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Connecting Information Professionals

Using Semantic Resources to Enrich Content Services

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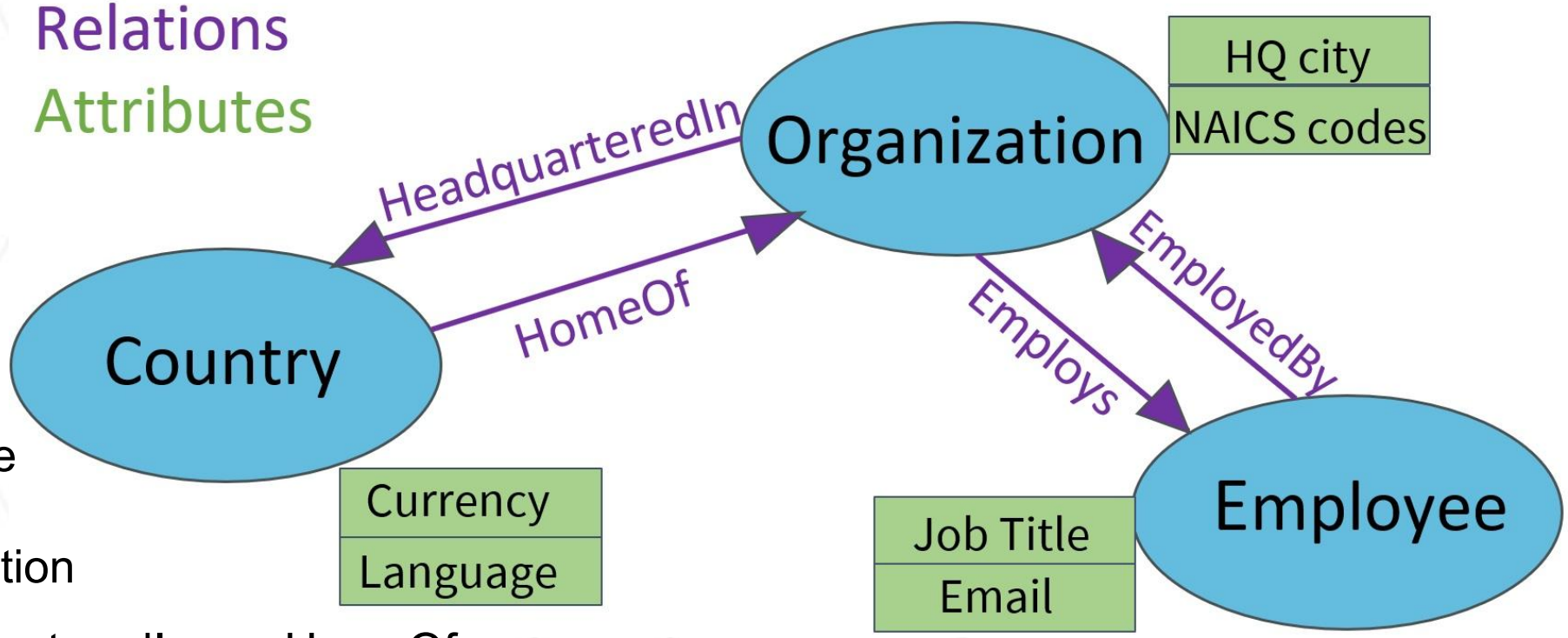
Agenda

- Introductions
- Value of Semantic Resources
- Types of Semantic Resources (KOS)
- Knowledge Graph Use Cases
- JPL's Knowledge Graph Use Cases
- Knowledge Graph Implementation Examples

