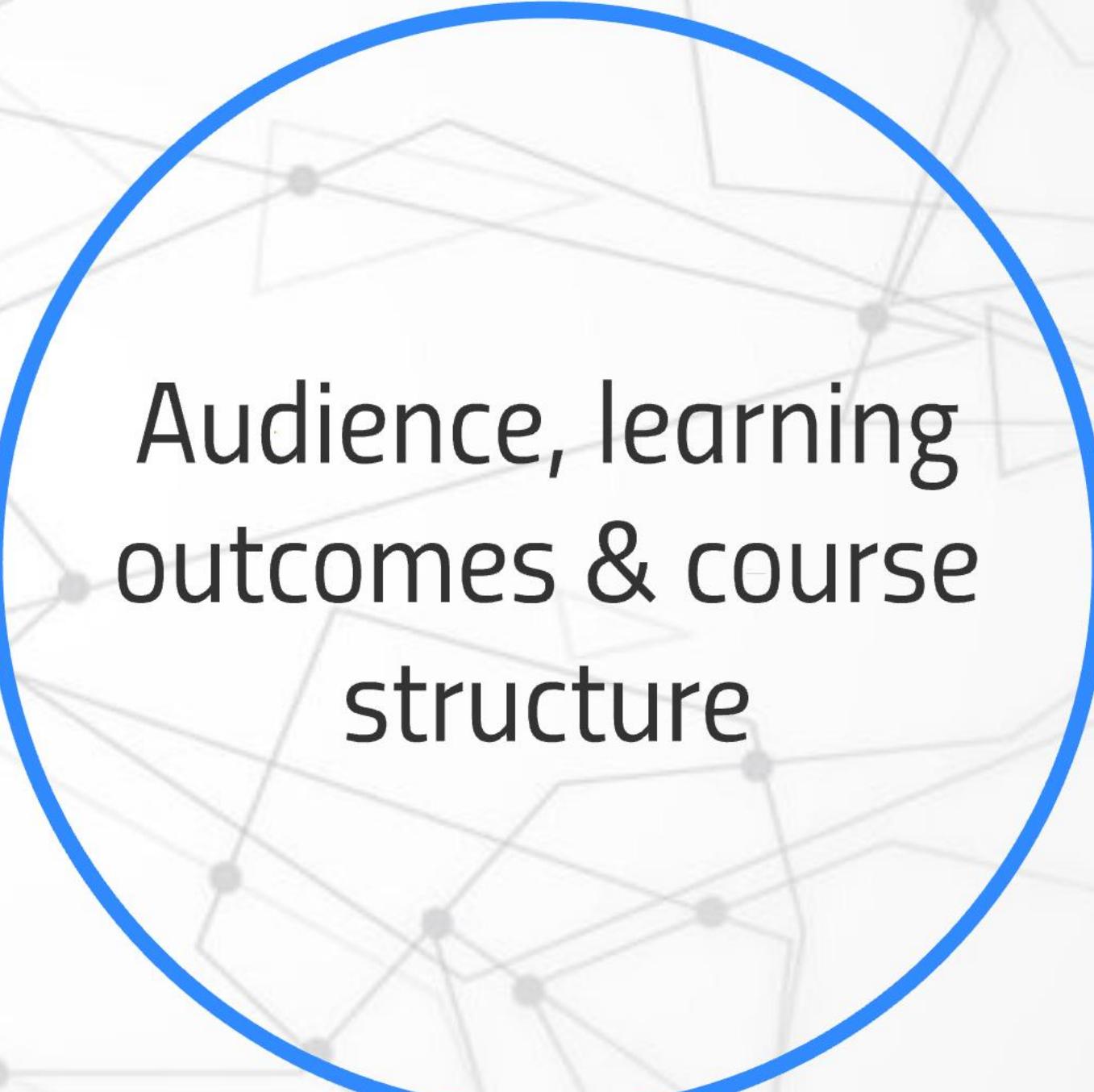
covered



# Definition

A network of facts connected via explicitly defined relationships, from which new knowledge can be inferred.

A Knowledge Graph may have an underlying structure (or schema), known as an ontology



Audience, learning  
outcomes & course  
structure

# Audience



- No prerequisites (it's a beginner course)
- Data analysts
- Data management professionals
- Technology managers, business analysts, etc.

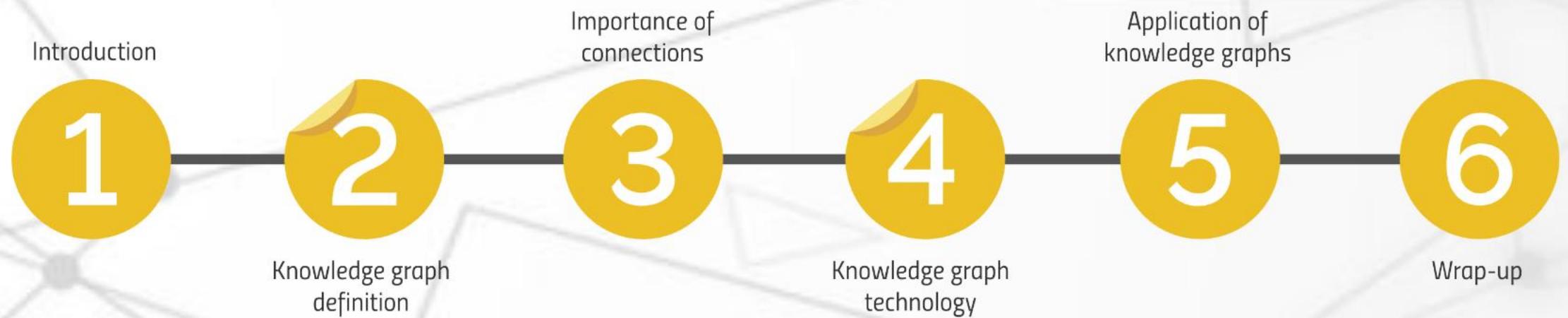
# Learning outcomes



- Become familiar with jargon
- Foundational knowledge to tackle more advanced topics
- Recognise opportunities for knowledge graph application
- Understand the knowledge graph tech stack

Note: This course is **not** about working with charts and mathematical functions

# Course structure



## 02 What is a knowledge graph?

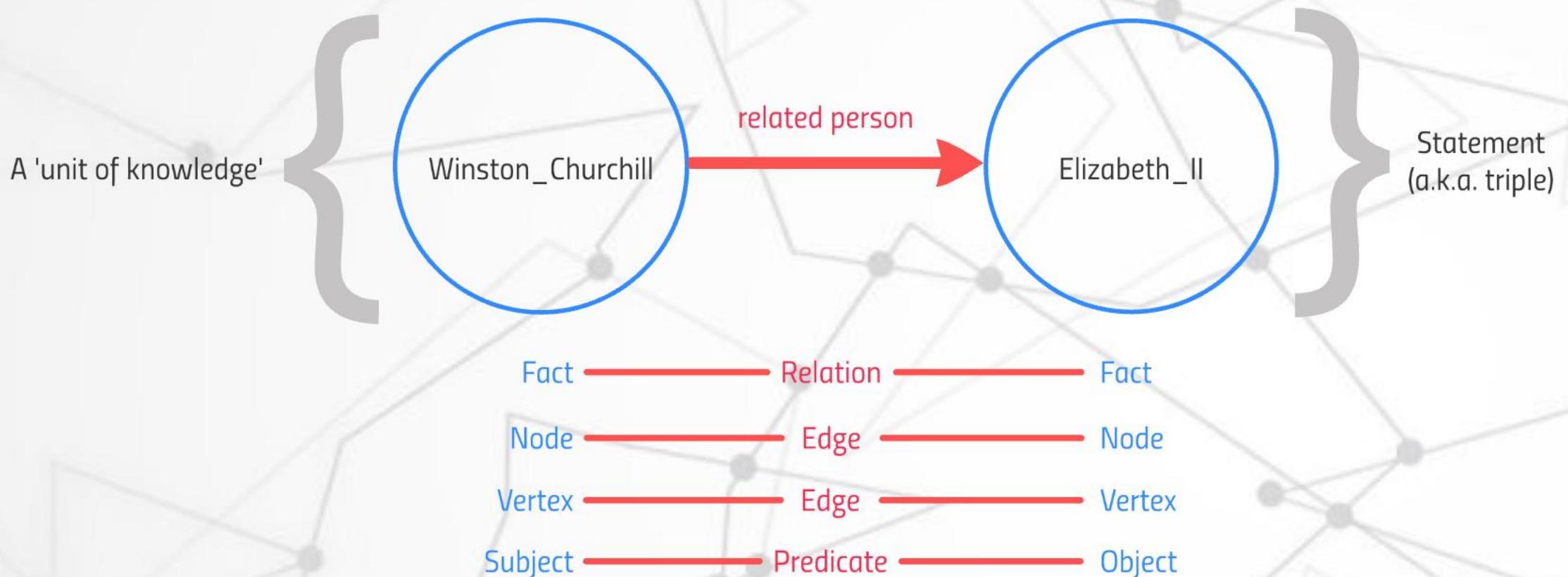
# Definition

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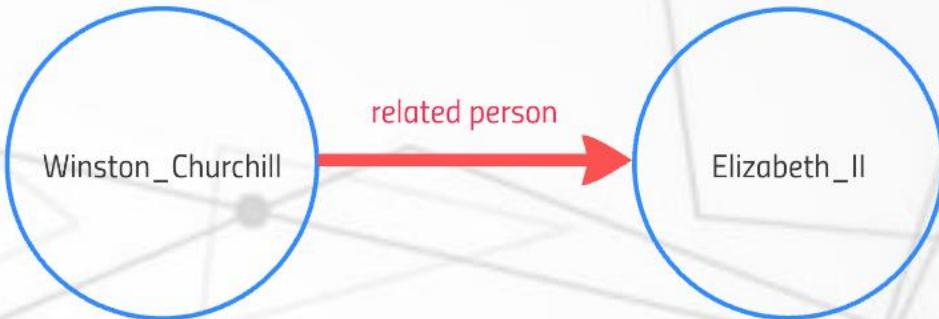
# 1

## Network of facts



2

## Explicitly-defined relationships

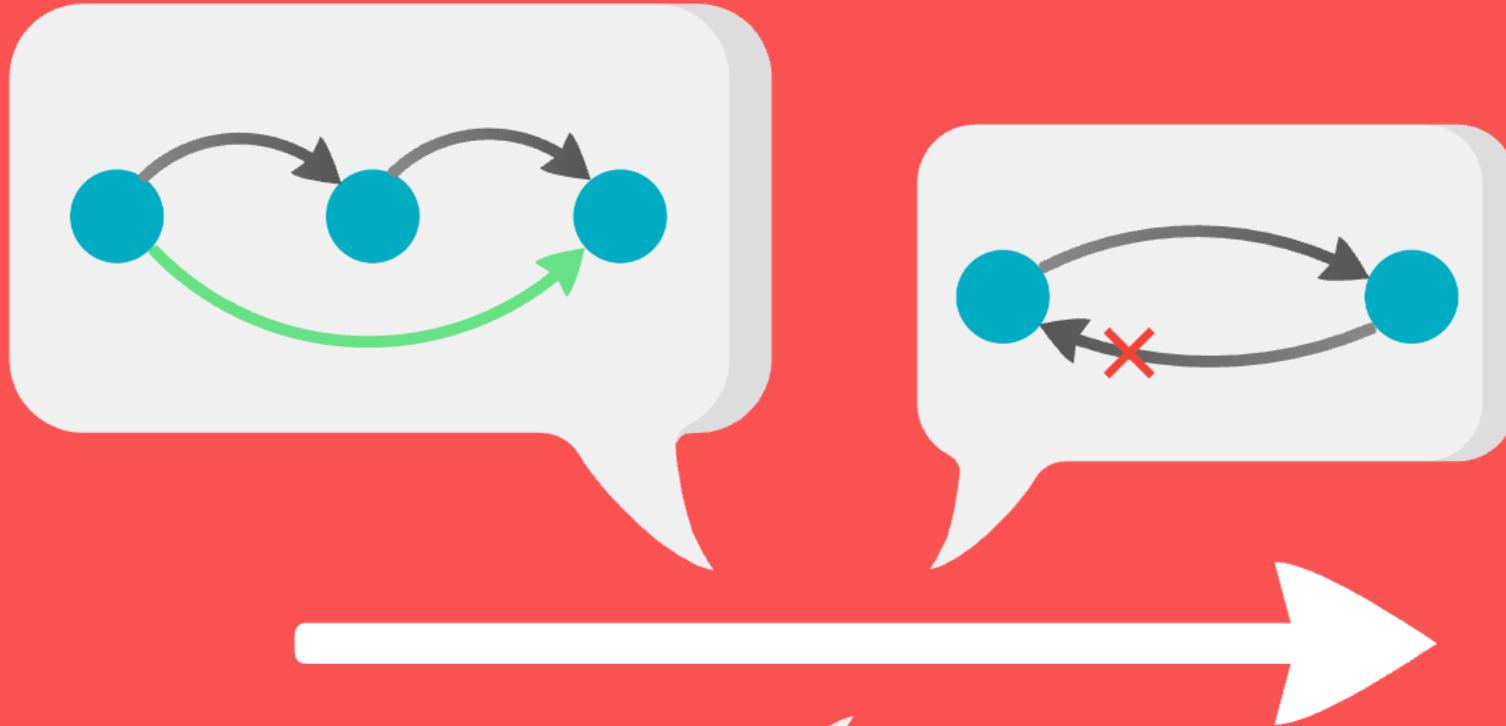


- 
- Carries a label
  - Binds facts
  - Typically has a direction
  - May have properties

