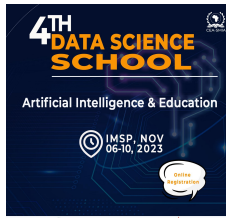


# Scholarly Knowledge Graphs

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Web: <https://ateazing.org>

DSS 2023 - Dangbo, Benin



# Agenda

- What is a Knowledge Graph (KG) ?
- An application of generating KG for tenders in Cameroon (Jules Kouamo, PhD student)
- Scholarly KGs Initiatives & Applications
- Demos
- Q/A session



<https://app.sli.do/event/5NEbyWFvTZpECs4FzrCgzE> for interaction.

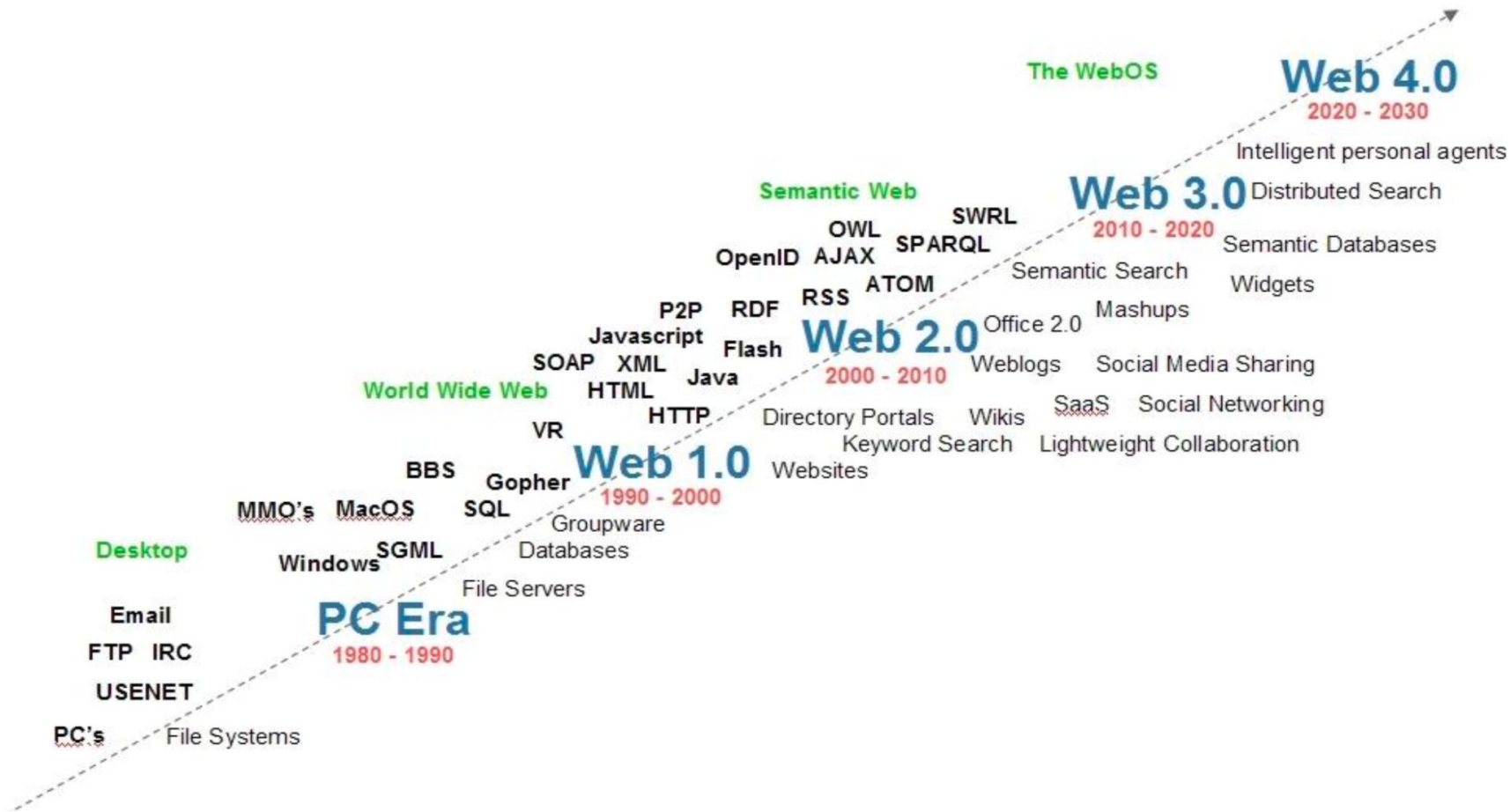
- It is raw data
- Something that belongs to machines
- Something which is known
- It haven o idea

