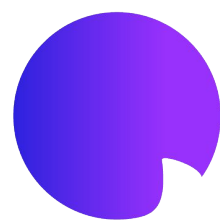# OpenCitations

Open citations in Informatics

European Computer Science Summit 2021

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RESEARCH CENTRE
FOR OPEN SCHOLARLY METADATA

OpenCitations

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF CLASSICAL PHILOLOGY
AND ITALIAN STUDIES

What is an *open* citation

Entity A — cites → Entity B

Citation: a conceptual directional link from a citing entity to a cited entity, for the purpose of acknowledging or ascribing credit for the contribution made by the author(s) of the cited entity.

The citation data related to a particular citation must include:
- the *representation* of such a conceptual directional link
- the *basic metadata* of the citing entity and the cited entity, i.e. sufficient information to create or retrieve textual bibliographic references
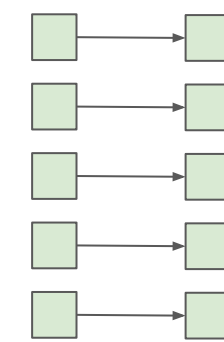
A citation is open when its data are compliant with the following characteristics:

structured

```
"reference":[{
    "issue":"2",
    "key":"10.7717/peerj.4375/ref-11",
    "doi-asserted-by":"crossref",
    "first-page":"237",
    "DOI":"10.1002/asi.22963",
    "article-title":"Anatomy of green open access",
    "volume":"65",
    "author":"Björk",
    "year":"2014",
    "journal-title":"Journal of the Association for
},
...
```
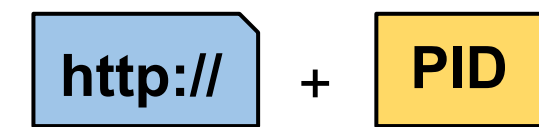
separate