related person

\_Churchill

Elizabeth

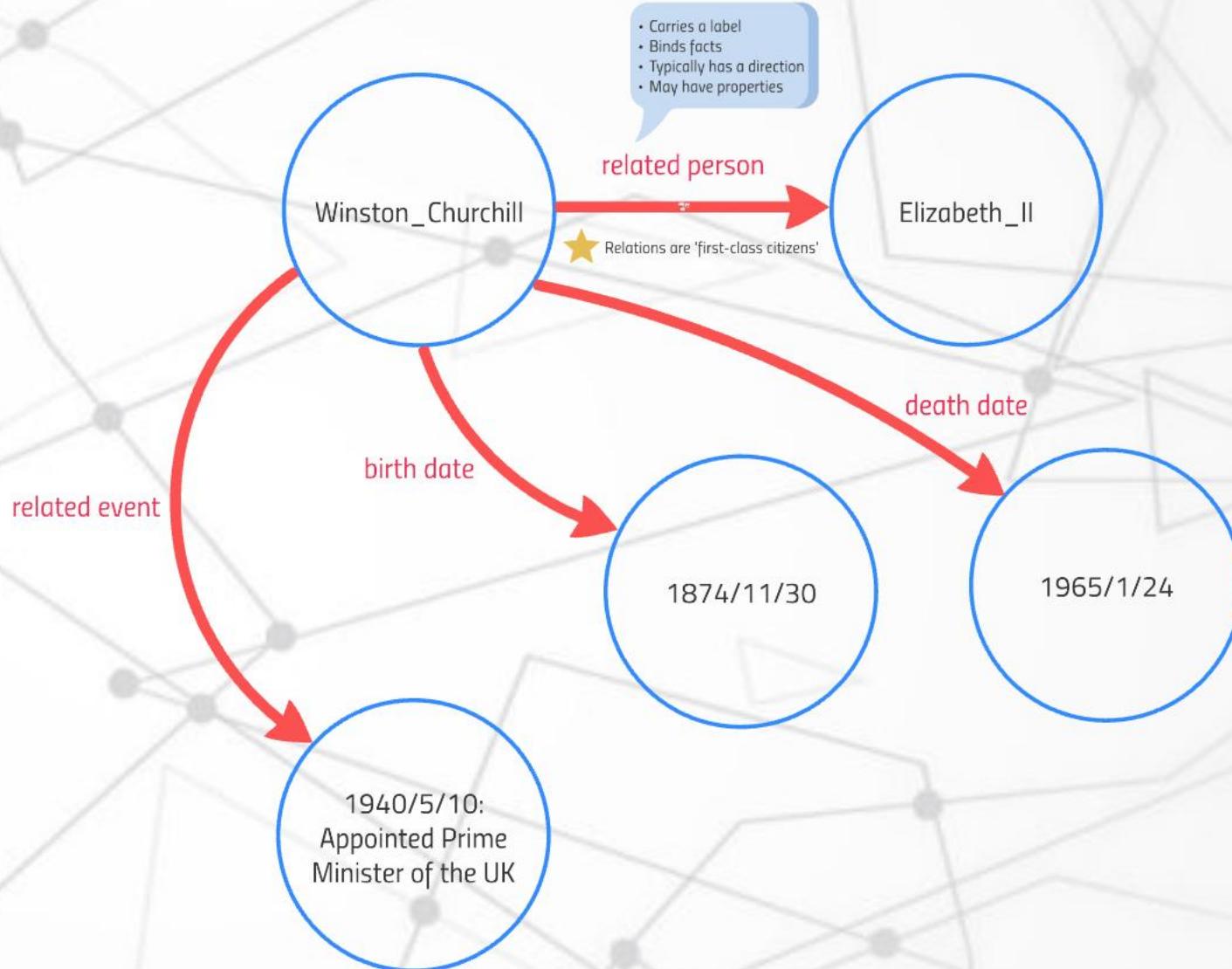


prop\_1: 12345  
prop\_2: "Text"