Types of Semantic Resources

Ontology

Classes
Relations
Attributes

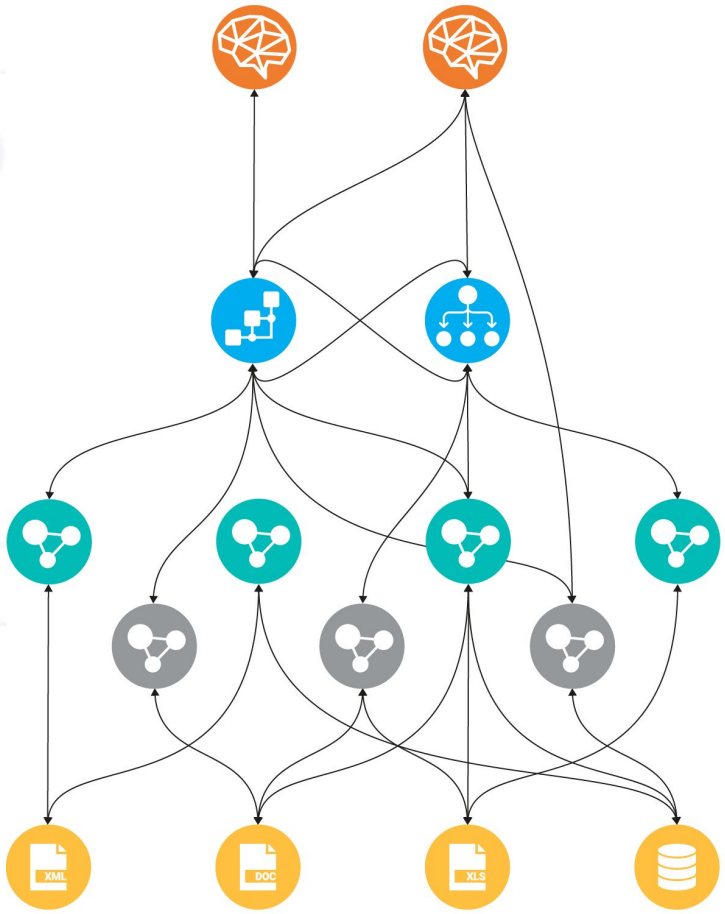


Classes: Employee
Country
Organization

Relations: HeadquarteredIn < > HomeOf
EmployedBy < > Employs

Attributes: Email address, Job title, HQ city, NAICS codes, Currency, Language

What is an Enterprise Knowledge Graph (EKG)?



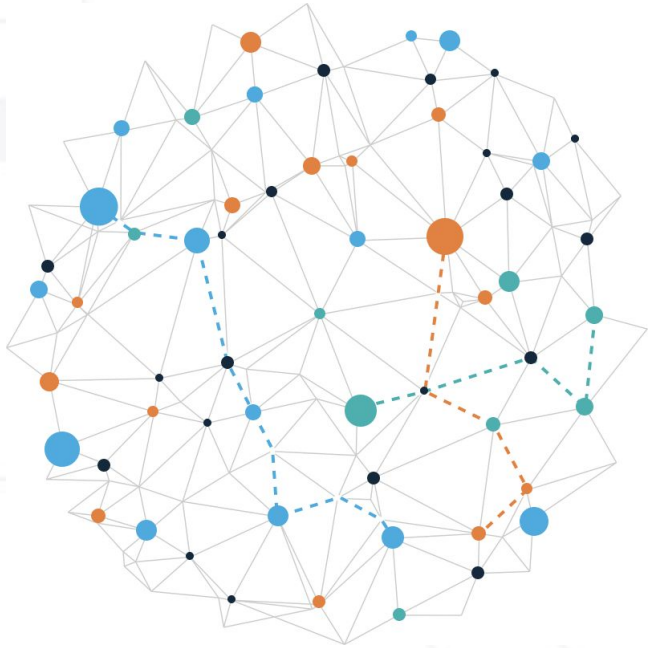
SEMANTIC AI APPLICATION

CONCEPTUAL AND LINGUISTIC MODEL

(VIRTUAL) DATA GRAPH

CONTENT & DATA LAYER

ENTERPRISE KNOWLEDGE GRAPH



An Enterprise Knowledge Graph (EKG) contains business objects and topics that are closely linked, classified, semantically enriched, and connected to existing data and documents.

Knowledge Graph Implementation Examples

Knowledge Graph Implementations

Systems that provide information without standard search for non-expert users:

Recommendation Systems

- Users don’t know how best to look for information that would benefit them
- Users don't know that the information is there or how to find it
- Use cases for suggesting content: cross-selling, networking, learning

Question Answering Systems

- Natural language interface over enterprise data
- Concise and comprehensible answers to user questions
- Fast access to enterprise data for non-technical users
- It is already everywhere (Alexa, Siri, Google Assistant, etc.)

Knowledge Graph Implementations

Advantages of *knowledge graph*-based systems over other methods:

For recommendation systems:

- Based on explicit knowledge of content stored in database
- Does not require prior interactions, large numbers of users, or trained data, as in content filtering or collaborative filtering systems
- Does not have cold start problem due to insufficient data

For question answering systems:

- Requires little or no training data
- Robust in handling user mistakes
- Efficient and scales with the increasing size of the knowledge graph
- Can include explanations for how the question was interpreted
- Can deal with questions and answers in different languages

Knowledge Graph Implementations

Example solutions:

Recommendation system:

HR Recommender

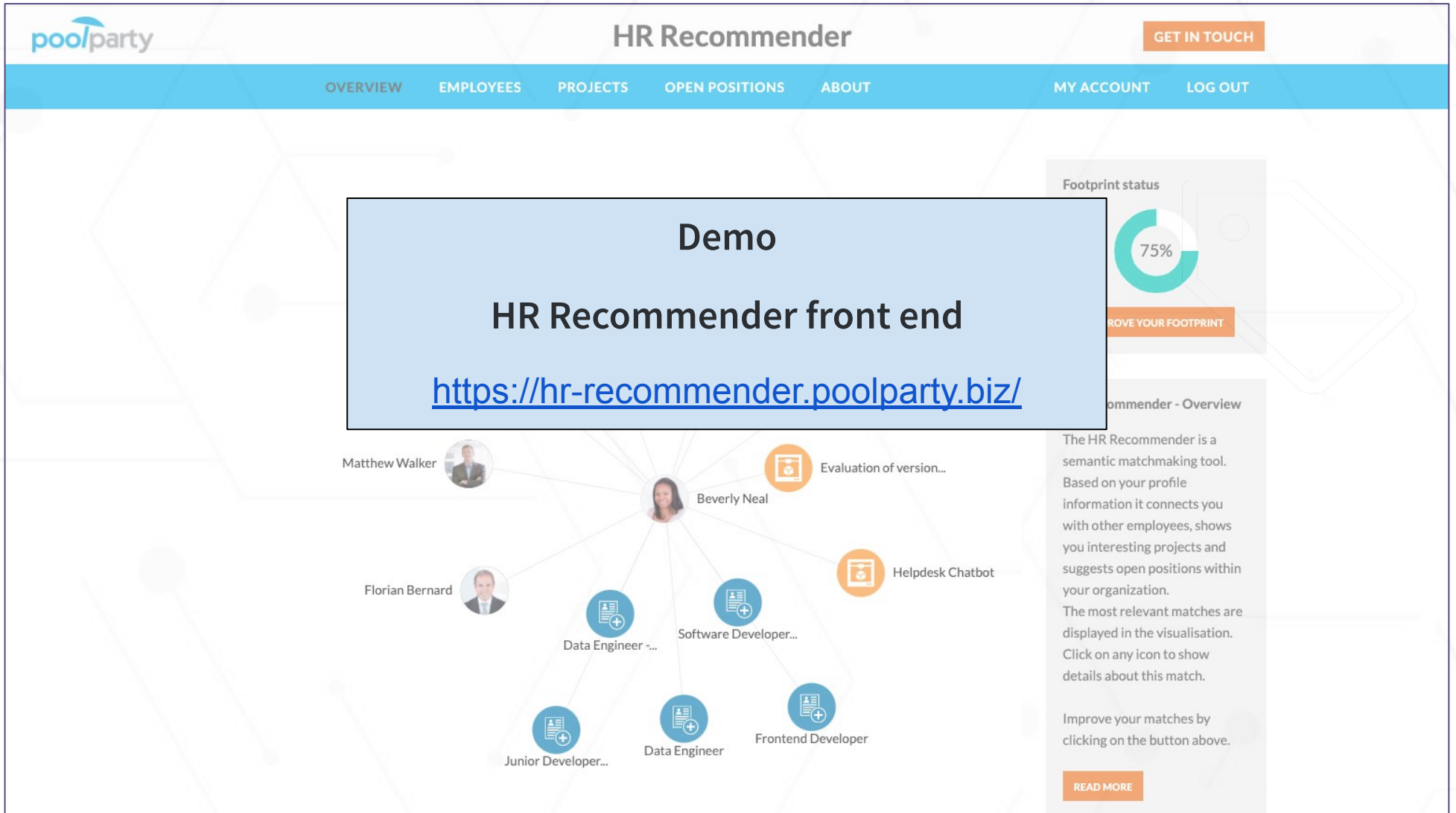
Prototype application developed by Semantic Web Company with knowledge graph built in PoolParty software and user interface in Drupal
https://hr-recommender.poolparty.biz

Question answering system:

QAnswer

Developed in a strategic partnership between QA Company
and Semantic Web Company with knowledge graph built in PoolParty.
https://qanswer.poolparty.biz

Recommendation System Example



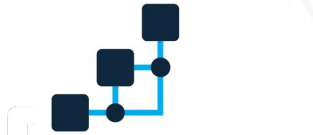
Recommendation System Example: HR Recommender

Recommendation System Example: HR Recommender

HR Recommender Components

Semantic resources

- Taxonomies containing concepts and labels
- Ontology of semantic relations



Content that is text-mined

- CVs, personal profiles, job descriptions, project descriptions

Stored data

- Knowledge graph and a search index (Solr)