# Web Evolution - 33 Years Old

	Web 1.0	Web 2.0	Web 3.0
<b>Definition (selon Berners-Lee)</b>	Read Only	Read Write	Read Write Execute
<b>Web type</b>	Simple Web	Social Web	Semantic Web
<b>Number of users</b>	$10^6$	$0.25 \cdot 10^9$	$2 \cdot 10^9$
<b>Basic concept</b>	Connecting information	Connecting people	Connecting knowledge
<b>Processus</b>	Publishing	Collaboration	Digging, search
<b>Years</b>	1990-2000	2000-2010	2010-2020+

<https://waytolearnx.com/2019/03/difference-entre-web-1-0-web-2-0-et-web-3-0.html>

# Web Evolution - Technologies



# Knowledge Graph - A Definition

*“A graph of data intended to accumulate and convey knowledge of the real world, whose nodes represent entities of interest and whose edges represent relations between these entities.*

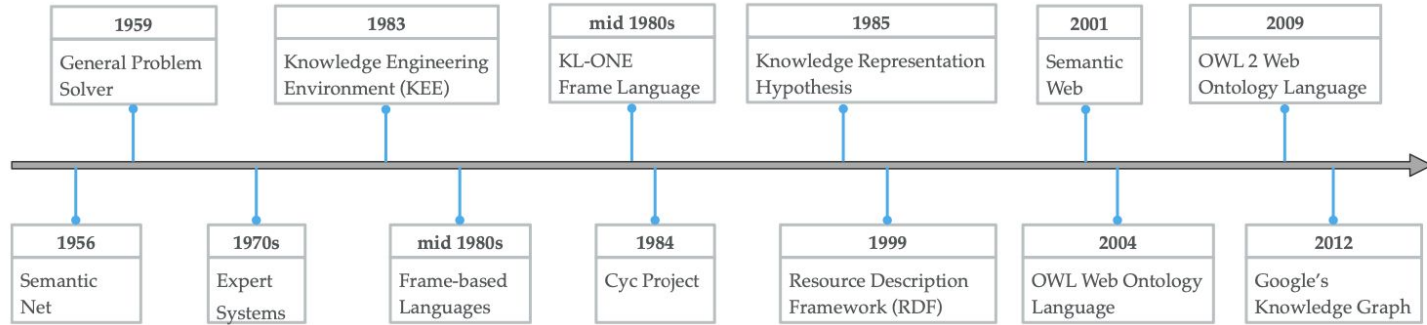
The graph of data (aka *data graph*) conforms to a graph-based data model, which may be a **directed edge-labelled graph**, a *property graph*, etc.

(Hogan and al., 2021)

<https://kgbook.org/>

```
@book{kg-book,  
  author = {Hogan, Aidan and Blomqvist, Eva and Cochez, Michael and  
d'Amato, Claudia and de Melo, Gerard and Guti\`errez, Claudio and  
Kirrane, Sabrina and Labra Gayo, Jos\`e Emilio and Navigli, Roberto and  
Neumaier, Sebastian and Ngonga Ngomo, Axel-Cyrille and Polleres, Axel and  
Rashid, Sabbir M. and Rula, Anisa and Schmelzeisen, Lukas and  
Sequeda, Juan F. and Staab, Steffen and Zimmermann, Antoine},  
  doi = {10.2200/S01125ED1V01Y202109DSK022},  
  isbn = {9783031007903},  
  language = {English},  
  number = {22},  
  numpages = {237},  
  publisher = {Springer},  
  series = {Synthesis Lectures on Data, Semantics, and Knowledge},  
  title = {{K}nowledge {G}raphs},  
  url = {https://kgbook.org/},  
  year = {2021}  
}
```