# 2

## Explicitly-defined relationships

Self-describing (i.e. semantic) network or graph

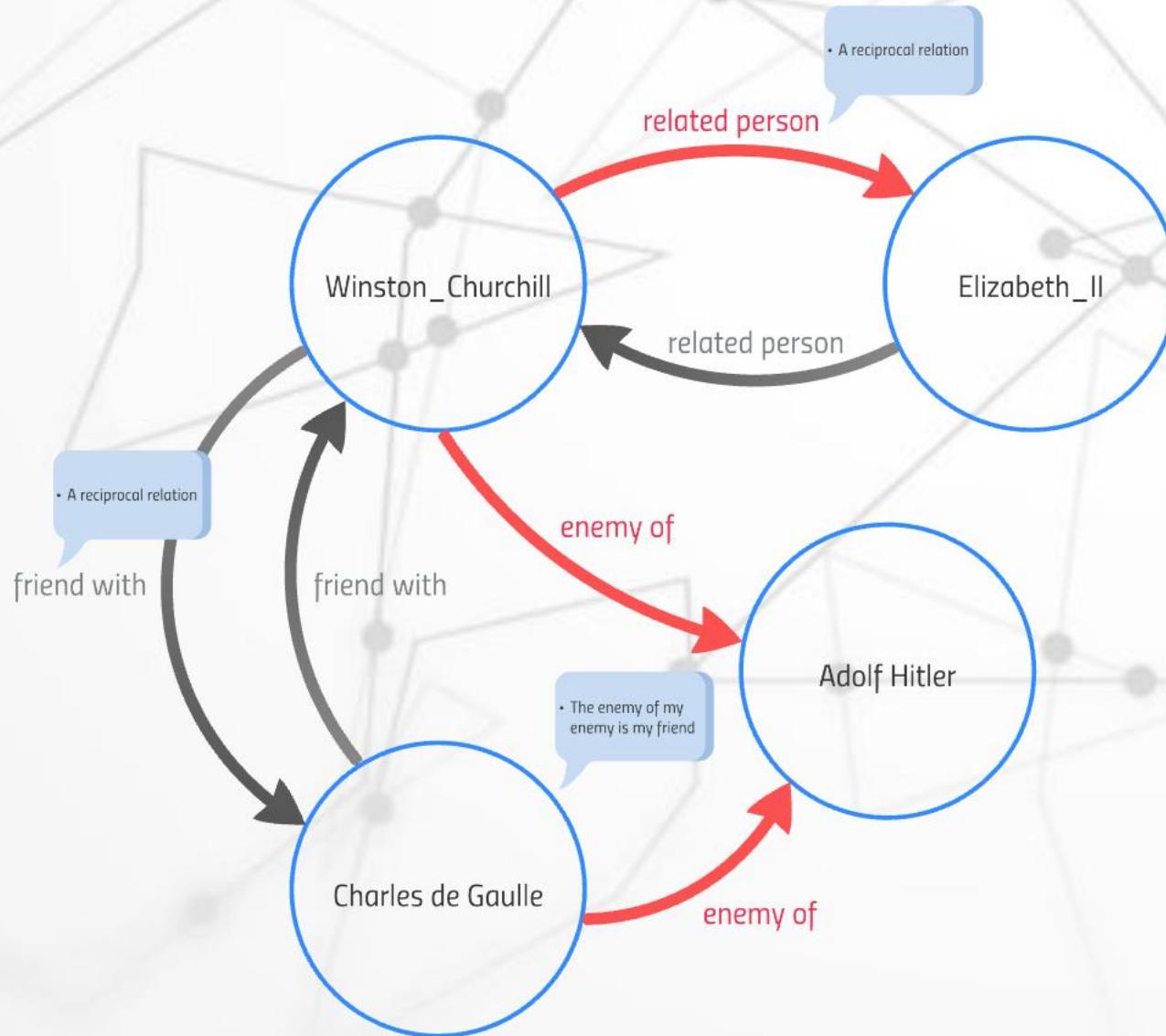


# 3

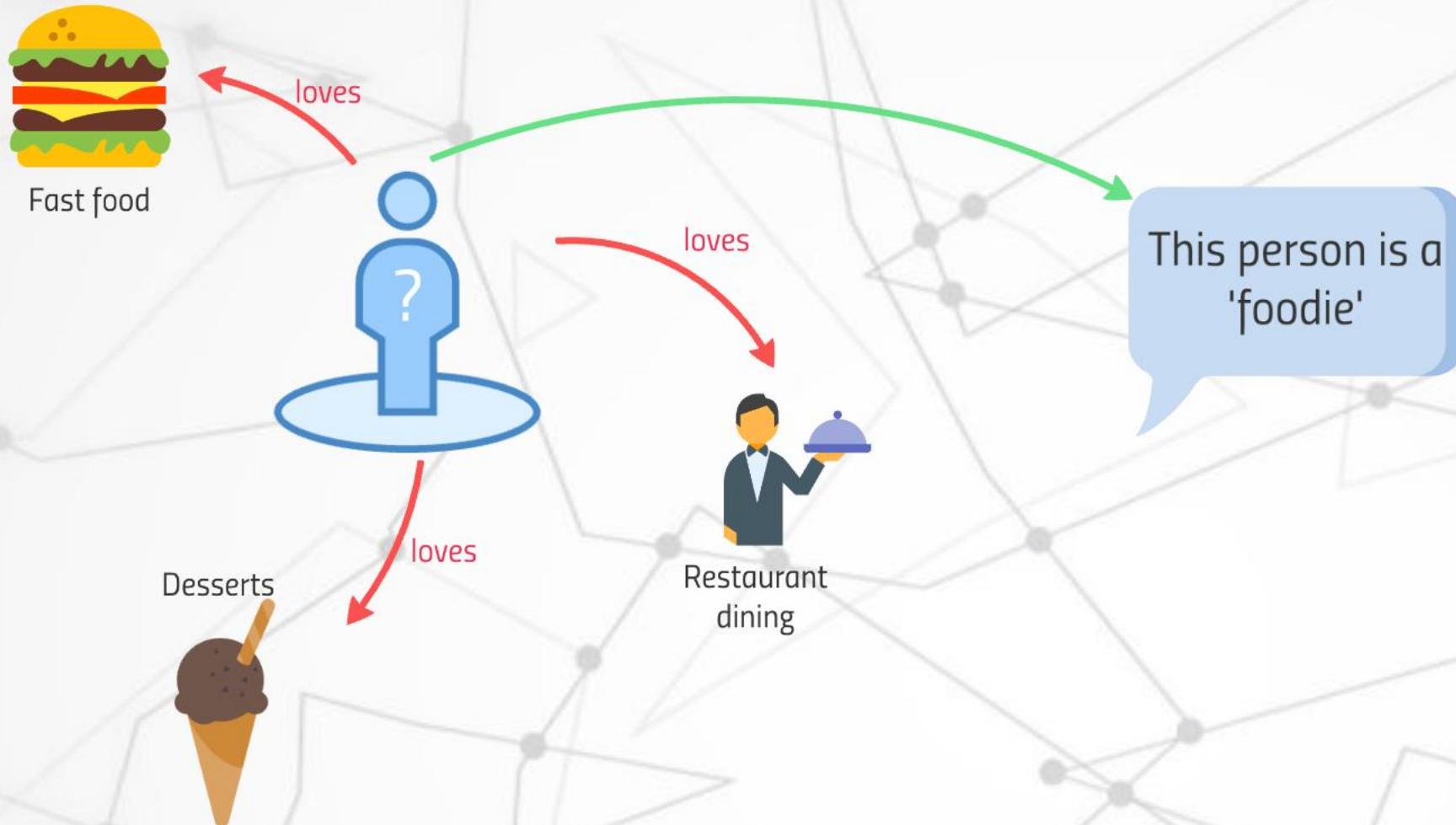
# New knowledge can be inferred

Deductive & automated reasoning through rules

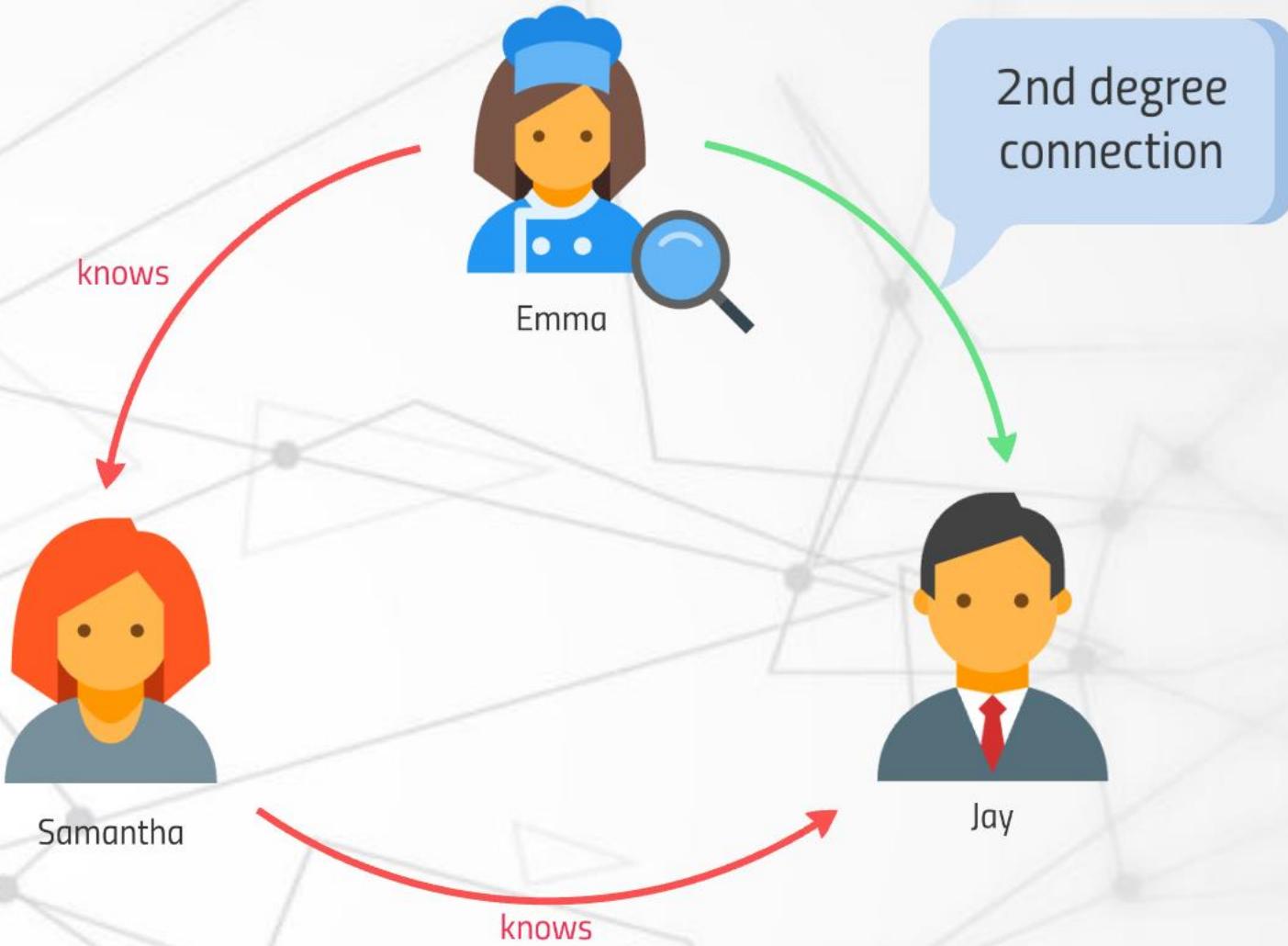
part of



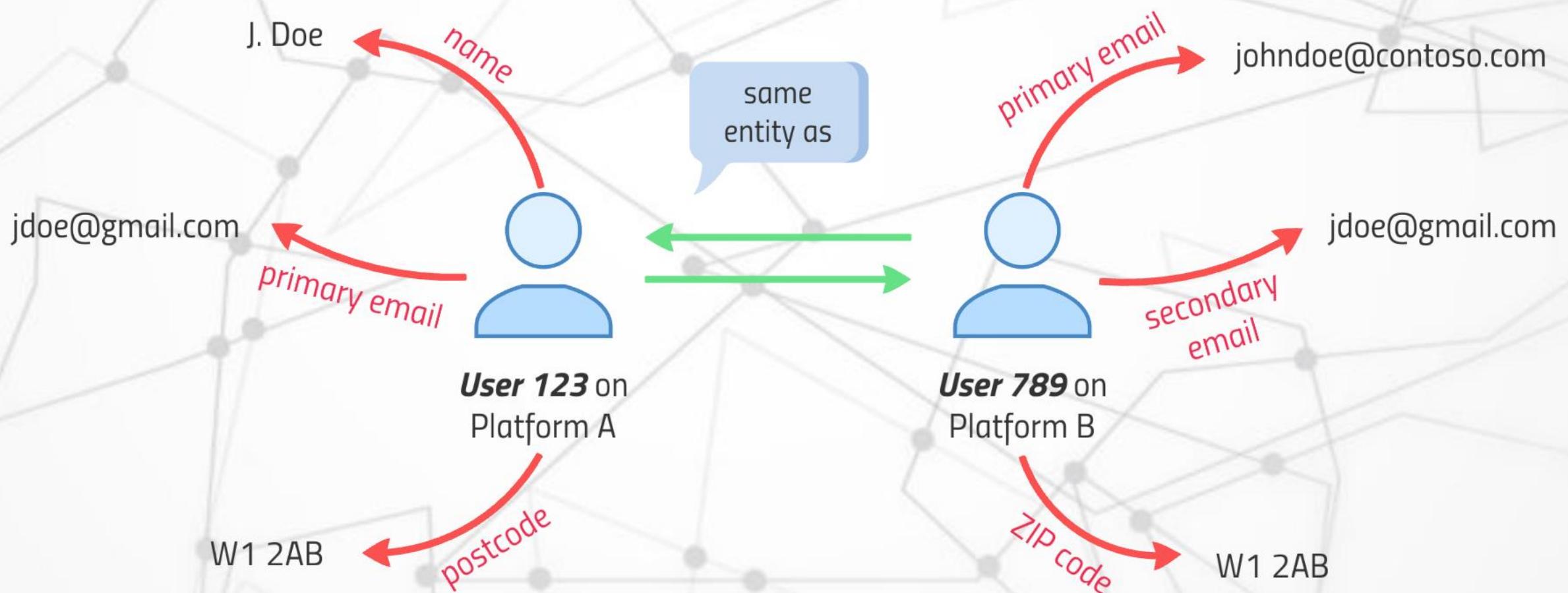
# Automated computation of membership



# Path querying

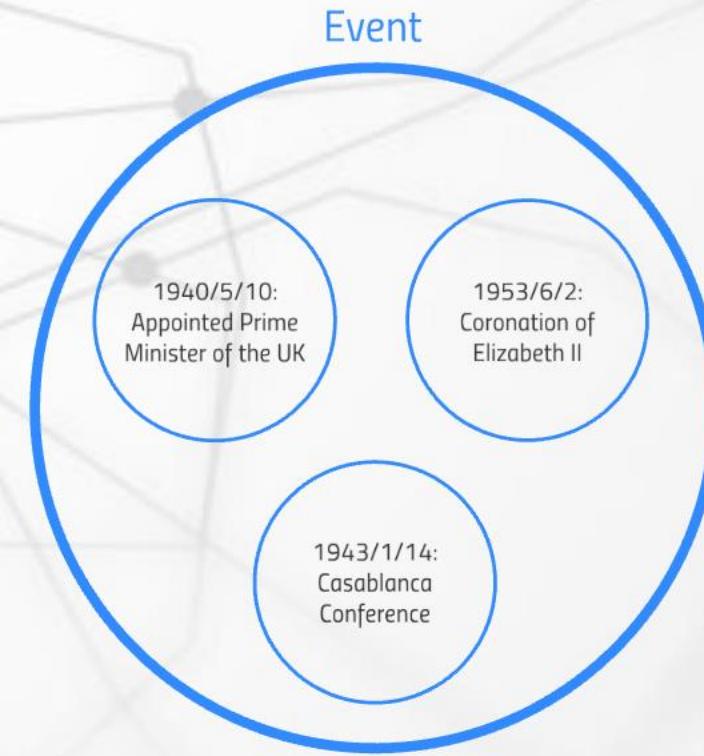
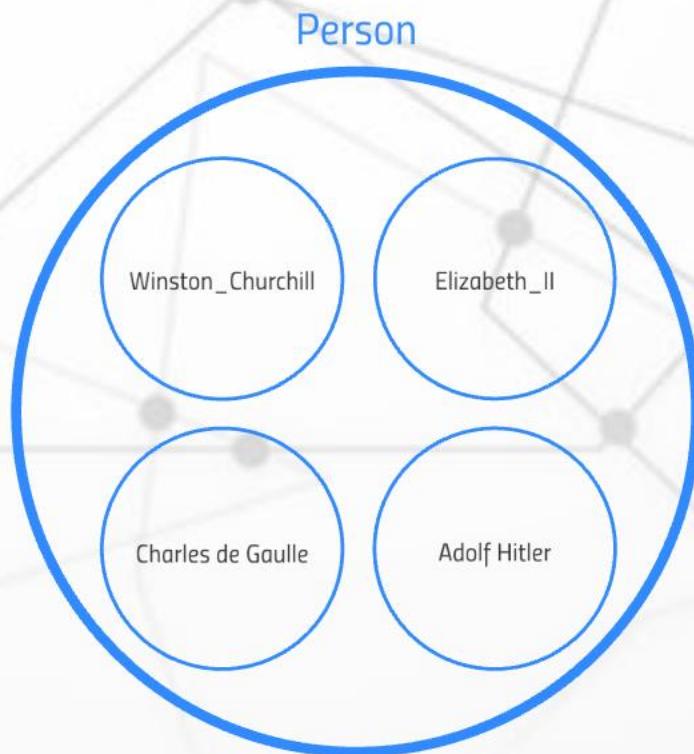