Recommender application

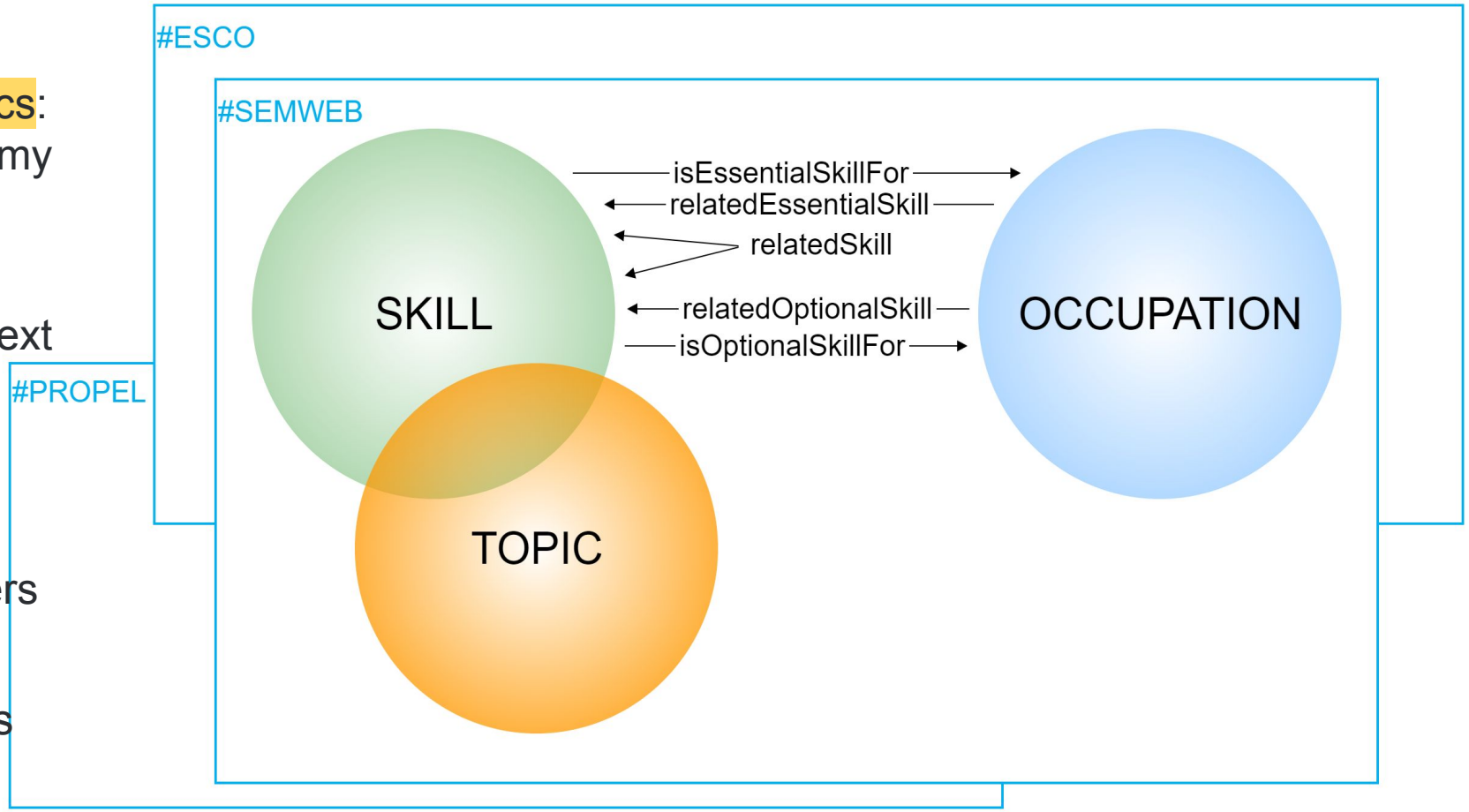
- Algorithms for calculating similarities and recommendations to *enrich* the semantic footprint
- Web application user interface on top of an API

