



UNIVERSITY
OF TRENTO - Italy



Course in Data and Knowledge Representation Languages

Digital University Case study

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- **Universities nowadays**
- **The university of the future**
- **Trento as Digital University**

**Course in
Data and Knowledge
Representation
Languages**

**Universities
nowadays**

Ecosystem of actors

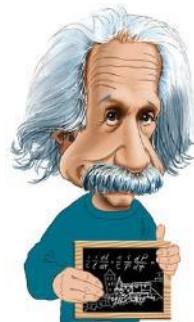


Students

**Professors &
Researchers**

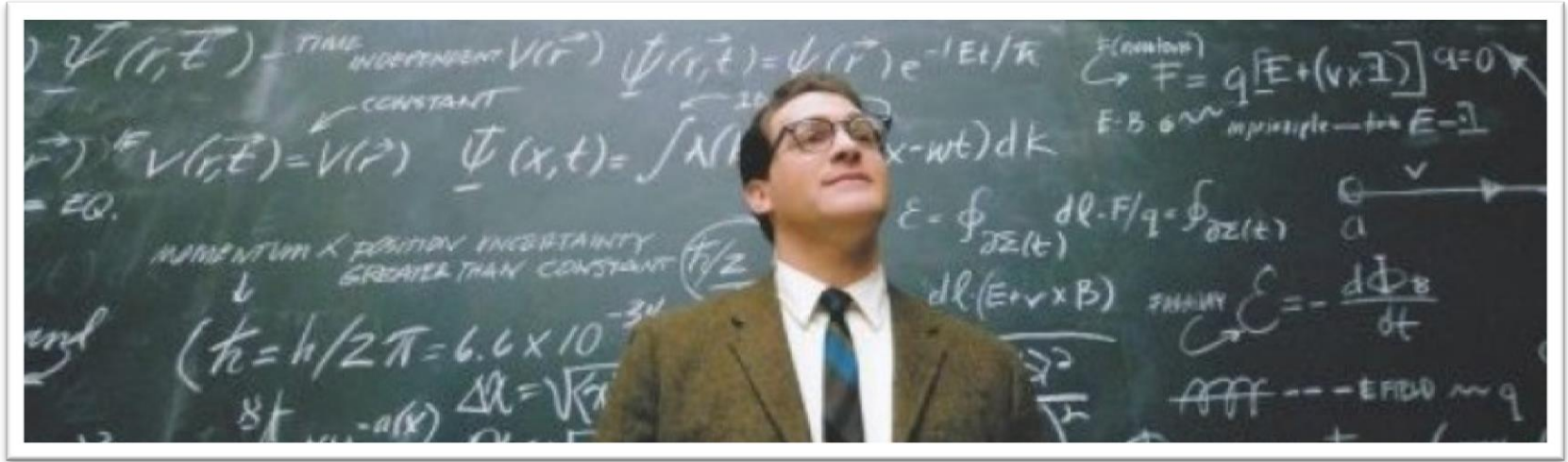
**Management
Staff**

**Administrative
and IT staff**



They all contribute as producers and consumers

Services offered



Knowledge-based services

Teaching



Research



Libraries



They are traditionally provided in the physical world

Data fragmentation



Courses

ID	Professor	Course	Year
05	Fausto Giunchiglia	Logic	2010

Projects

ID	Project	Coordinator
35	Smart Society	Fausto Giunchiglia

Research papers

ID	Title	Author	Subject
09	Theory of Contexts	F. Giunchiglia	AI

Exams

ID	Student	Course	Mark
09	Mary Chen	Logics	28

- Data come from different sources
- Each data source contains a subset of the information about a certain entity (a course, a person, a project, a paper ...)

What is an entity?



- Entities are objects which are so important in our everyday life to be referred with a **proper name** (e.g. the University of Trento)
- Each entity is described by its **attributes** (e.g. latitude, longitude, address...)
- Each entity is described in **relation** with other entities (e.g. the University of Trento is located in Trentino, Italy)
- Each entity as a reference **entity type** (e.g. organization)
- Each entity type, relation and attribute denotes a specific **concept**.