# Entity resolution



# 4

## Underlying structure



Class, type or kind

# Class, type or kind

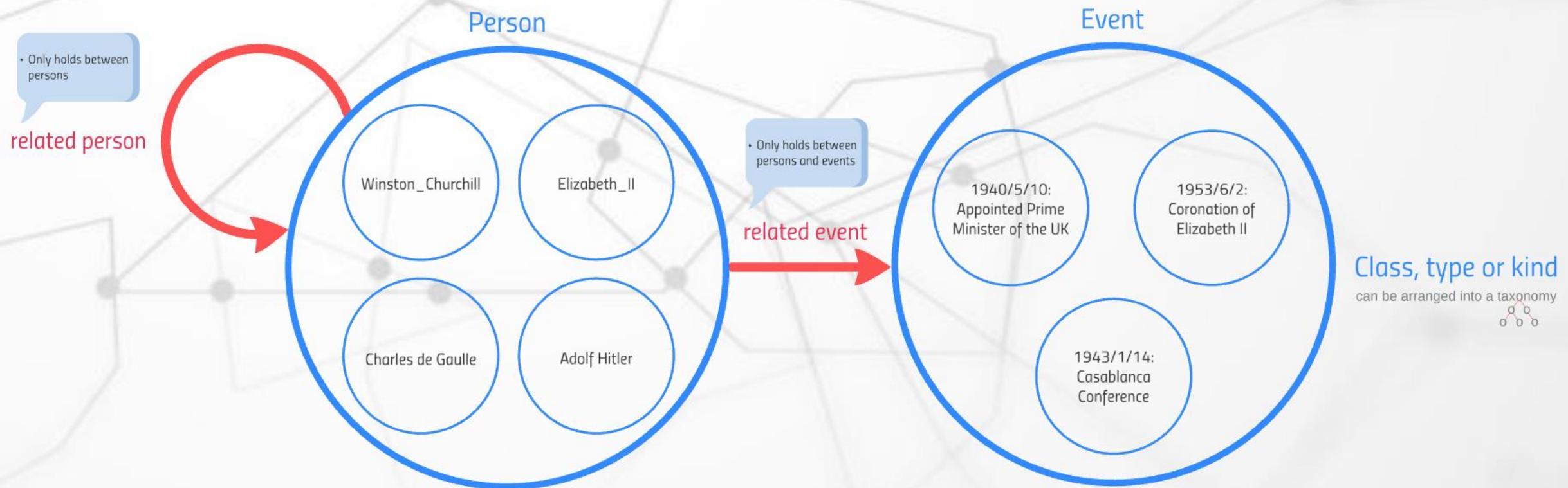
can be arranged into a taxonomy



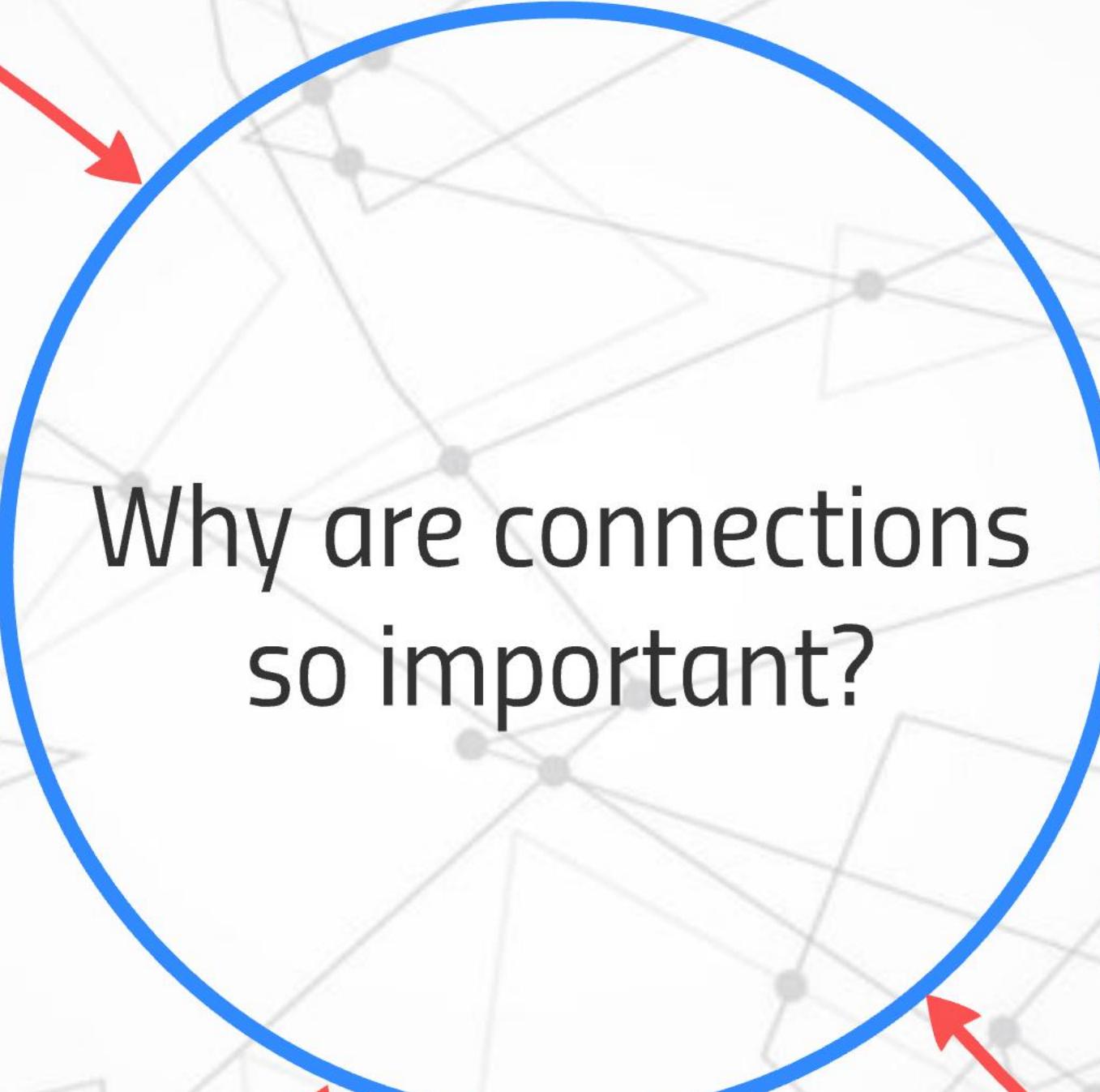
# 4

## Underlying structure

An ontology is a blueprint for organizing facts and statements



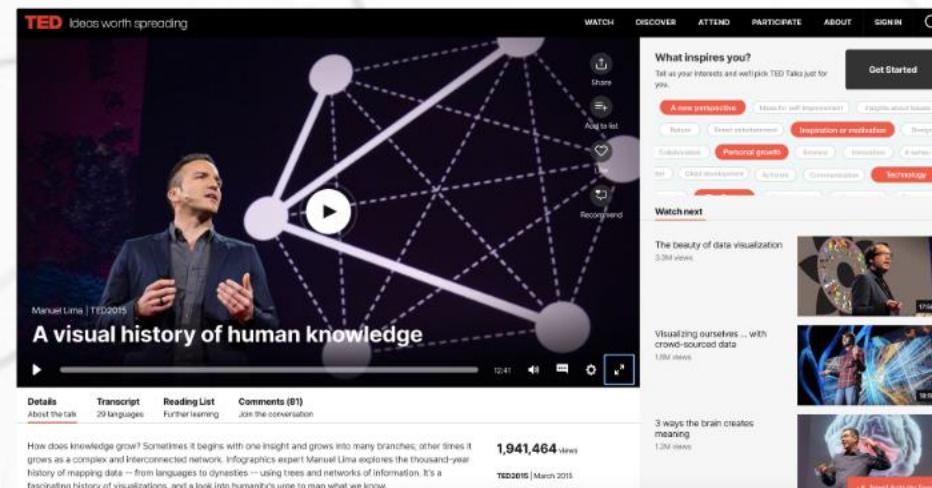
# 03 Why are connections so important?

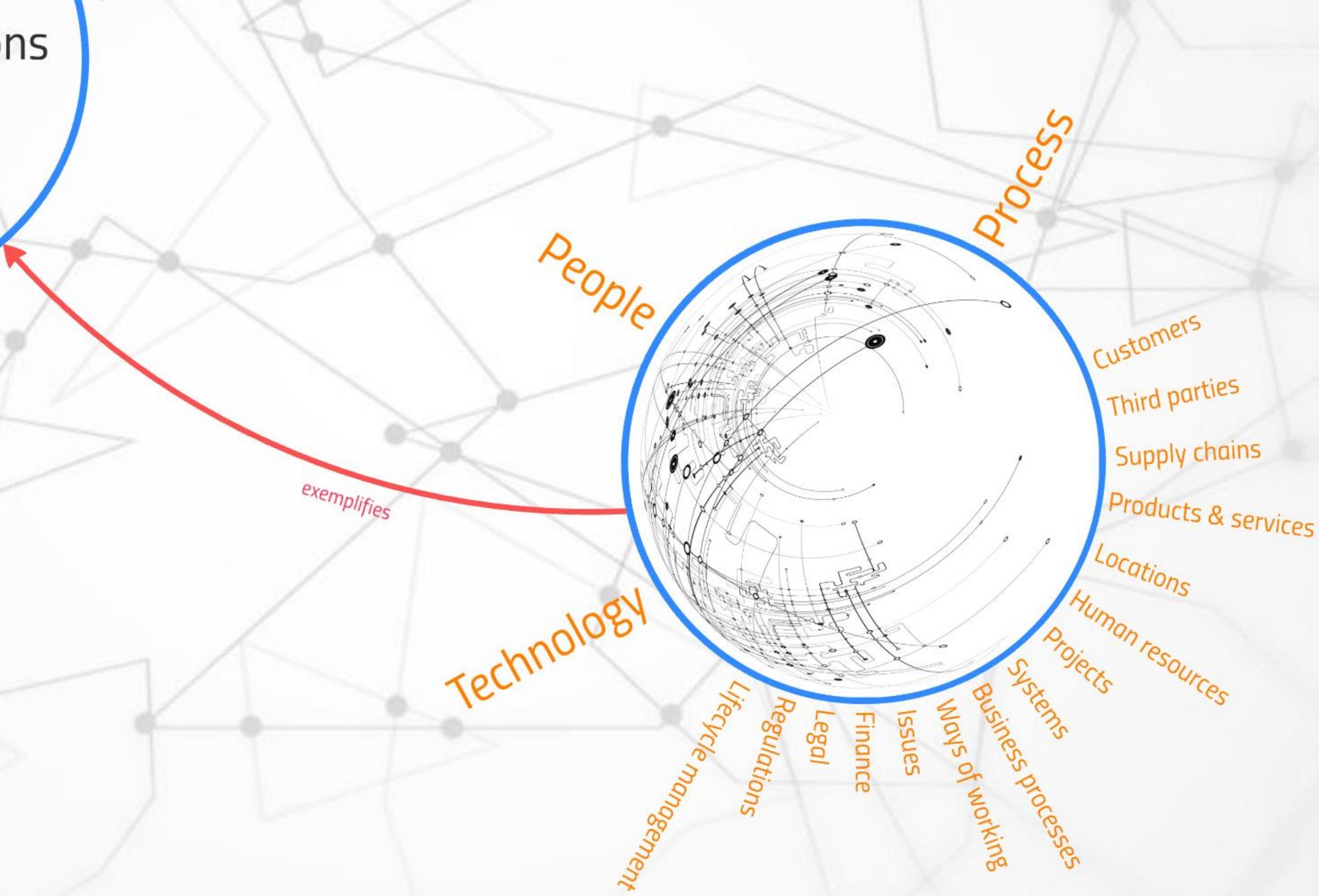


Why are connections  
so important?

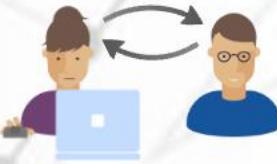
exemplifi

# A visual history of human knowledge





- Pass down knowledge
- Learn, adapt and improve
- Make the best possible decisions