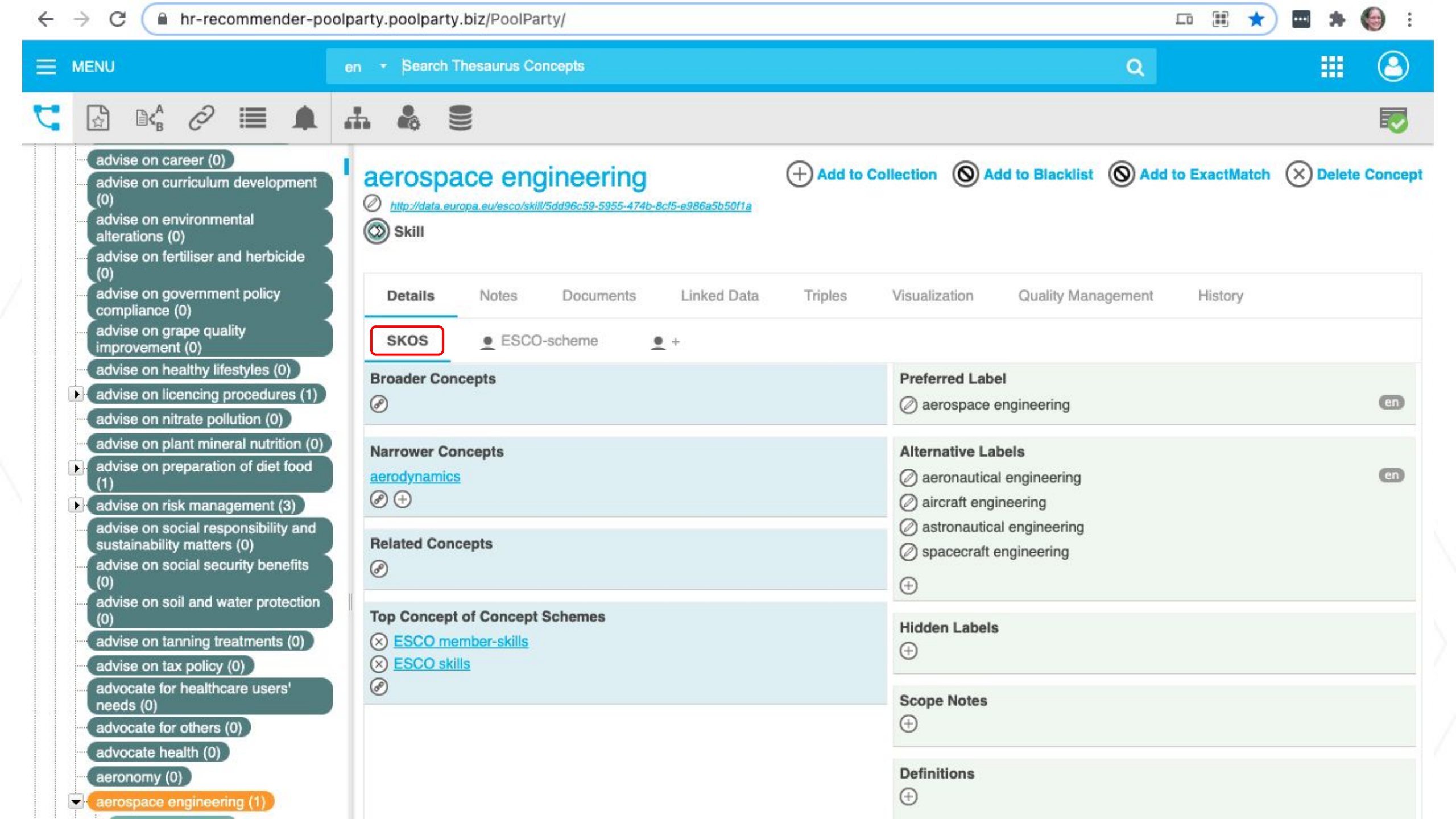
Recommendation System Example: HR