What is a concept?



Geological formation
Natural depression
Oceanic depression
Oceanic valley
Oceanic trough
Continental depression
Trough
Valley

Natural elevation
Oceanic elevation
Seamount
Submarine hill
Continental elevation
Hill
Mountain
Ridge

Data heterogeneity



ID	Type	Title	Author	Subject	Year
09	Scholarly article	Theory of Contexts	F. Giunchiglia	AI	2003

ID	Kind	Title	Author	Topic
43	Book	Intelligent robots	A. Smith	Artificial intelligence
44	Paper	Theory of Contexts	Giunchiglia Fausto	Automated reasoning

- Each data source describes data in different ways and with different terminology

Language and knowledge



«AI» and «Artificial Intelligence» are synonyms in English



«Automated Reasoning» is more specific than «AI»

«indice» is polysemous in Italian

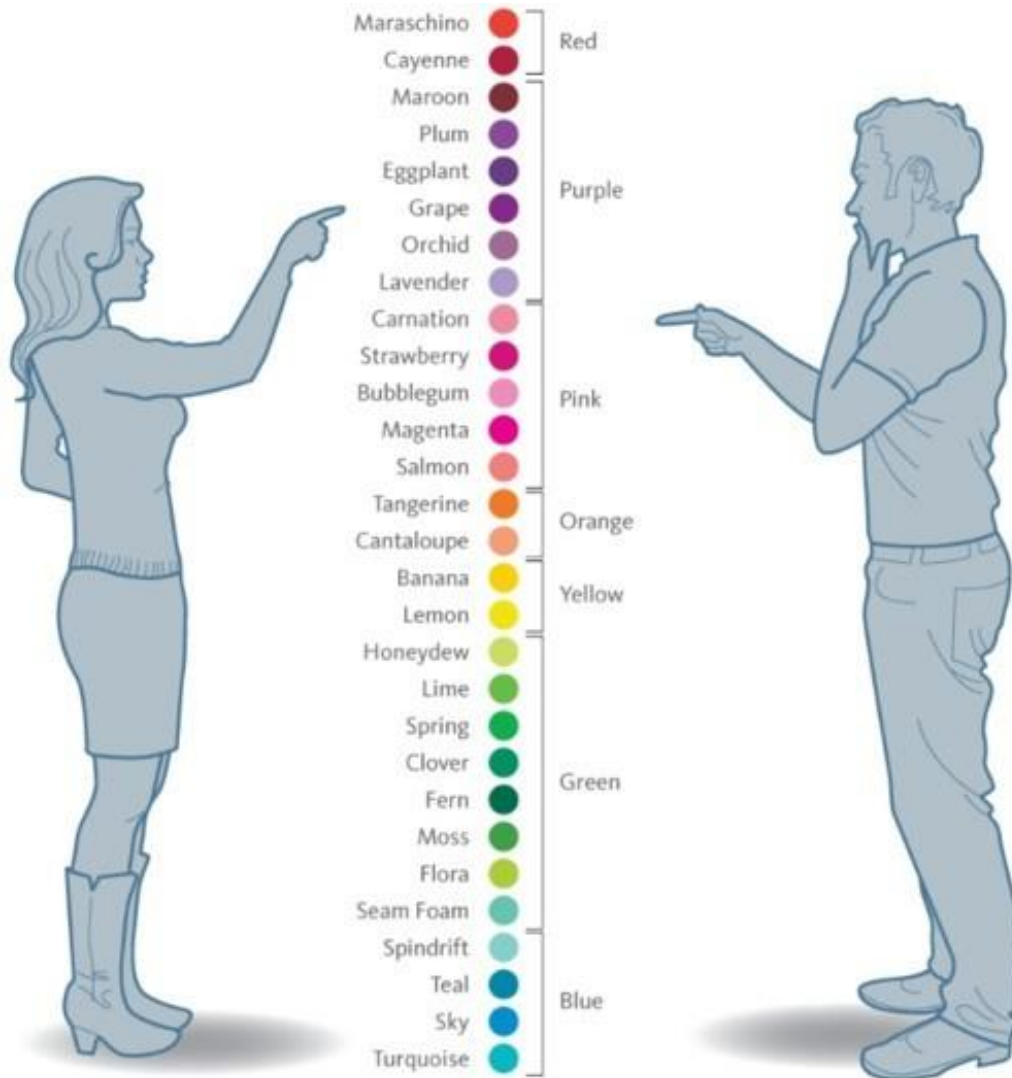


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4.3 Composizione e schemi del bilancio d'esercizio individuale.....	pag. 43

«calzino» and «pedalino» are synonyms in Italian



A feature or a problem?



Heterogeneity is a function of local goals, culture, belief, personal experience.

Semantic heterogeneity has been defined as the difficulty of establishing a certain level of connectivity between people, software agents or IT systems at the purpose of enabling each of the parties to appropriately understand the exchanged information

Sources of heterogeneity

In language

- “bug as malfunction” vs. “bug as food” (homonymy)
- “stream” and “watercourse” have same meaning (synonymy)

In meaning

- “watercourse” in English is same as “corso d’acqua” in Italian (concepts)
- There is no lemma in Italian for “biking” (lexical GAP)

In knowledge

- There are several types of bodies of water (semantic relations)
- Rivers have a length, lakes have a depth (schematic knowledge)

In opinions and viewpoints

- “Bugs are great food” vs. “how can you eat bugs?” (the role of culture)
- Climate is/is not an important issue” (the role of schools of thought)

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**The university of
the future**

B2B services



Sustainability: balancing **costs** with **efficiency**



Promoting **transparency** and fulfilling obligations



Stimulating **reflection** to improve processes and performance



B2C services



Providing
research results



Promoting
lifelong learning



Exploiting **knowledge assets** for social service innovation



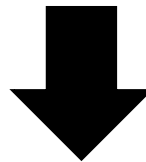
They will be provided in the integrated physical/virtual world