# Challenges



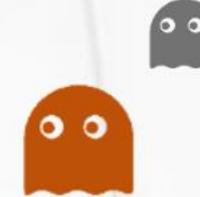
The landscape is  
far too complex



Inability to find  
answers



Lack of reusable  
knowledge



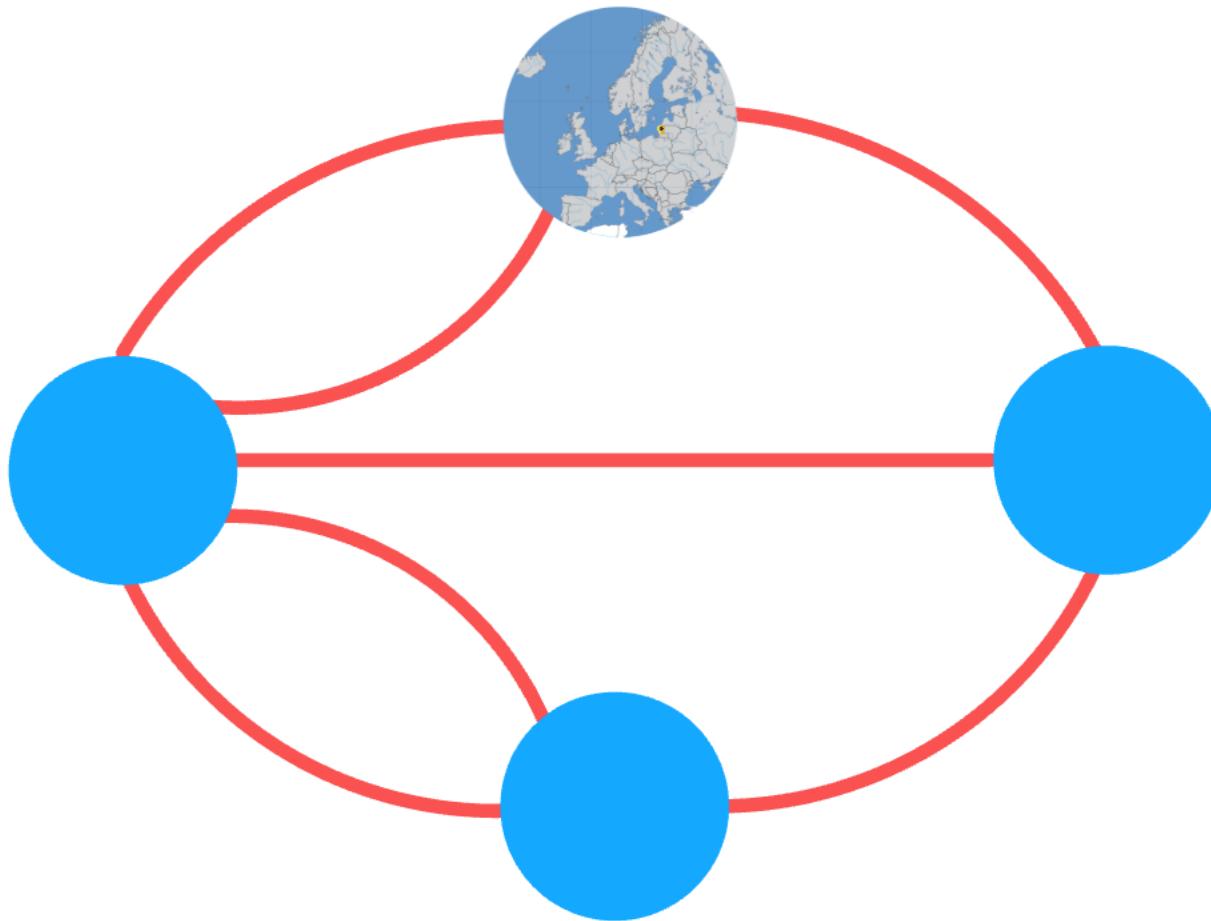
Silo effect



Reinventing the  
wheel



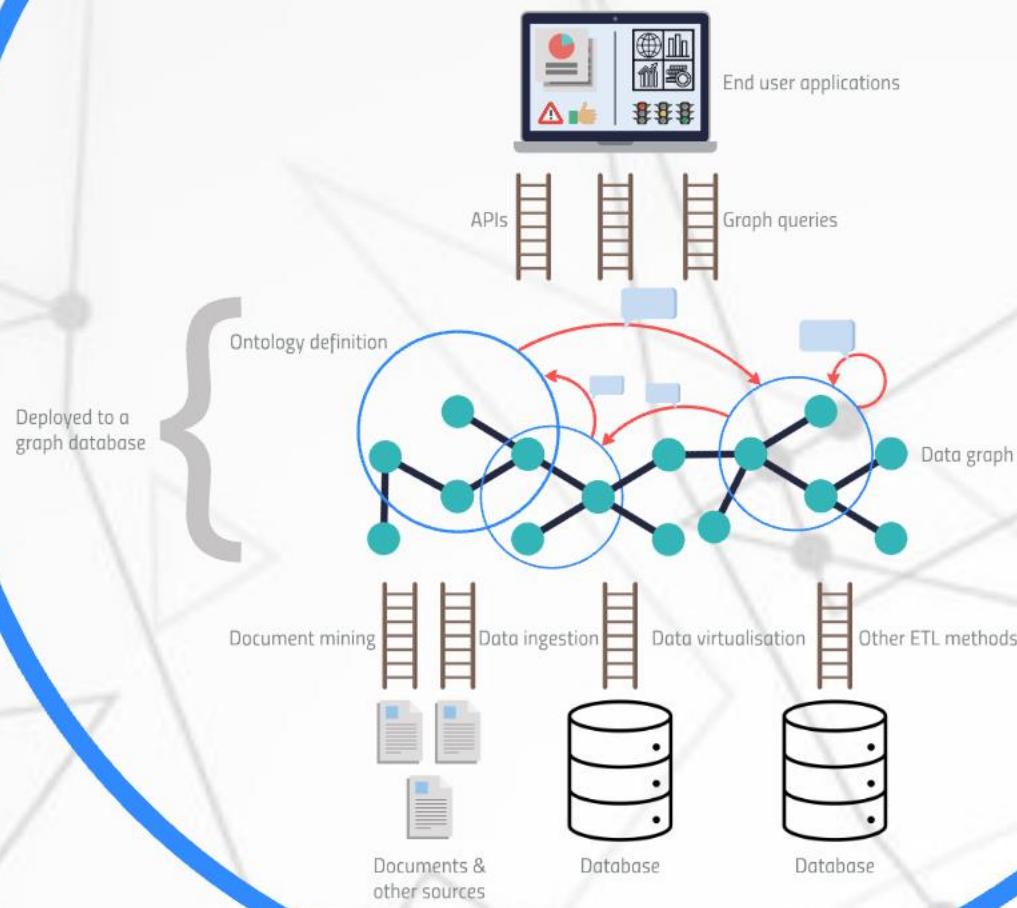
# 1736

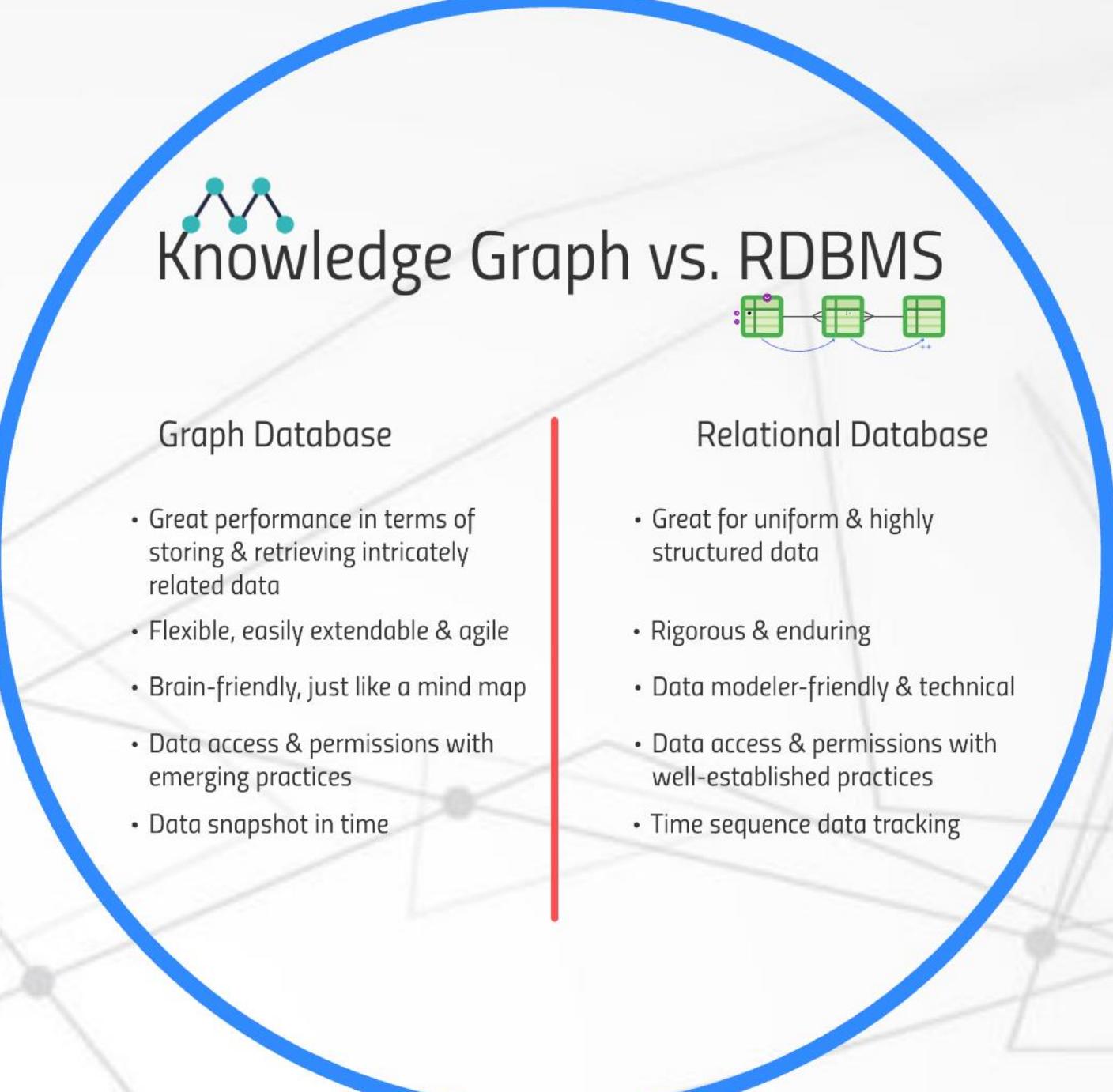


# 04 Knowledge graph technology

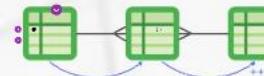
# Knowledge graph technology

# Core architecture





# Knowledge Graph vs. RDBMS



## Graph Database

- Great performance in terms of storing & retrieving intricately related data
- Flexible, easily extendable & agile
- Brain-friendly, just like a mind map
- Data access & permissions with emerging practices
- Data snapshot in time

## Relational Database

- Great for uniform & highly structured data
- Rigorous & enduring
- Data modeler-friendly & technical
- Data access & permissions with well-established practices
- Time sequence data tracking