Recommender

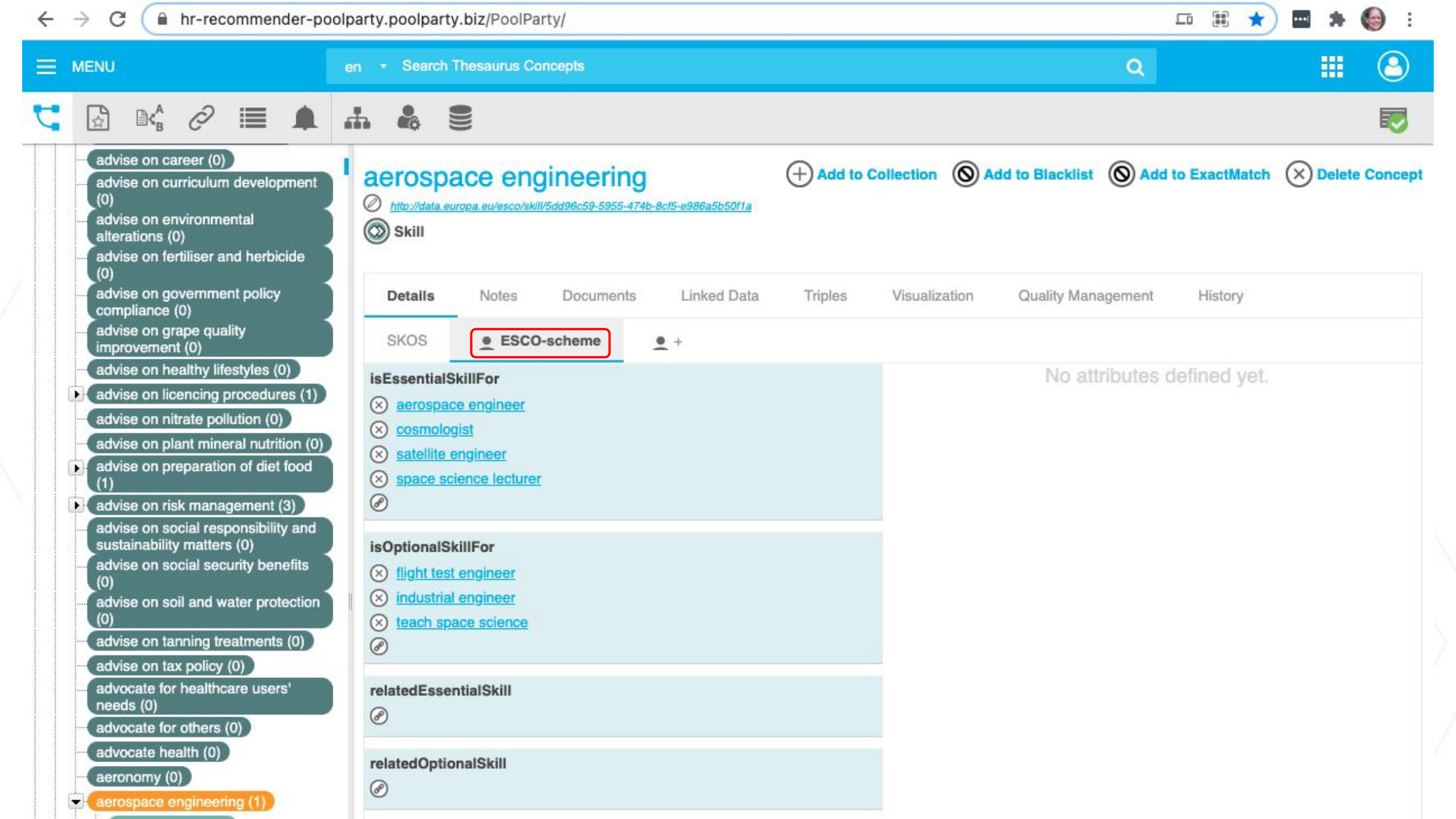
Taxonomy sources:

- Skills & Occupations Topics: **SEMWEB** custom taxonomy
- Skills & Occupations: **ESCO** Classification
- Taxonomy enriched with text mining (entity extraction) of Topics: **Propel** corpus of industry conference content: submitted papers, speakers

Ontology layer:
Adds semantic relationships




hr-recommender-poolparty.poolparty.biz/PoolParty/
MENU
en
Search Thesaurus Concepts
advise on career (0)
advise on curriculum development (0)
advise on environmental alterations (0)
advise on fertiliser and herbicide (0)
advise on government policy compliance (0)
advise on grape quality improvement (0)
advise on healthy lifestyles (0)
advise on licencing procedures (1)
advise on nitrate pollution (0)
advise on plant mineral nutrition (0)
advise on preparation of diet food (1)
advise on risk management (3)
advise on social responsibility and sustainability matters (0)
advise on social security benefits (0)
advise on soil and water protection (0)
advise on tanning treatments (0)
advise on tax policy (0)
advocate for healthcare users' needs (0)
advocate for others (0)
advocate health (0)
aeronomy (0)
aerospace engineering (1)
aerospace engineering
Add to Collection
Add to Blacklist
Add to ExactMatch
Delete Concept
http://data.europa.eu/esco/skill/5dd96c59-5955-474b-8cf5-e986a5b50f1a
Skill
Details
Notes
Documents
Linked Data
Triples
Visualization
Quality Management
History
SKOS
ESCO-scheme
+
Broader Concepts
Narrower Concepts
aerodynamics
Related Concepts
Top Concept of Concept Schemes
ESCO member-skills
ESCO skills
Preferred Label
aerospace engineering
en
Alternative Labels
aeronautical engineering
aircraft engineering
astronautical engineering
spacecraft engineering
en
Hidden Labels
Scope Notes
Definitions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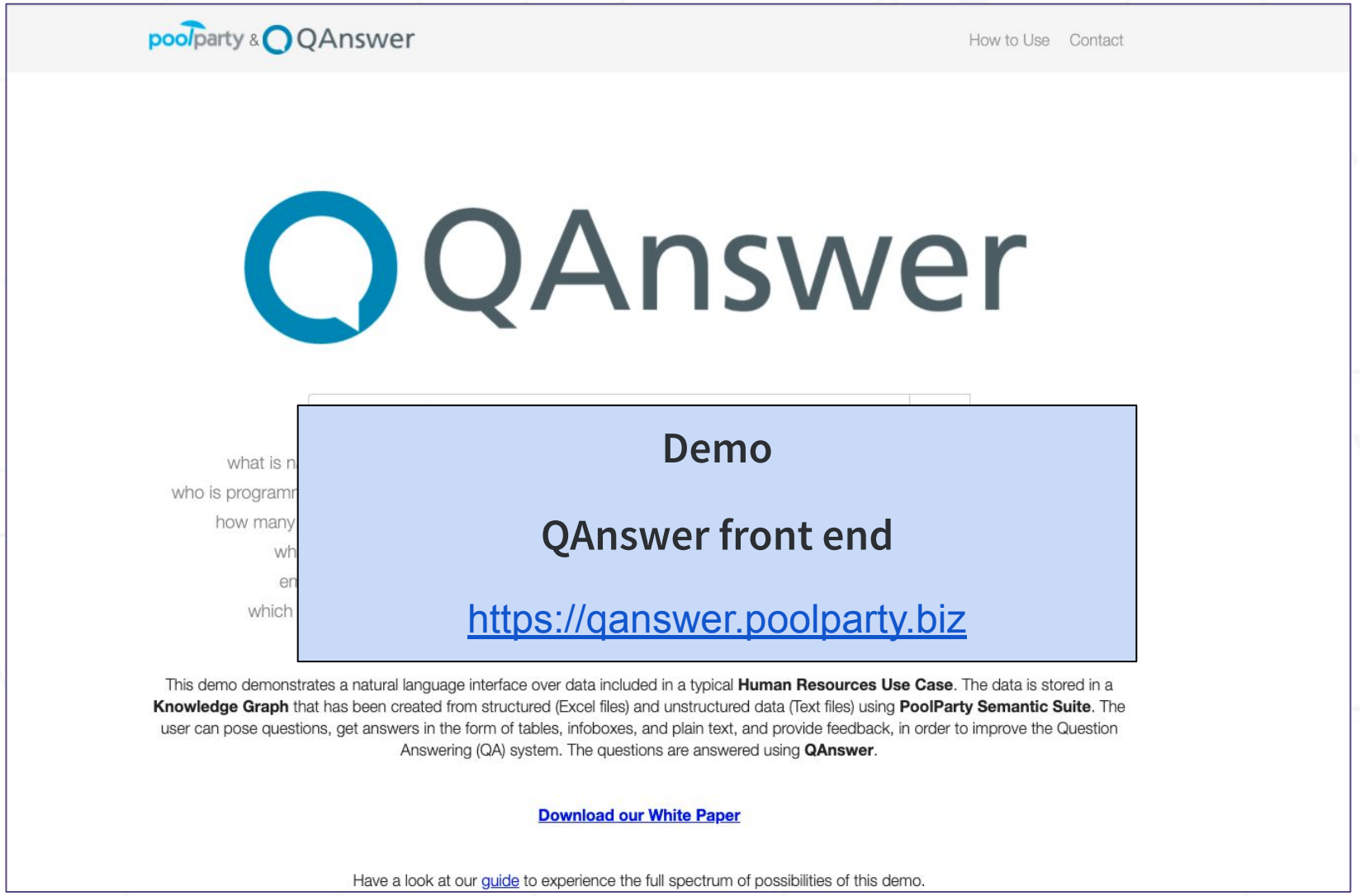
Skill
Details
Notes
Documents
Linked Data
Triples
Visualization
Quality Management
History
SKOS
ESCO-scheme
isEssentialSkillFor
aerospace engineer
cosmologist
satellite engineer
space science lecturer
isOptionalSkillFor
flight test engineer
industrial engineer
teach space science
relatedEssentialSkill
relatedOptionalSkill
No attributes defined yet.

Question Answer System Example



QAnswer System Example

QAnswer System Components

Semantic resources

- Taxonomies containing concepts and labels
- Ontology of semantic relations

Data sources

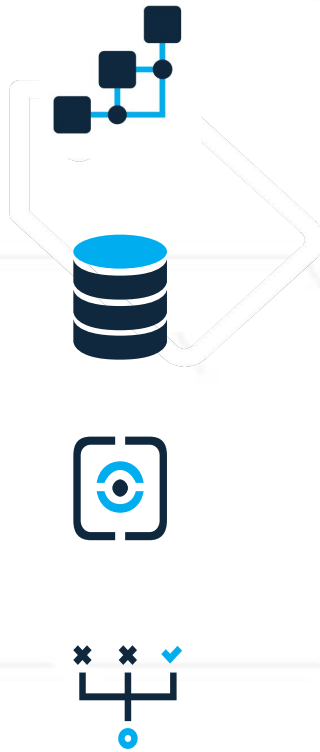
- Databases, spreadsheets, document repositories