Open Data



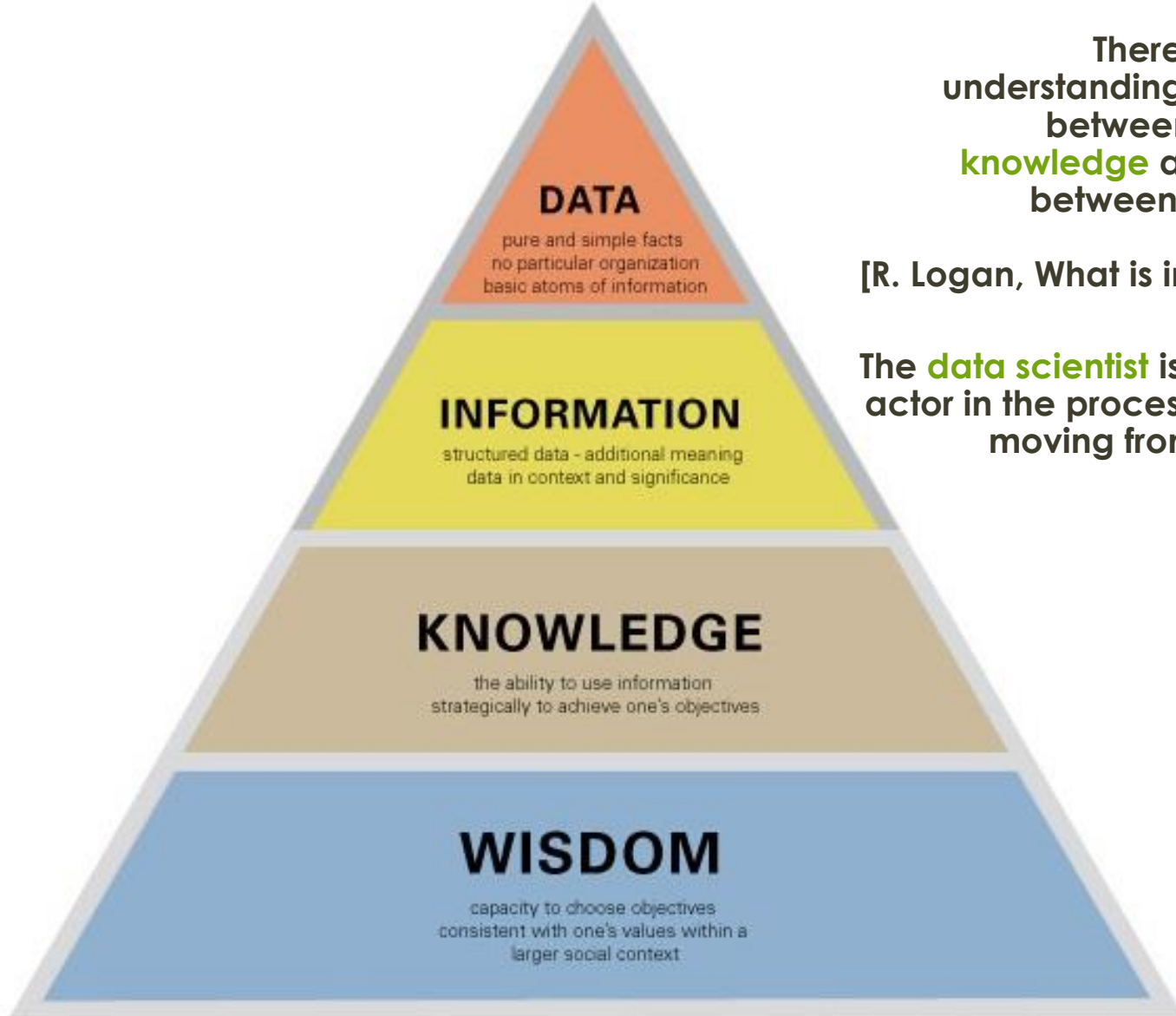
- o Distributing data in **open format** and license such that everybody can use them
- o Distributing data with **links to vocabularies** to promote **interoperability**

ID	Type	Title	Author	Subject	Year
09	Scholarly article	Theory of Contexts	F. Giunchiglia	AI	2003



09	Type	Scholarly article	→	Paper, Scholarly article. An article describing the results of observations or stating hypotheses
09	DC>Title	Theory of Contexts		
09	DC:Author	F. Giunchiglia		
09	DC:Subject	AI	→	AI, Artificial Intelligence. The branch of computer science that deal with writing computer programs that can solve problems creatively
09	DC:Date	2003		

Why the data scientist?




There is often a lack of understanding of the difference between **information and knowledge** and the difference between explicit and tacit knowledge

[R. Logan, What is information? 2010]

The **data scientist** is the fundamental actor in the process of progressively moving from data to wisdom

From data to information

ID	Type	Title	Author	Subject	Year
09	Scholarly article	Theory of Contexts	F. Giunchiglia	AI	2003

- 
- Data curation
 - Data analysis
 - Data integration

Mind Product

ID 09
Type Scholarly article
Title Theory of Contexts
Author F. Giunchiglia
Subject AI
Date 2003

Person

Type Professor
Name Fausto Giunchiglia
Birthdate February 13, 1958



- Which **kinds of entities** are described with the data?
- Which **relations** and **attributes** are used?
- Which **terms** are used to denote the relations, the attributes and their values?
- What is the **meaning** of the terms and how they are related with each other?