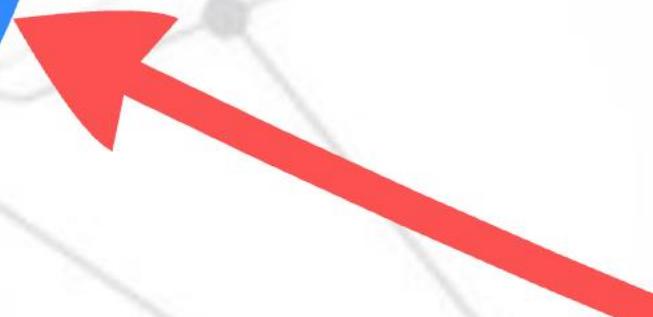
# Graph technology landscape



Source: graphaware.com

# Resource Description Framework

Based on Semantic Web standards



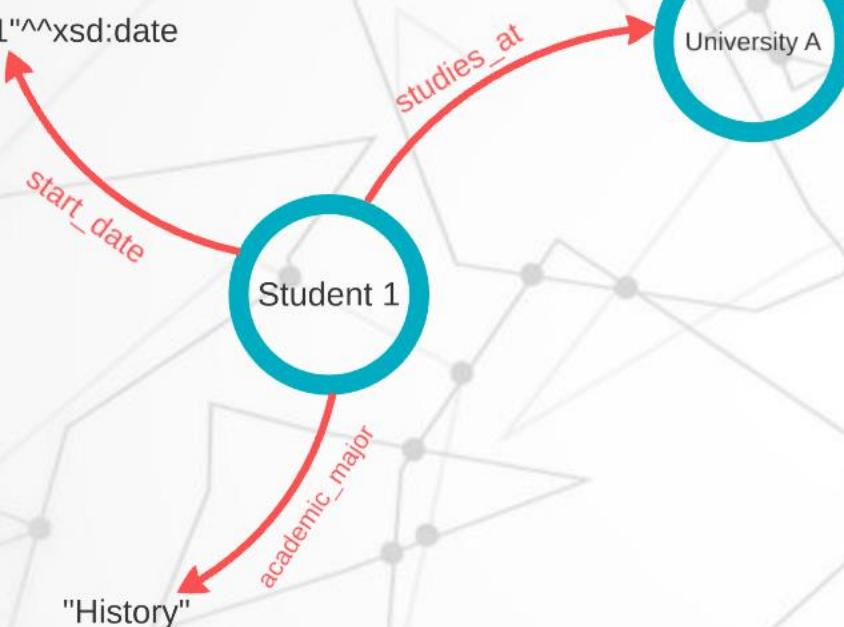
# Labeled- property graph

Not based on Semantic Web standards



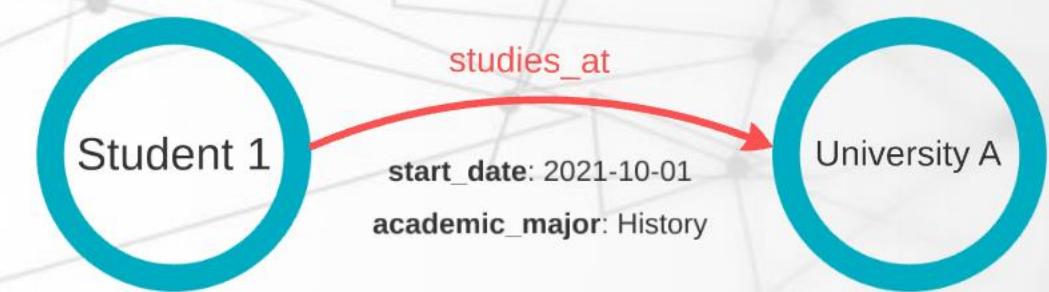
## Representation in RDF

"2021-10-01"^^xsd:date



## Representation in LPG

student\_at  
start\_date: 2021-10-01  
academic\_major: History

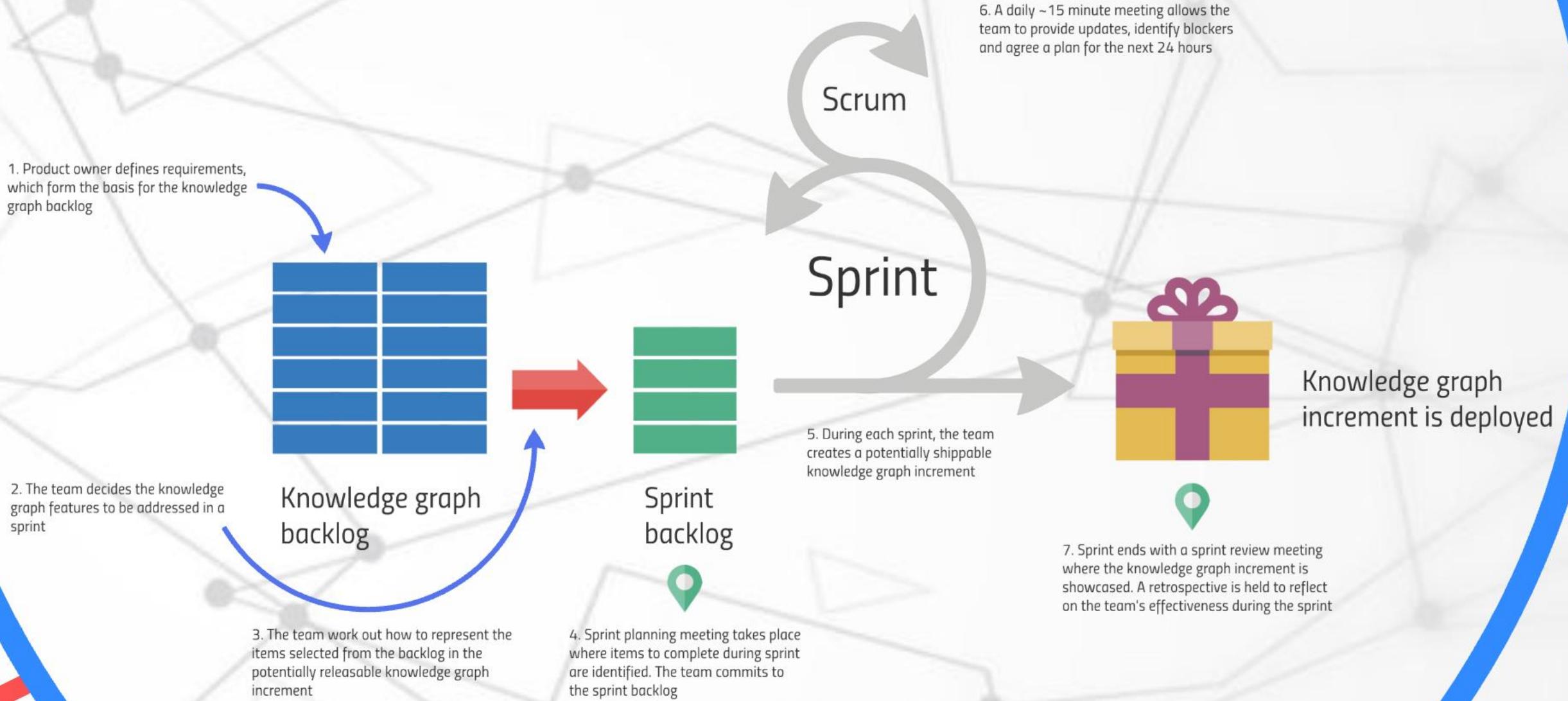


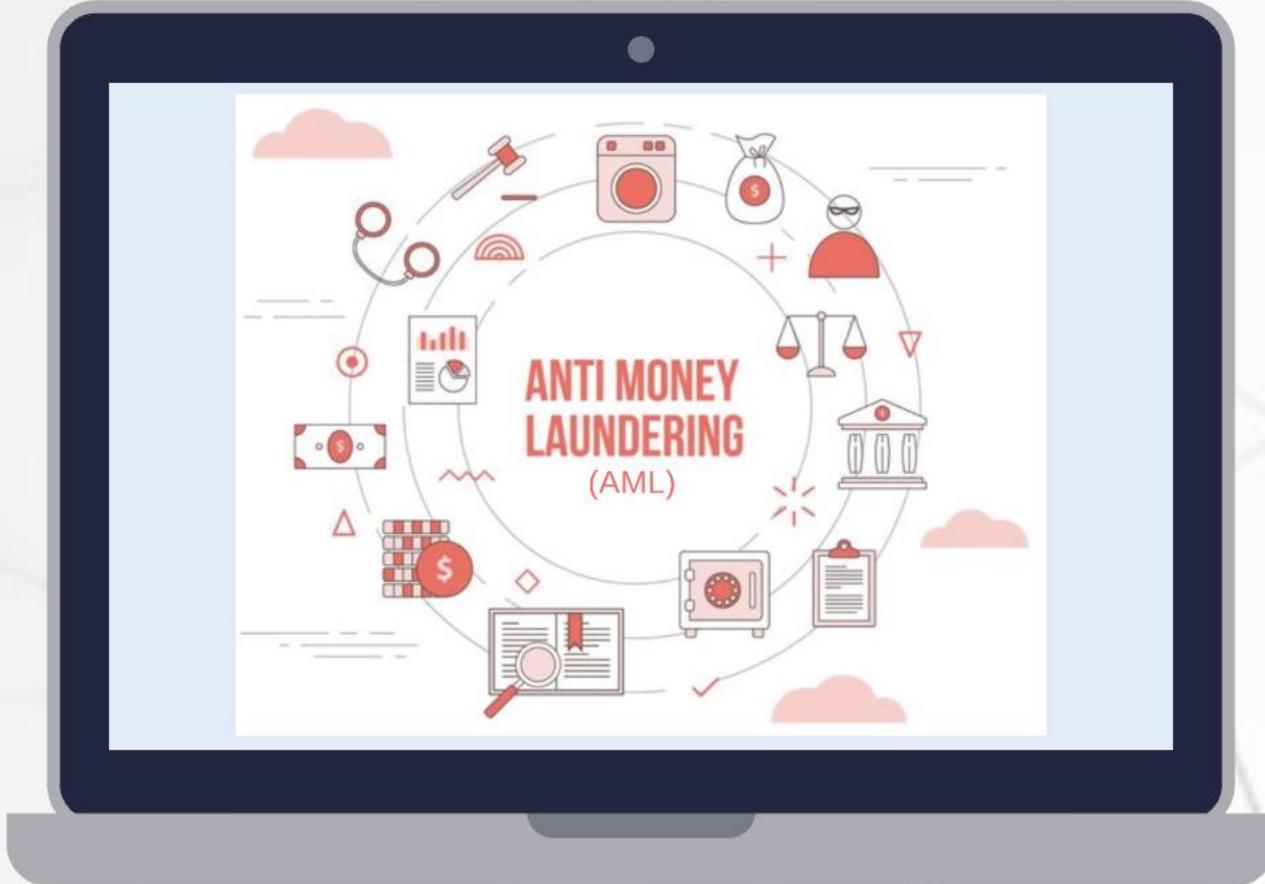
# Build methodology

Agile

uses

part of

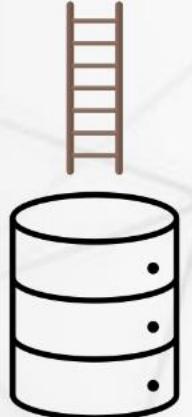
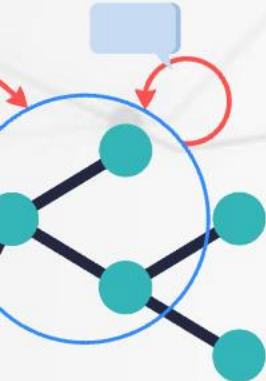




- AML compliance
- Activities of Politically Exposed Persons (PEPs)
- Profile search & behaviour discovery for customer due diligence



- AML compliance
- Activities of Politically Exposed Persons (PEPs)
- Profile search & behaviour discovery for customer due diligence



Data about Members of the UK Parliament (MPs)



Bill voting events



Voting decisions



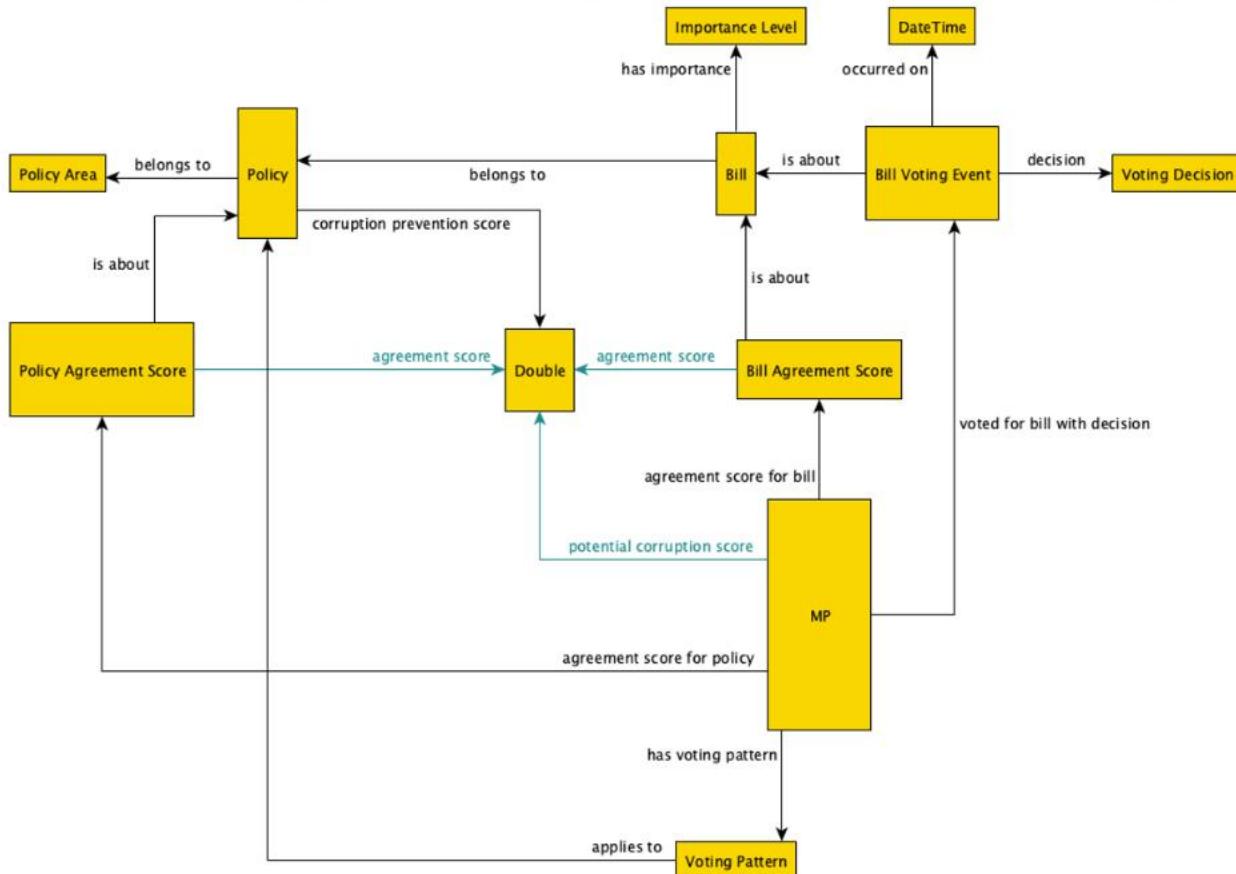
Policies



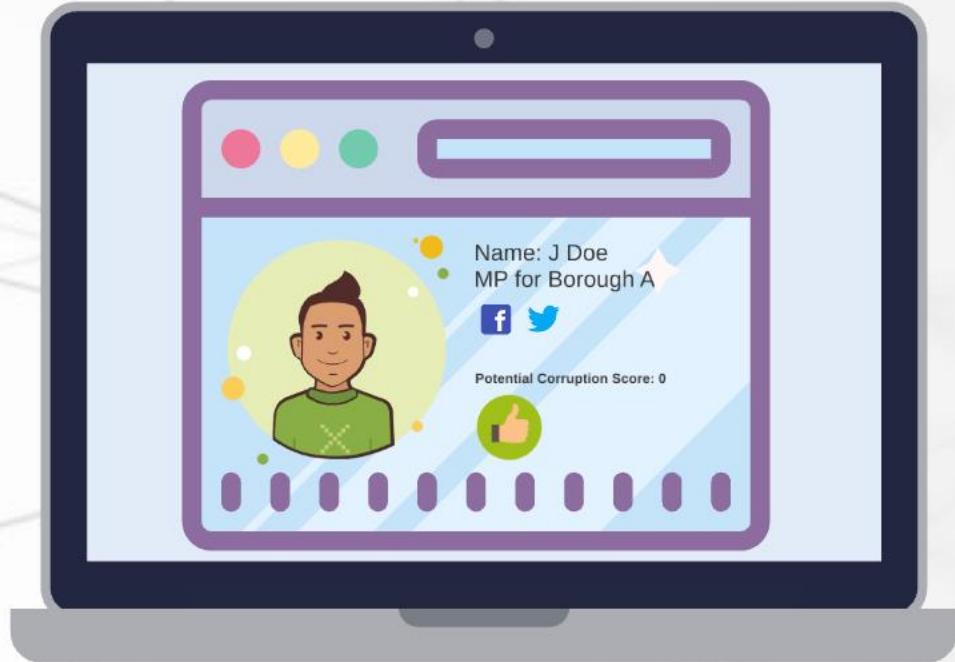
Potential corruption scores



# Data graph



Ontology



# Schema-first

Ontology is first developed before the data graph is exposed



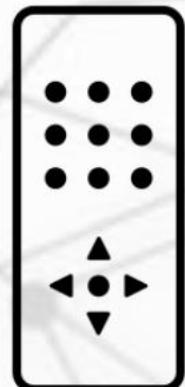
# Schema-late

Data graph is first exposed before the ontology is developed

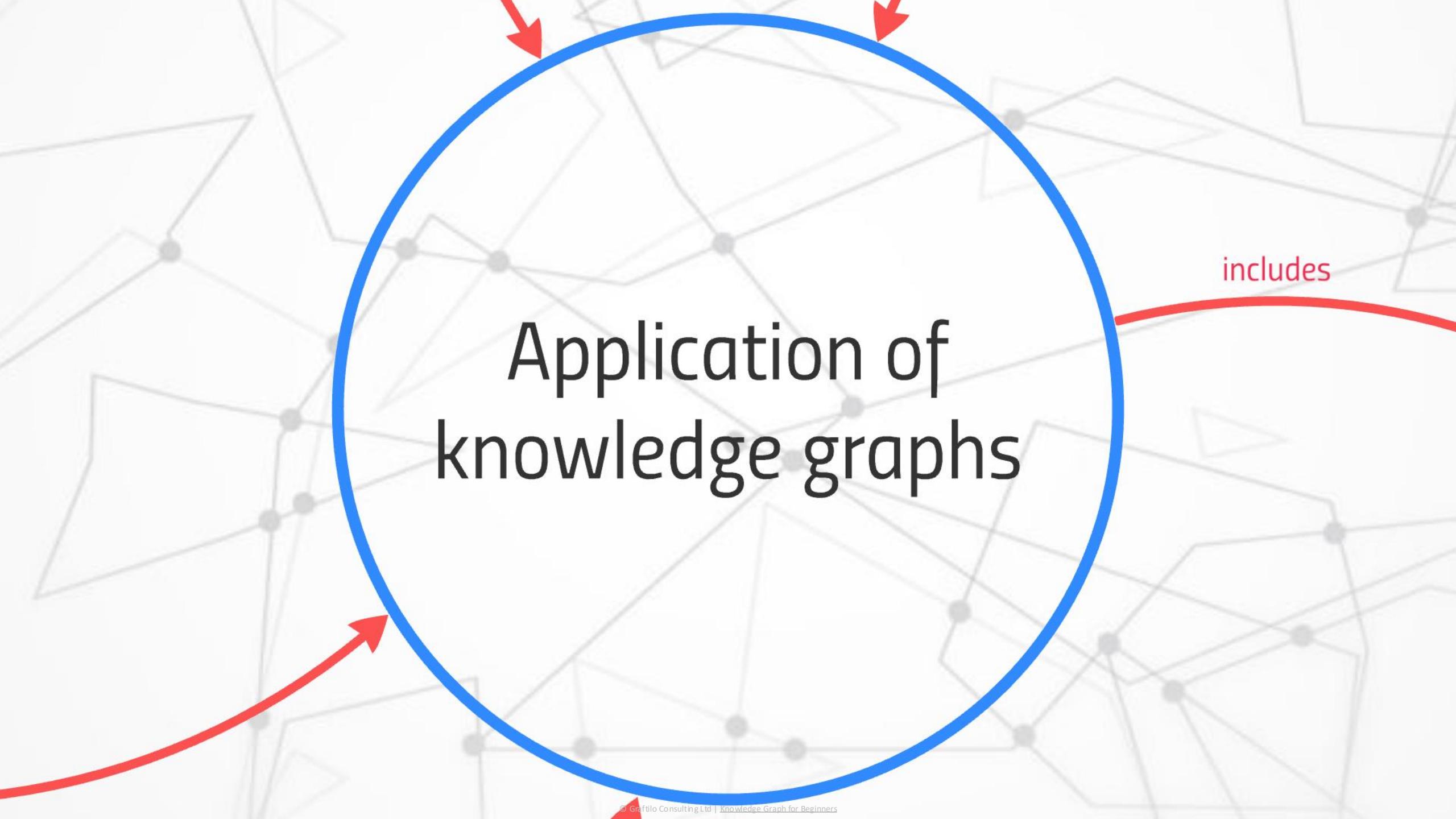


# Schema on-demand

Ontology is developed either in parallel with  
the data graph or as and when needed