Pipelines

- To automatically extract and semantify the data

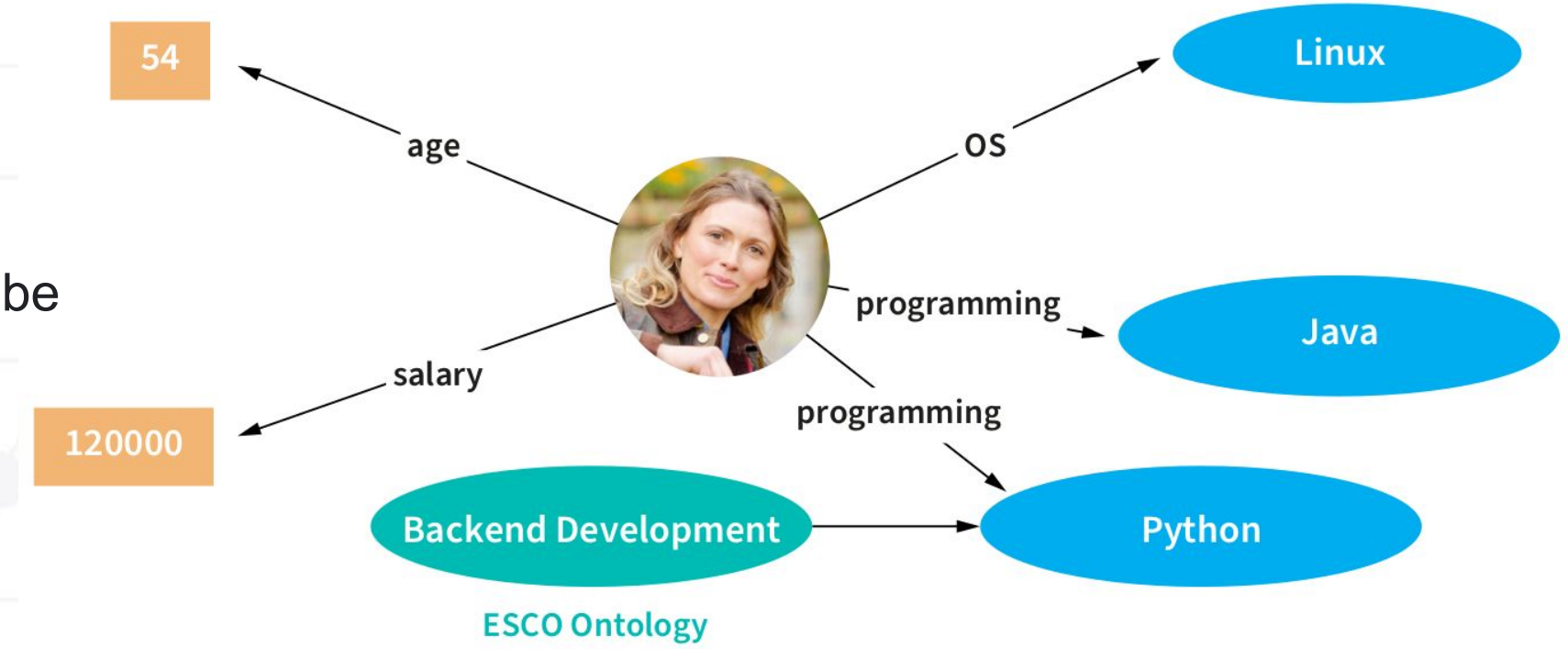
Machine learning models

- Pre-trained machine learning models
- New machine learning models generated and trained



QAnswer System Example

- Create a semantic model using taxonomies and ontologies to describe the domain.
- Establish new relationships using logical inferences, graph analysis or link discovery.



QAnswer System Example

/ Technology domains / Artificial Intelligence
/ type / Employee

TABLE | LIST | IMAGES

	Technology domains	description	Education	type	age	gross salary	image
Dani Van Dinteren	◦ Artificial Intelligence ◦ Database	I hold a Artificial Intelligence degree from University of Texas at Dallas. I currently work as a Sc ...	Intelligent Systems	Employee			
Hugo Saez	◦ Data Mining ◦ Artificial Intelligence	I studied Artificial Intelligence at University of Amsterdam. I am employed as a Data Specialist at	Intelligent Systems	Employee			

Pre-trained machine learning models

New ML models are generated automatically based on the training data provided

Details

TRAIN | DOWNLOAD TRAIN | REMOVE | REMOVEALL | CHECK SELECTION

ID	Question	Lang	Validated	Ranking	Confidence	Ok
3228178	who speaks english and can use dos	en	T	0	0.1	T
3228182	os	en	T	1	0.08	F
3228188	who is using mac os	en	T	0	0.69	F
3228202	who is using windows	en	T	0	0.72	F
3228212	who is using linux	en	T	0	0.73	F
3228222	who can use sql	en	T	0	0.11	F
3228231	employees that can program in java	en	T	1	0.33	F
3228275	who can program in java and speak spanish	en	T	0	0.12	T
3228279	who can program in c++ and speak english	en	T	0	0.08	F

Contact

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