# Brief History of Knowledge Bases



Source: Shaoxiong Ji and al., 2021 « *A Survey on Knowledge Graphs: Representation, Acquisition and Applications* »

# Small KG

## Example of RDF data (small KG)

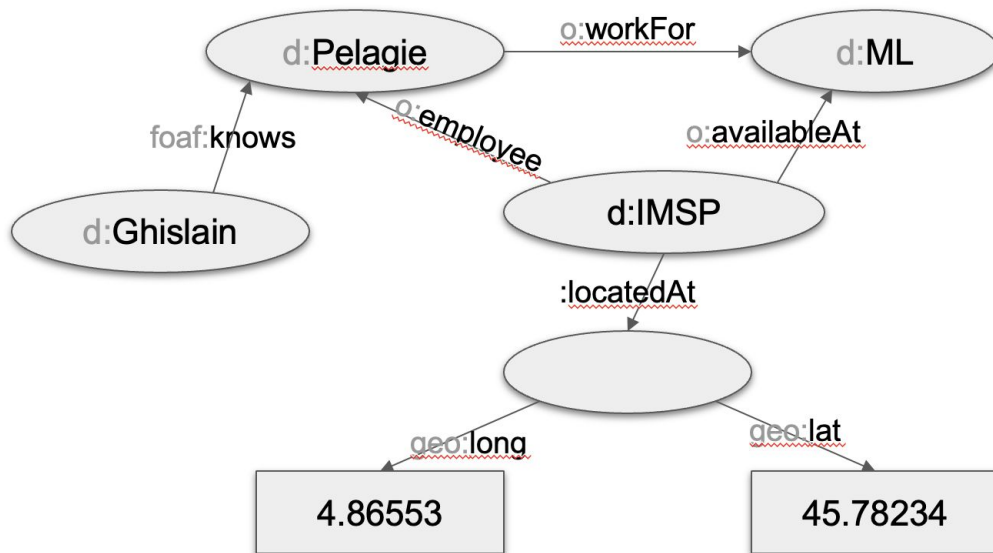
### Namespaces

@prefix d: <http://data.imsp-benin.com/data/>

@prefix o: <http://data.imsp-benin.com/onto/>

@prefix foaf: <>

@prefix geo: <>





# Example of RDF data (small KG)

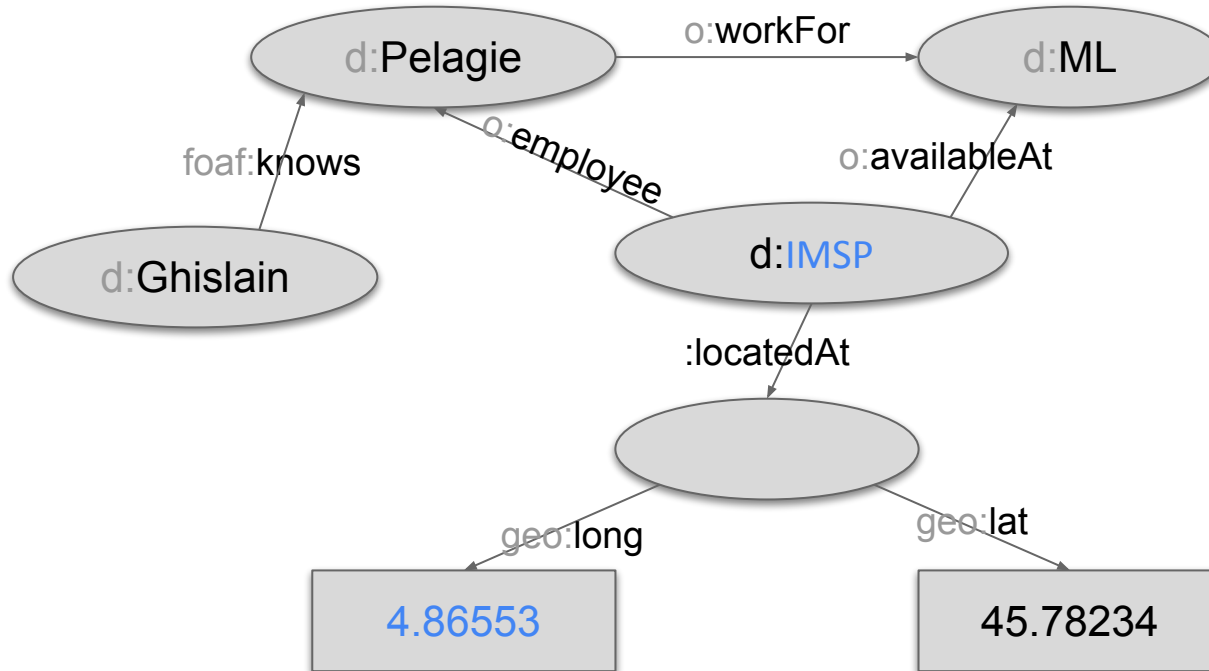
Namespaces