# 05 Application of knowledge graphs



# Application of knowledge graphs

includes

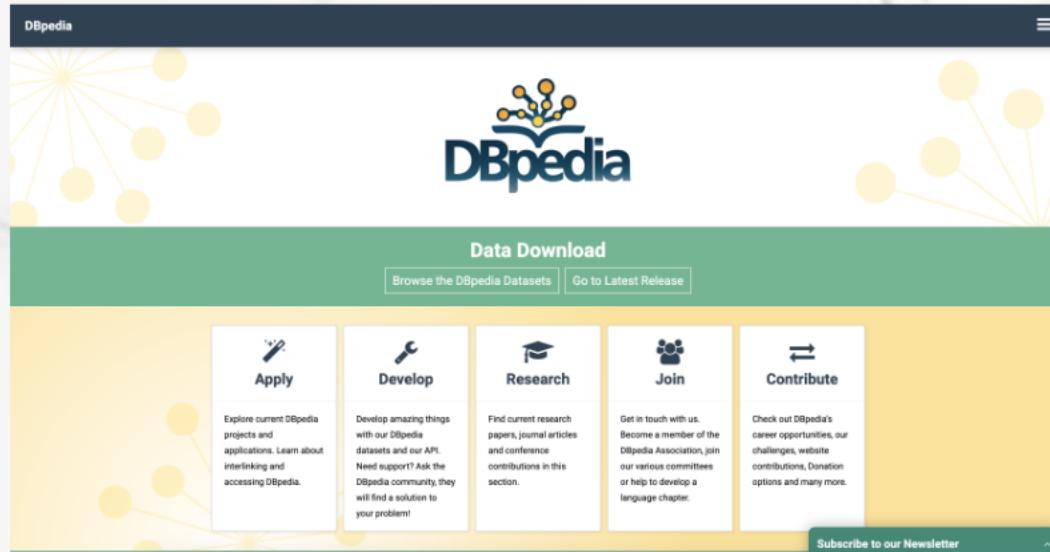
# Linked data

- Relates information from different sources on the Web to expose richer connected data that can be made more useful through semantic queries
- Linked data sources can be used to curate and enrich user-defined knowledge graphs
- Not confined to just Web-based resources and can, therefore, be used in custom applications

supports

supports

# DBpedia



support

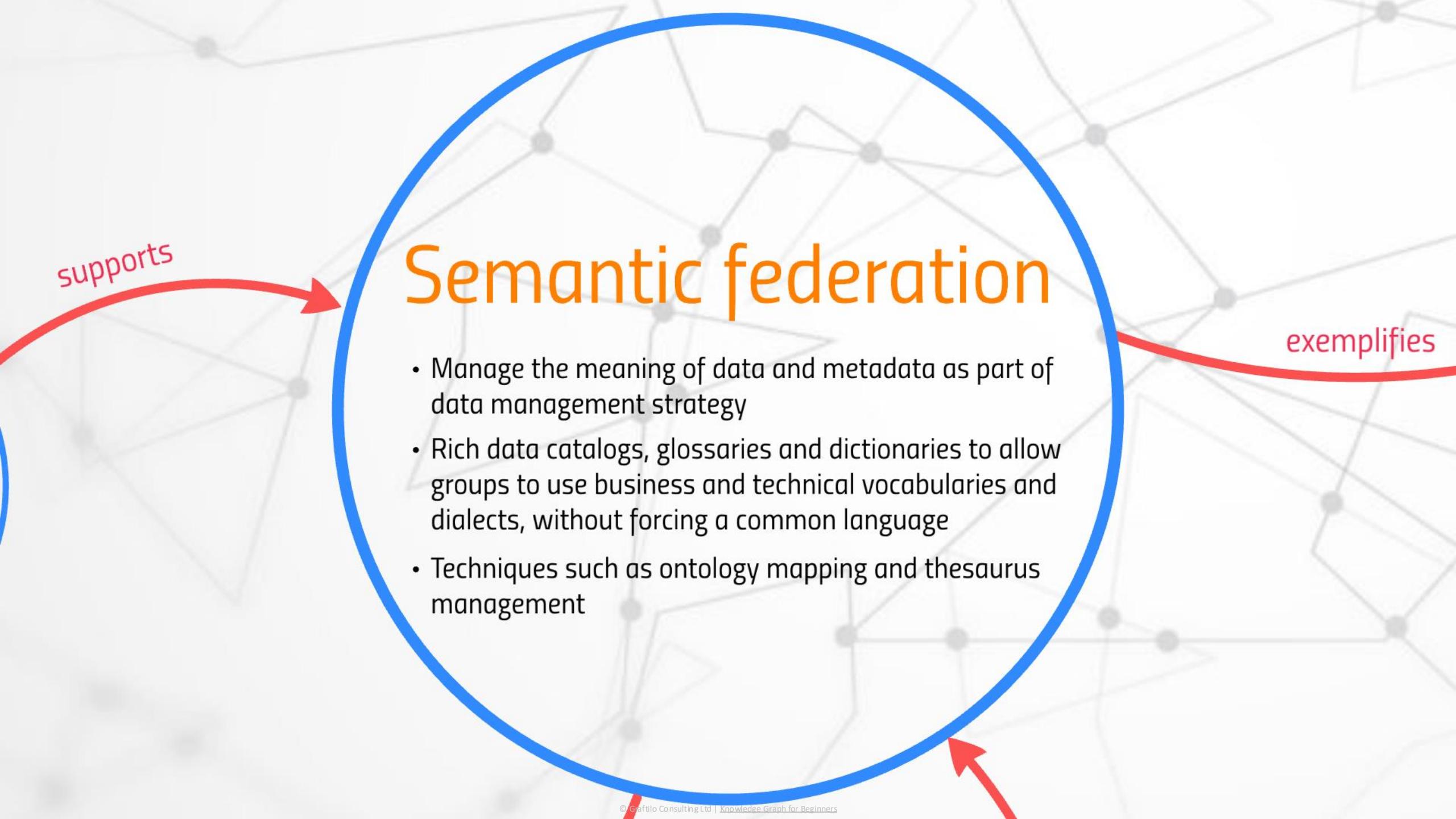
# GeoNames



# Semantic search

- Intelligent search with 'Google-like' capabilities and powerful search filters
- Content is tagged with the relevant metadata to provide rich contextual information
- Search results can be tailored based on audience characteristics

exemplifies



# Semantic federation

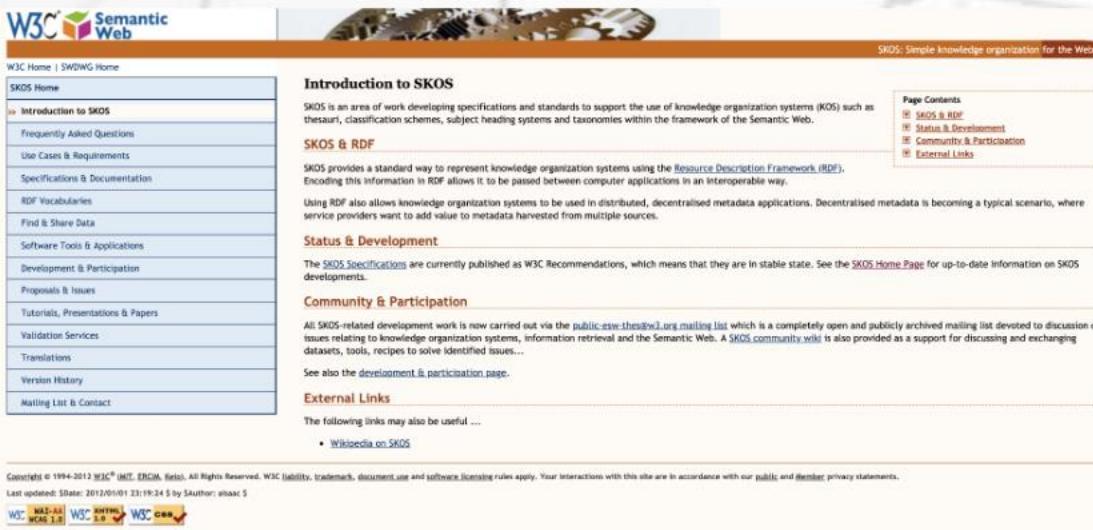
- Manage the meaning of data and metadata as part of data management strategy
- Rich data catalogs, glossaries and dictionaries to allow groups to use business and technical vocabularies and dialects, without forcing a common language
- Techniques such as ontology mapping and thesaurus management

supports

exemplifies

SUPER

# SKOS



The screenshot shows the W3C SKOS homepage. At the top left is the W3C Semantic Web logo. The main content area has a brown header bar with the text "Introduction to SKOS". Below this is a large section titled "Introduction to SKOS" which contains text about SKOS being an area of work developing specifications and standards for knowledge organization systems. It also mentions RDF and its use in distributed, decentralised metadata applications. To the right of this main content is a sidebar with "Page Contents" including links to "SKOS & RDF", "Status & Development", "Community & Participation", and "External Links". At the bottom of the page, there's a footer with copyright information, a "Last updated" timestamp, and several W3C logos.

# Entity mapping & resolution

In System A ...



In System B ...



same as

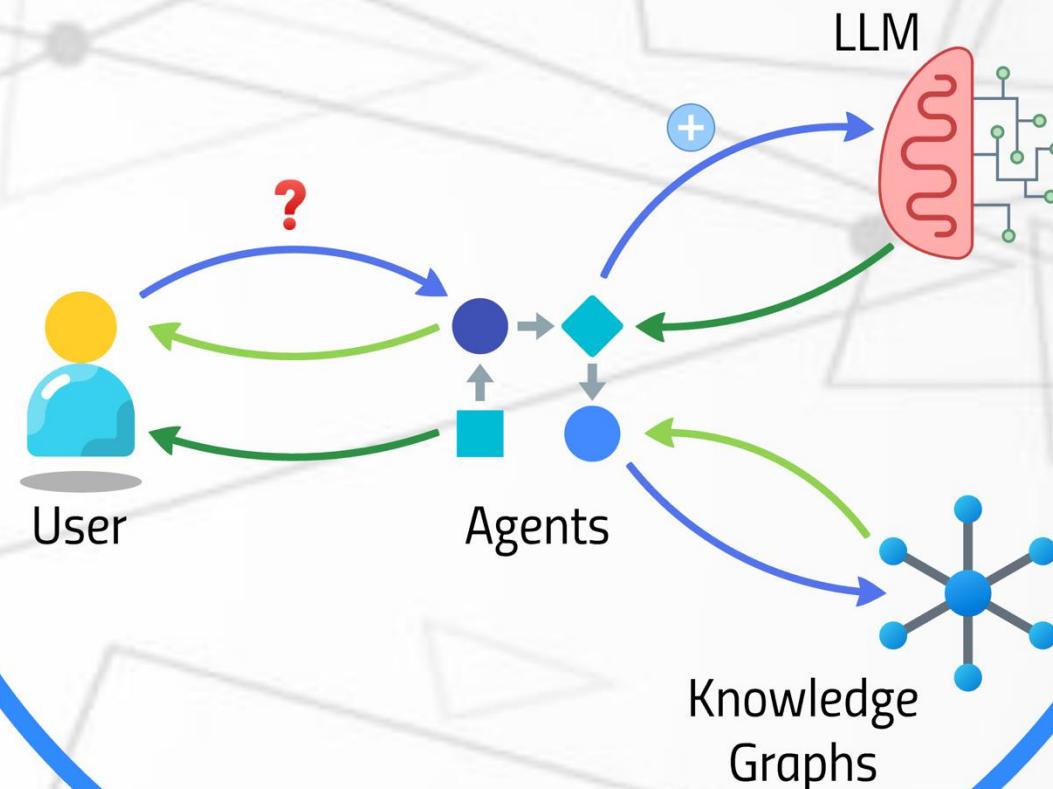
# Enterprise knowledge graphs

- Consolidate data silos to deeply understand the business at a macro and micro level
- Absorb complexity by linking and describing large parts of an organisation
- Array of use cases to help the enterprise to self-describe its dimensions, evolve, innovate and adapt

# Retrieval-Augmented Generation (RAG)

- Prevent AI from hallucinating
- Supply context-enriched information and question-answering rigour to AI
- RAG architectures may utilise vector and/or graph databases

# Example RAG architecture



# Domain use cases

- Knowledge graphs as enterprise-wide and point solutions to address several use cases, across different industries

# Publishing & education sector

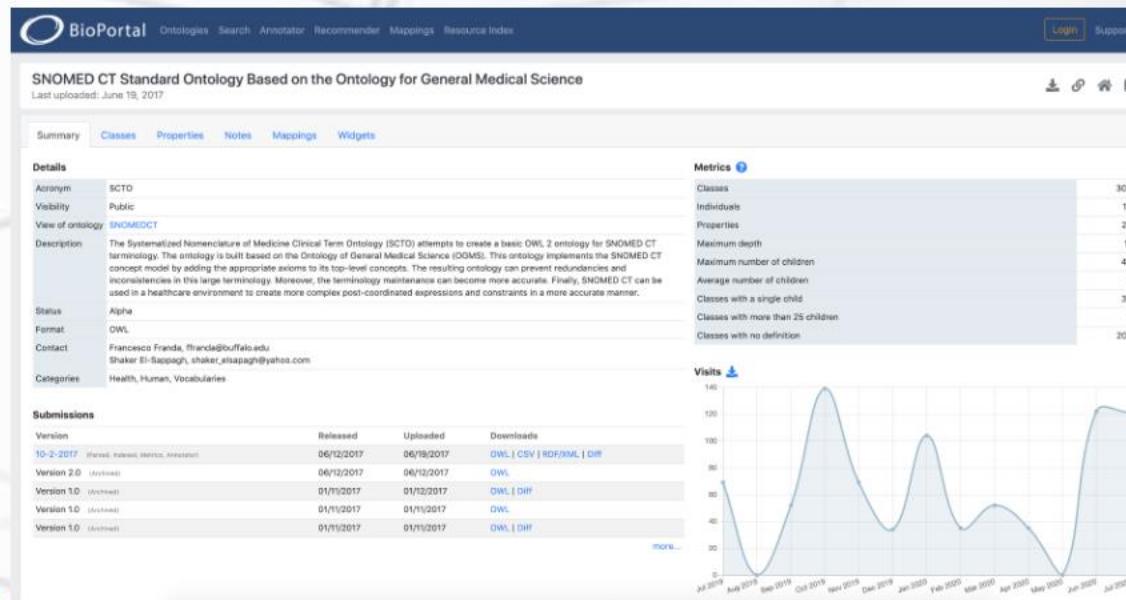
- Content tagging
- Curation of bibliographic databases
- Intelligent search, etc.