The ODR tool for data scientists

An open source tool that extends Open Refine: <http://openrefine.org/>

<p>▼</p> <p>Caratteristiche</p> <p>↓</p> <p>Description Semantic text []</p>	<p>▼</p> <p>Riferimenti normativi</p> <p>↓</p> <p>Normative reference String</p>
<p>Golden Delicious: forma tronco-conica oblunga e colore dal verde al giallo, a volte con faccetta rosata. La polpa è croccante e succosa, con un peculiare sapore dolce-acidulo. Red Delicious: colore rosso su fondo verde. La polpa è pastosa con gusto dolciastro. Renetta Canada: forma tronco-conica o appiattita con buccia rugosa di colore giallo-verdastro. A seconda dell'epoca del consumo, la polpa assume diversa consistenza e differenti sapori, da croccante e acidula a pastosa e dolce.</p> 	<p>Registrazione Europea Reg CE n. 1665/2003 del 22 settembre 2003, pubblicato sulla Guce L. 235 del 23/9/2003.</p>

any of numerous superior eating apples with yellow or greenish yellow skin flushed with red

From information to knowledge

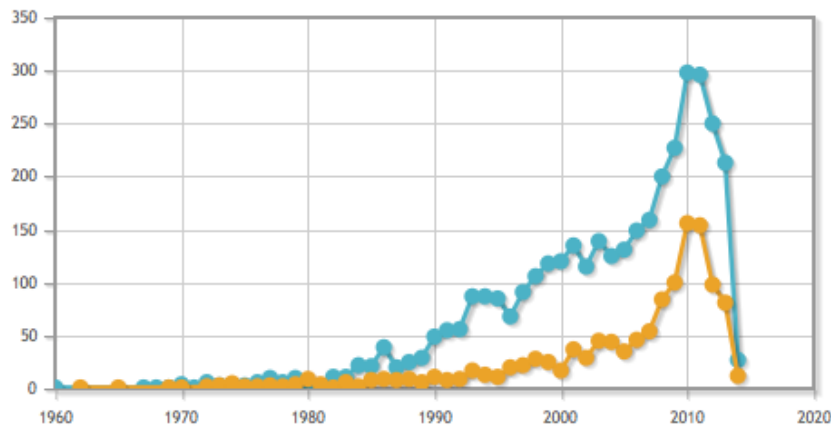
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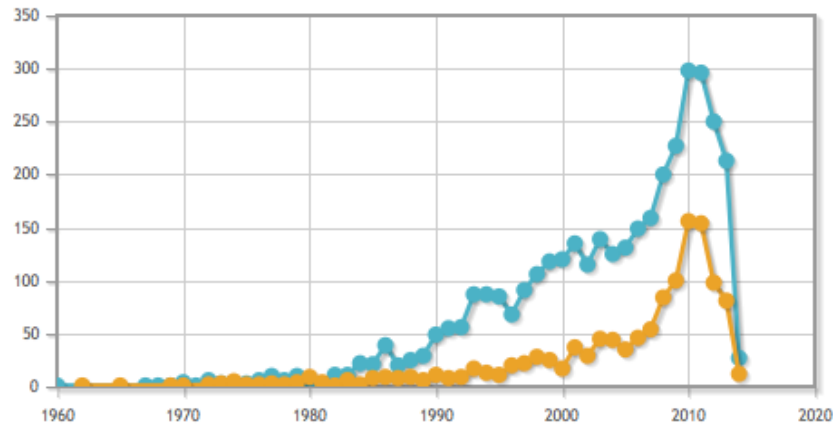
Person

Type	Professor
Name	Fausto Giunchiglia
Birthdate	February 13, 1958

- Analytics design
- Analytics interpretation
- Learning



From knowledge to wisdom



- Communication / storytelling
- Negotiations
- Taking informed actions

- ✓ Invest in training
- ✓ Invest in new projects
- ✓ Incentivize the production of papers
- ✓ Hire experts in a poorly represented field