@prefix d: <http://data.imsp-benin.com/data/>

@prefix o: <http://data.imsp-benin.com/onto/>

@prefix foaf: <>

@prefix geo: <>

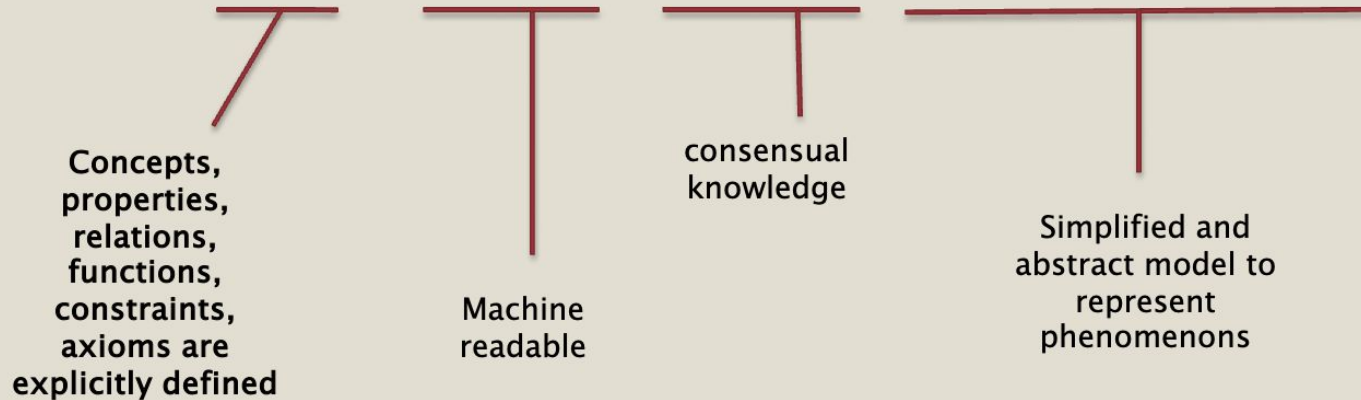


# Ontology - Backbone of a KG

## Definitions

- An ontology is an explicit specification of a shared and formal conceptualization
- It includes the following artifacts: classes, instances, facts and axioms
- **(Semantic) vocabulary is an explicit formalization of existing concepts in natural language**