# Medical & pharmaceutical

- Data management
- Semantic interoperability
- Reference ontologies, etc.

emphasizes

# SNOMED CT



# Engineering

- Augmented Product Lifecycle Management (PLM)
- Semantic interoperability
- Knowledge verification
- Intelligent search, etc.

fies

# Media & mass media

- Content tagging
- Content curation
- Intelligent search, etc.

# Financial services

- Data management
- Customer 360
- Product taxonomies
- Risk management, etc.

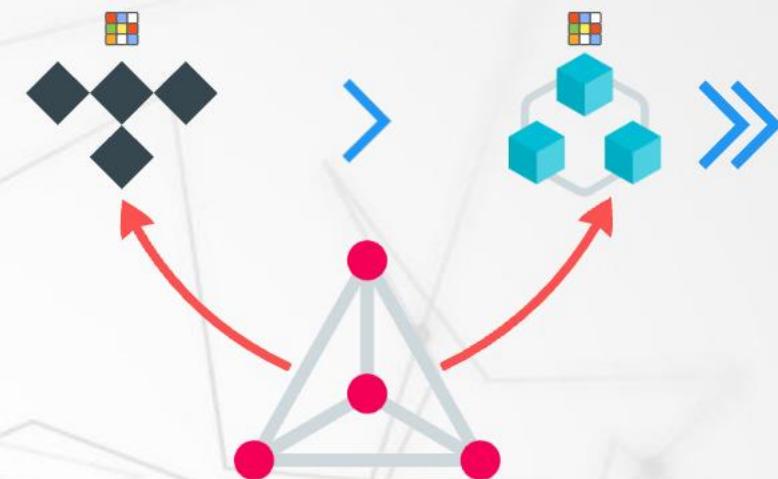
# FIBO

The screenshot shows the EDM Council FIBO OWL website. At the top, there's a navigation bar with links for DOWNLOAD, GET TO CONNECT, SIGN IN, and REGISTER, along with social media icons for Twitter, LinkedIn, and YouTube. Below the navigation is a banner with the text "FIBO IS DEVELOPED AS AN ONTOLOGY IN THE WEB ONTOLOGY LANGUAGE (OWL)" and a "DOWNLOAD FREE OWL" button. The main content area features a sidebar with a tree view of ontology domains, including Business Entities, Business Process Domain, Collective Investment Vehicles Domain, Corporate Actions and Events Domain, Derivatives (selected), Commodities Derivatives, Credit Derivatives, Derivatives Contracts, and Exchange-Traded Derivatives. The Exchange-Traded Derivatives module is currently selected. The main panel displays the "EXCHANGE-TRADED DERIVATIVES" module page, which includes a detailed description, a glossary, and ontological characteristics. The glossary defines terms like "label", "title", and "abstract". The abstract describes the module as covering standardized derivatives like options and futures traded on regulated exchanges. The ontological characteristic section lists "Instance classification" (ExchangeTradedDerivativesType module) and "has part" (DerivativesStandardizedTerms).

# Recommendation Engines



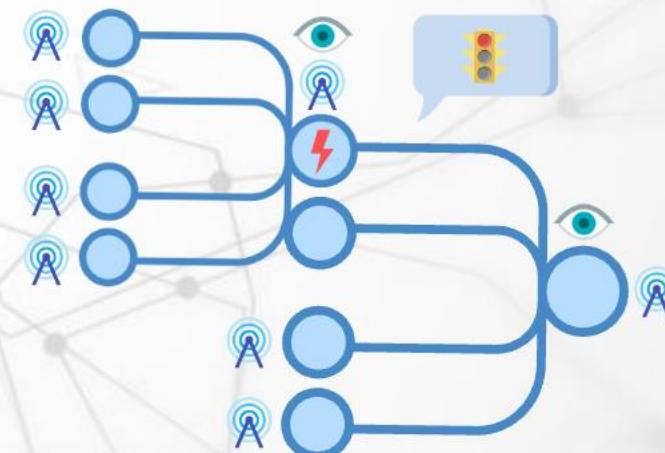
# AI Engines



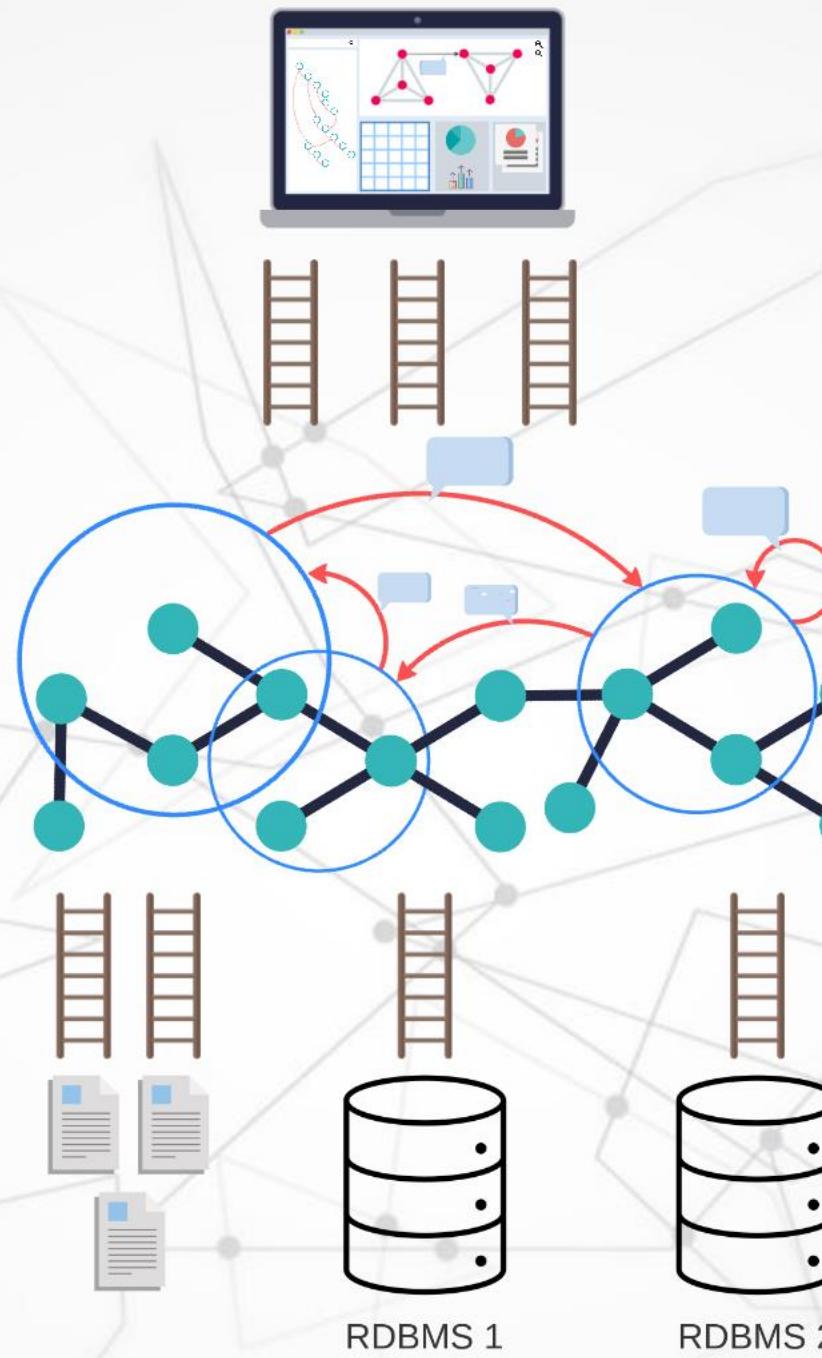
## Network Analysis



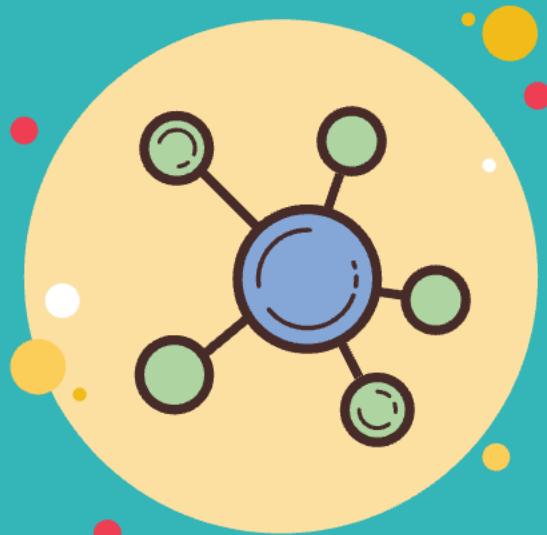
## Risk Analysis



# 06 Course wrap-up

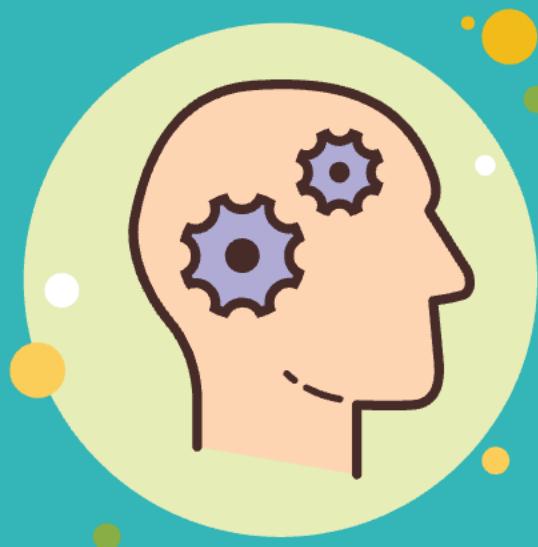


# Semantics



+

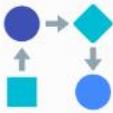
# Artificial Intelligence



+

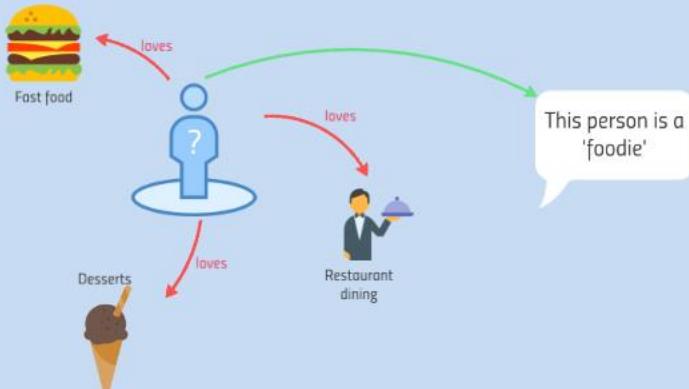
# Machine Learning



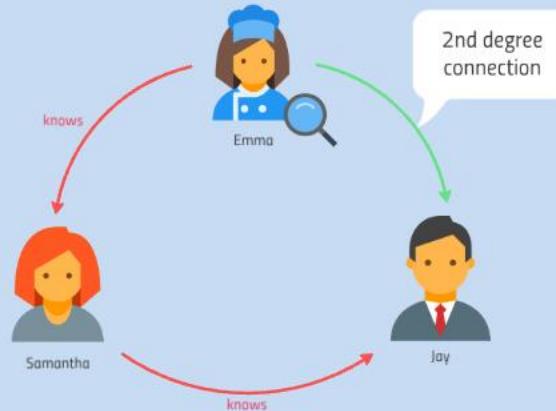


# Explainability

Automated computation  
of membership



Path querying



Entity resolution