Towards a Smart Society



Smart Society is a EU project: www.smart-society-project.eu/

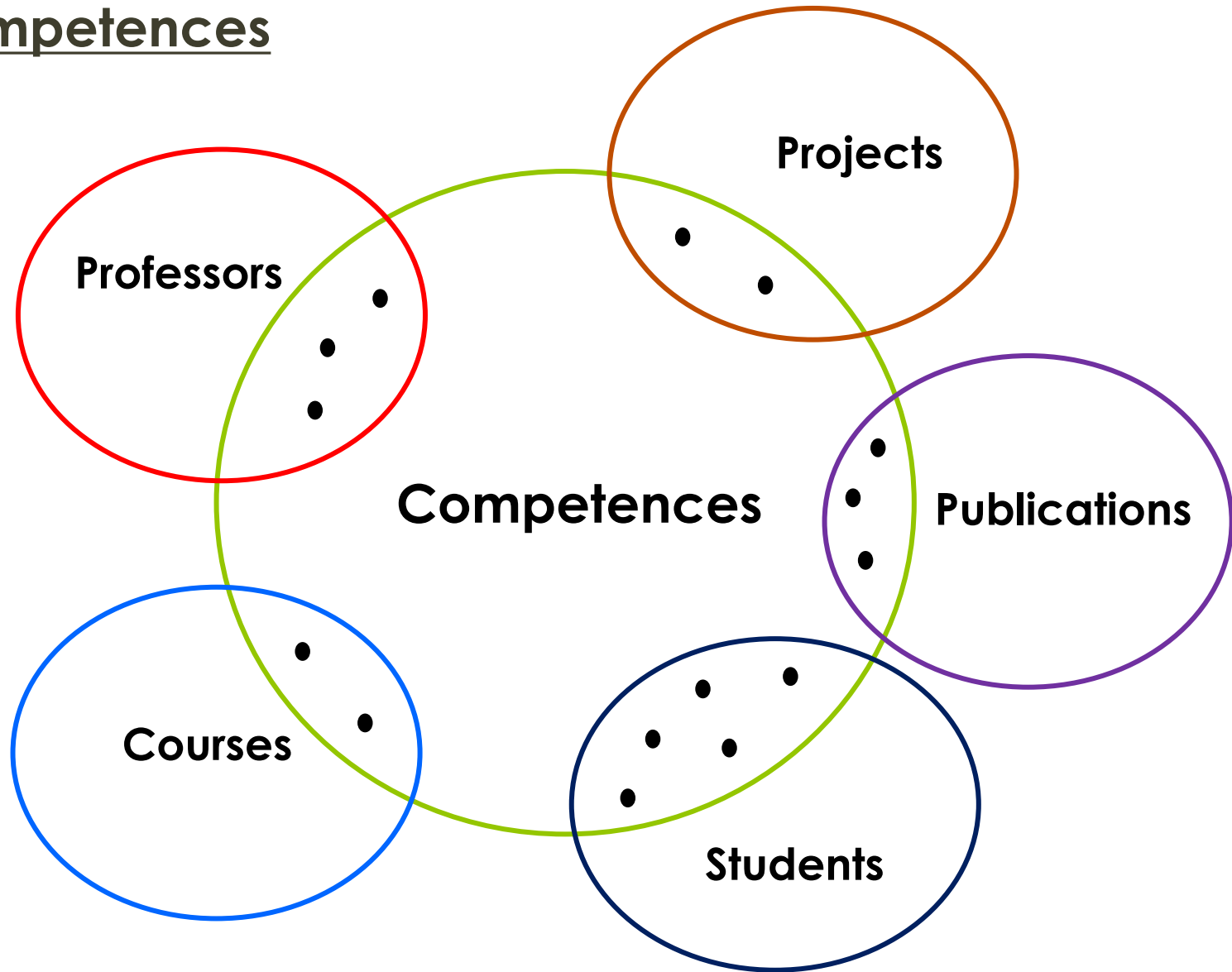
There is a need for supporting tools and processes able to guarantee for the quality of data (Veracity, Variety, Vulnerability) and the appropriateness of the actions:

- **Accountability** (provenance, trust, reputation, authority)
- **Security** (users, user groups and access control)
- **Privacy**
- **Incentives** (e.g. Gamification)
- ...