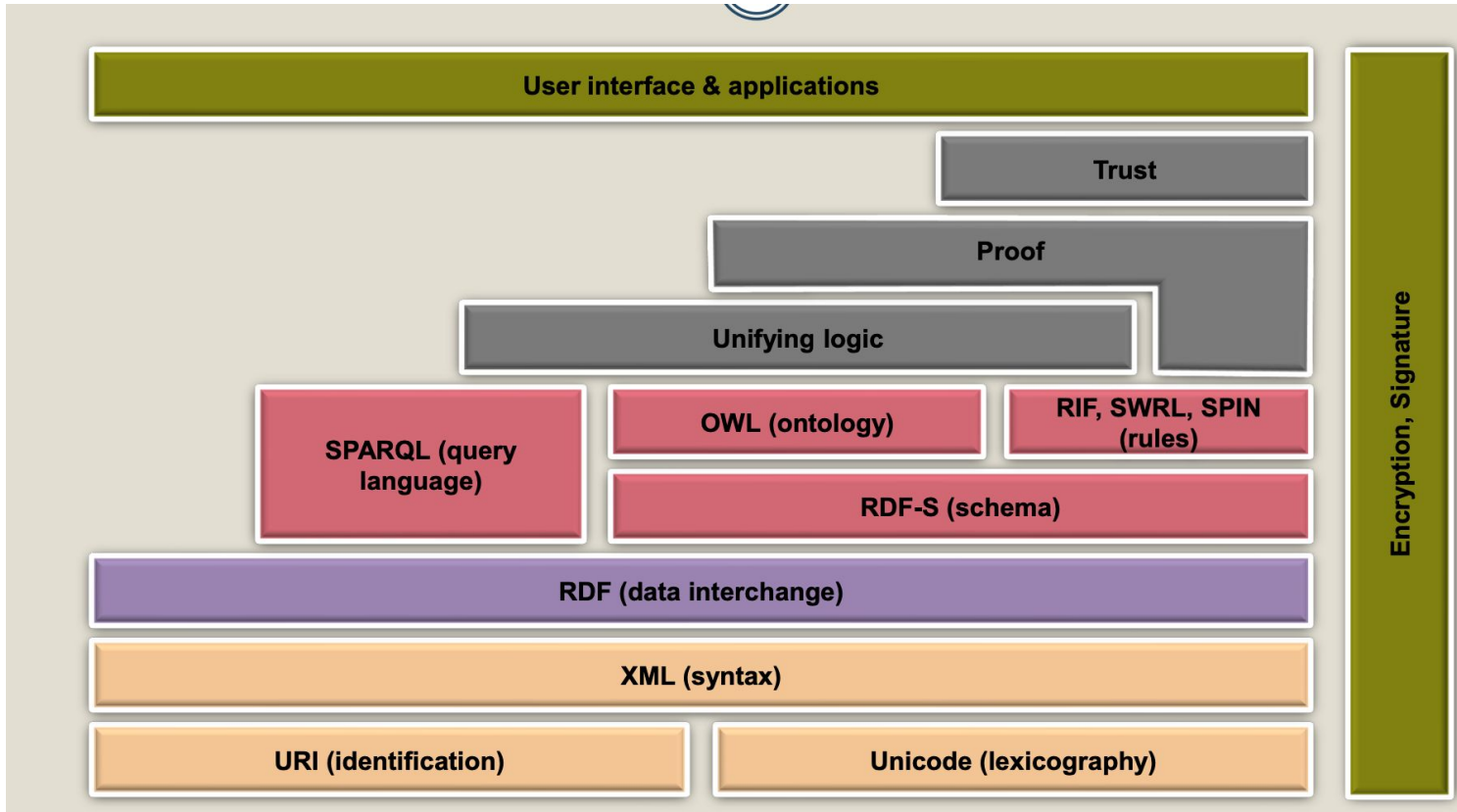
An ontology is an explicit specification of a shared and formal conceptualization



# Example of RDF data (small KG)

- Form the RDF triples for the following sentences?
  - Paul learns physics
  - Paul loves Katharina
  - Paul and Katharina are married
  - Edward is the son of Katharina and Paul
  - Edward is the son of Paul's wife

# Web of Data Architecture



# Wikipedia - DBpedia

- Let's search for "Cotonou" in Wikipedia  
<https://en.wikipedia.org/wiki/Wikipedia>
- Search for "Cotonou"
- Check the url of the City in Wikipedia
- Try to find the equivalent URL in french and spanish
- Now, let's discover the URI in DBpedia (semantic wiki)
- What can we derive from this exercise?

The screenshot shows a web browser at the URL [en.wikipedia.org/wiki/Wikipedia](https://en.wikipedia.org/wiki/Wikipedia). The search bar contains the text "Cotonou". The search results are displayed in a list format, each with a small thumbnail image and a brief description:

- Cotonou**: Largest city in Benin
- Cotonou Agreement**: 2000 EU economic and legal treaty with African, Carib...
- Cotonou Lighthouse**: Lighthouse in Cotonou, Benin
- First Liberian Civil War**: 1989–1997 civil war in Liberia
- Cadjehoun Airport**: International airport serving Cotonou, Benin
- Cotonou Central Mosque**: Mosque in Cotonou, Benin
- Cotonou Cathedral**: Roman Catholic cathedral in Benin
- Timeline of Cotonou**
- Stade de l'Amitié**: Sports stadium in Benin
- AS Cotonou**: Beninese football club

At the bottom of the search results, there is a search bar with the text "Search for pages containing Cotonou".

# BUILDING AND VALIDATING AN ONTOLOGY FOR PUBLIC PROCUREMENT: THE CASE OF CAMEROON

KOUAMO Jules Quentin

Supervisors: Dr Etienne KOUOKAM

Dr Ghislain ATEMEZING

November 8, 2023

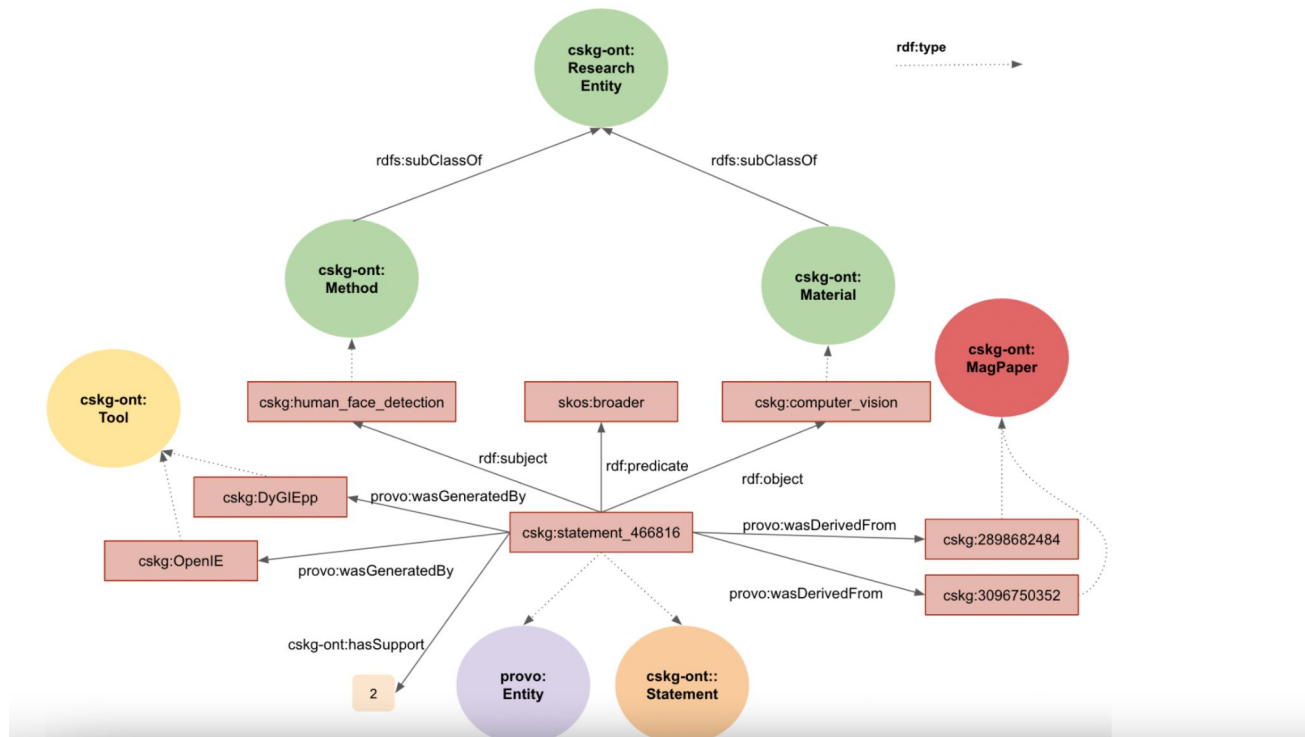


# Scholarly KGs & Applications

## ScholKG

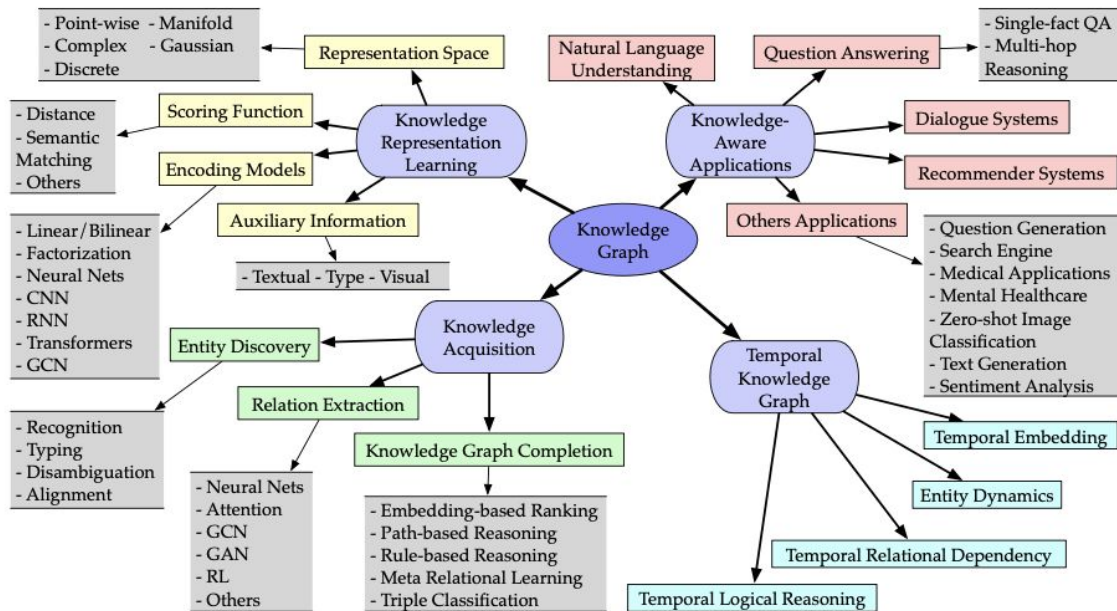
Each statement in CS-KG refers to a **specific claim** extracted from one or more research articles in the form <subject, predicate, object>.

Computer  
Science  
Knowledge  
Graph



<https://scholkg.kmi.open.ac.uk/cskg/documentation.php>

# Research in KGs



Source: Shaoxiong Ji and al., 2021 « *A Survey on Knowledge Graphs: Representation, Acquisition and Applications* »