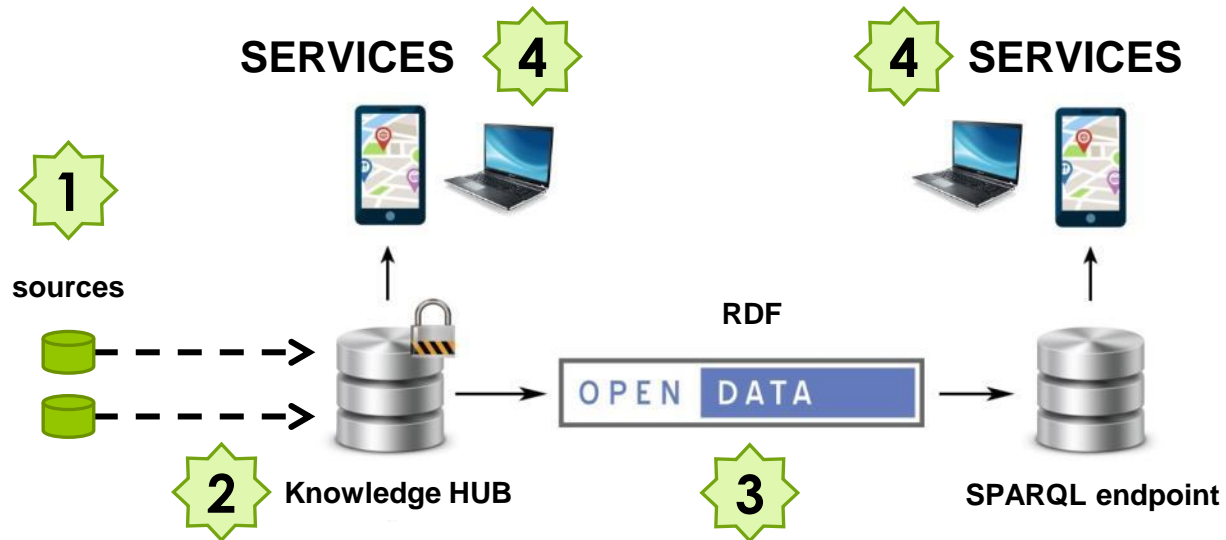
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Organize data by competences