# Benefits of Scholarly KGS

- Build intelligent tools and services for automatically classifying articles and proceeding books
- Recommendation of publications
- Evolving domain ontologies
- Prediction of the emergence of research topics

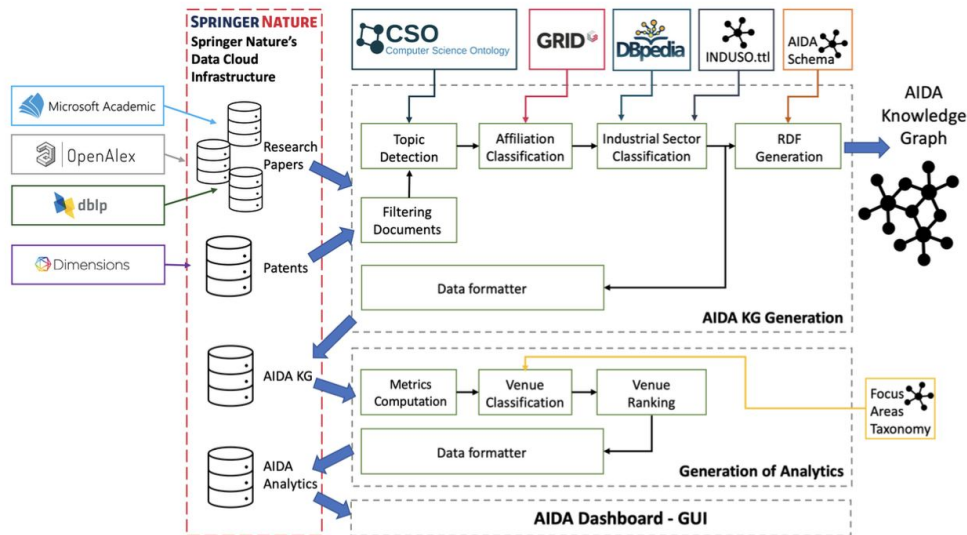
# AIDA KG

- 1.5B RDF triples
- 25M research papers and 8M patents
- Different sources: Microsoft Academic Graph, Dimensions, DBpedia, and the Global Research Identifier Database (GRID).
- 14K research topics from the Computer Science Ontology (CSO)
- Journals and conferences are categorised according to the 124 research fields within Computer Science venues.

AIDA knowledge graph (ver. 3.0) is publicly available via a dump and a SPARQL endpoint at

<https://w3id.org/aida/sparql> .

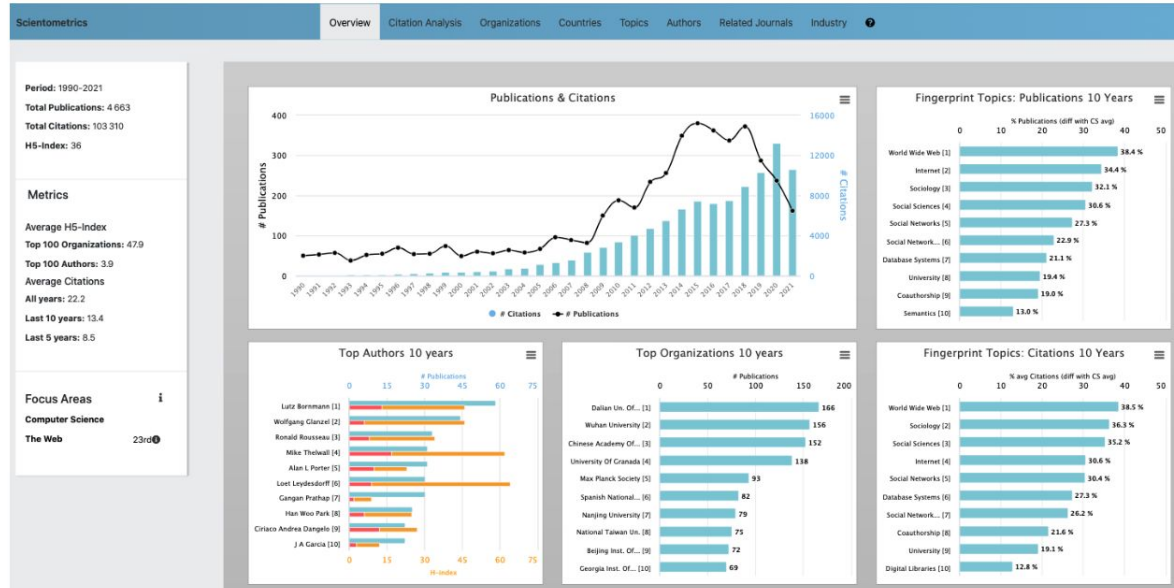
Dump: <https://w3id.org/aida/downloads>



# AIDA Dashboard

A place to check where to publish

- Search top publications per countries/organizations
- Search authors publications
- Advanced search



Demo time: <https://w3id.org/aida/dashboard>

# Towards CARI-KG

- CARI is one big venue for CS in Africa
- It has 2 years periodicity
- Started in 2004, last edition 2022
- Web page template changed almost each year
- Need to scrap HTML page to get relevant information
- Need to structure the data for better analysis

Year	#Articles	#Sessions
2004	57	24
2006	49	22
2008	82	27
2010	70	21
2012	61	20
2014	37	0
2016	50	0
2018	28	0
2020	36	12
2022	51	17

<https://www.cari-info.org/>

September 2022 / 3 Octobre 2022

PERIODE/HORAIRE  
Septembre ... /3 Octobre

YAOUNDE  
Symposium / Forum

DJANG  
Symposium sur le Machine Learning et la Cybersécurité

TUNIS  
Ecole CIMPA

# Towards CARI-KG

Objectives: Build a KG for scholarly African research work and outcomes

Link each researcher with existing CS field

Machine readable access to KG

Build smart tools on top like AIDA Dashboard

**Thank you!**

**Q/A Session**