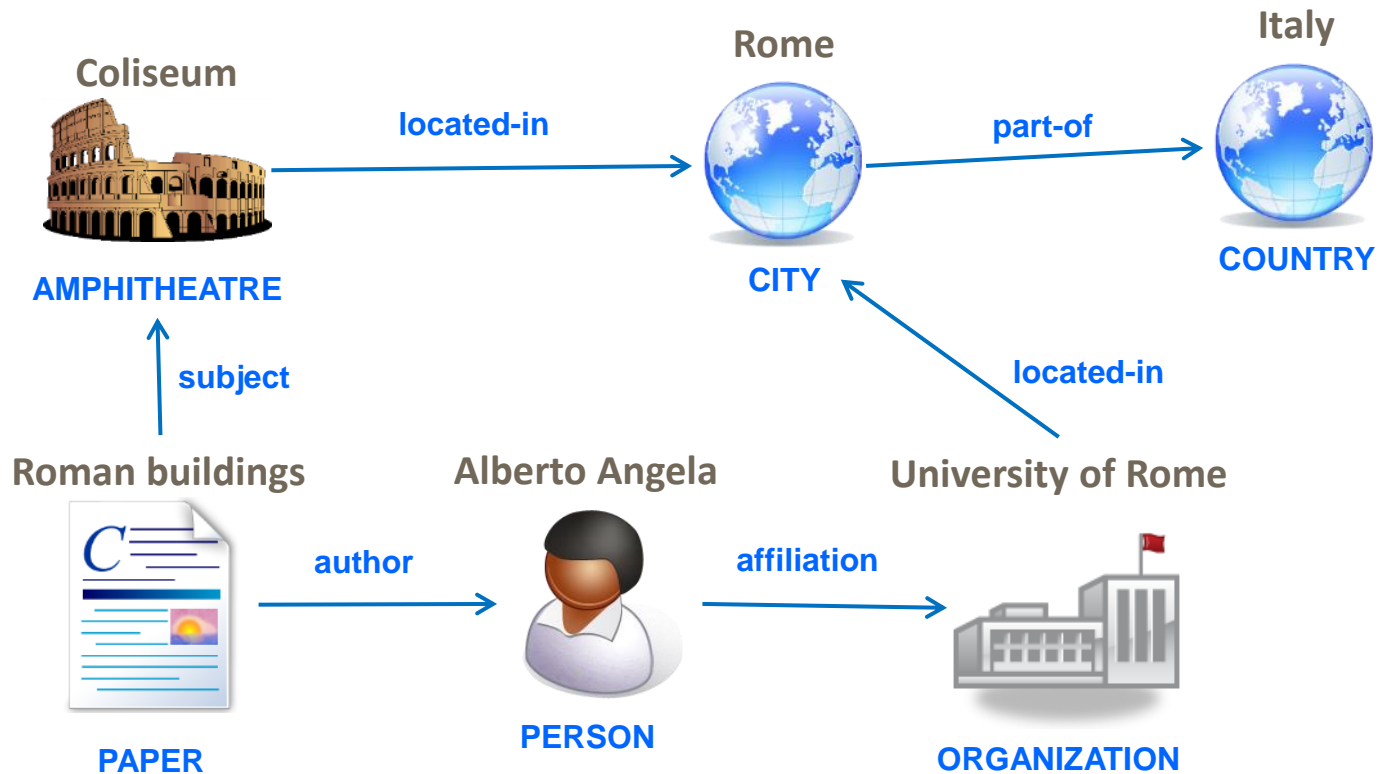


The infrastructure



A knowledge graph

From the integration of existing data sources



- Which **kinds of entities** are described with the data?
- Which **relations** and **attributes** are used?
- Which **terms** are used to denote the relations, the attributes and their values?
- What is the **meaning** of the terms and how they are related with each other?

The user interface

Digital Unitn - KOS ≡ 👤 Fausto Giunchiglia

dataset-import
Entity Base
Home Page
Knowledge Base
Etype Explorer
Classification Management
Department Portfolio
Digital Library
UserBase Management

Entity Base Explorer

English

Exact match query ... Search Advanced

26 results found

- 70643 4th International and Interdisciplinary Conference on Modeling and Using Context (CONTEXT 2003)
- 70679 Proceedings of the IJCAI-03 workshop on ontologies and distributed systems (ODS 2003). : CEUR-WS, 2003
- 70707 Agent-Oriented Software Engineering
- 70719 KR2002: proceedings of the 8th international conference on principles of knowledge representation and reasoning: Toulouse, France,
- 70739 Cooperative information systems: 9th international conference, CoopIS 2001
- 70759 Artificial Intelligence: methodology, systems and applications, 8th international conference, AIMSA'98:
- 70767 Ontology Matching ζ (OM-2008). Proceedings of the ISWC'08 International Workshop OM-2008
- 70779 Proceedings of the International Workshop on Ontology Matching (OM) collocated with the 6th International Semantic Web Conference (ISWC) and the 2nd Asian Semantic Web Conference (ASWC), November 11, Busan, Korea
- 71029 Advances in Web Semantics 1
- 71165 Normatività Logica e Ragionamento di Senso Comune

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Export RDF (0) Export JSON (0)

Tabular Compact

Entity

- Name
- Person
- Location
- Event
- Mind Product
 - Paper
 - Thesis
 - Patent
- Publication
 - Book
 - Collection
- Structure
- File
- Language
- Organization
- Duration
- Moment