open

without restrictions to maximise reuse

identifiable

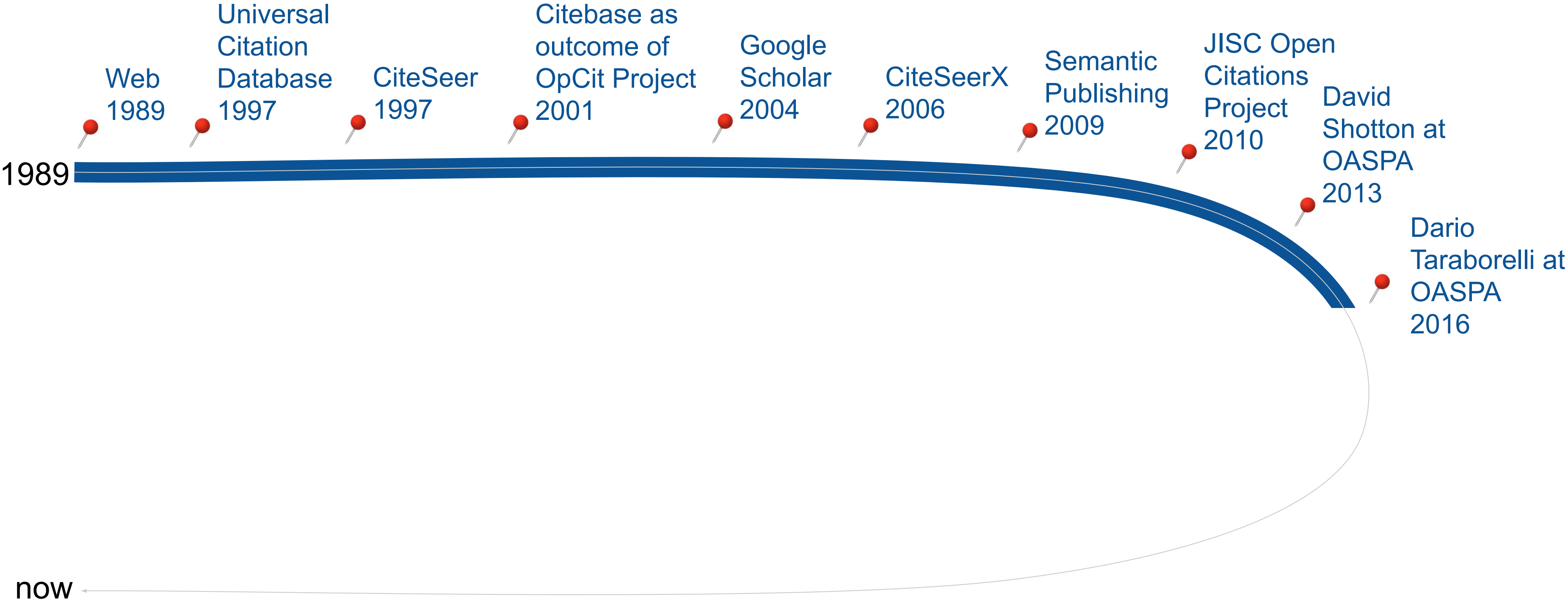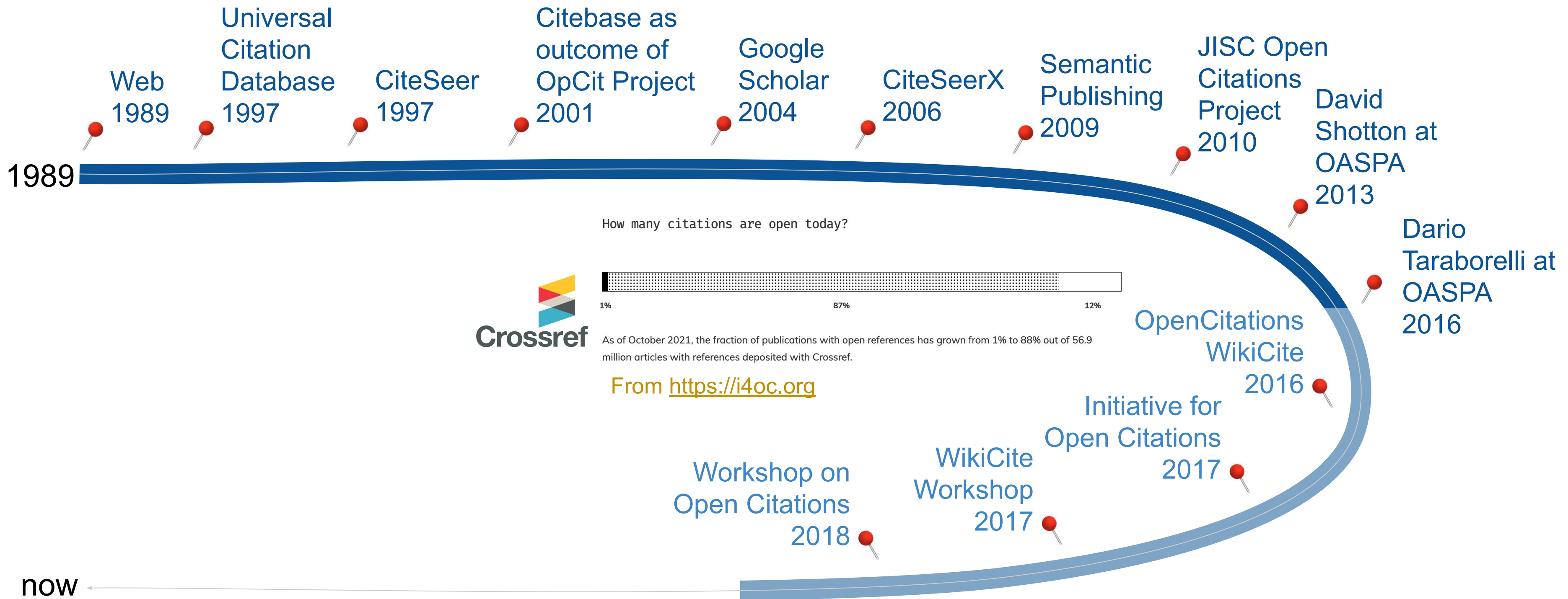**PID**

available

http:// + **PID** = metadata

History of open citations, in brief (1/3)

History of open citations, in brief (3/3)

Web
1989

Universal Citation Database
1997

CiteSeer 1997

Citebase as outcome of OpCit Project
2001

Google Scholar
2004

CiteSeerX 2006

Semantic Publishing 2009

JISC Open Citations Project 2010

David Shotton at OASPA 2013

Dario Taraborelli at OASPA 2016

1989

How many citations are open today?

1%   87%   12%

As of October 2021, the fraction of publications with open references has grown from 1% to 88% out of 56.9 million articles with references deposited with Crossref.

From https://i4oc.org

OpenCitations WikiCite 2016

Initiative for Open Citations 2017

WikiCite Workshop 2017

Workshop on Open Citations 2018

now

OpenCitations: basic information

OpenCitations (http://opencitations.net) is an independent not-for-profit infrastructure organization
- dedicated to open scholarship and the publication of open bibliographic and citation data by the use of Semantic Web (Linked Open Data) technologies
- engaged in advocacy for open citations and open bibliographic metadata, as a founding member of both the Initiative for Open Citations (I4OC) and the Initiative for Open Abstracts (I4OA)

It provides:
- a data model: the OpenCitations Data Model (based on the SPAR Ontologies)
- bibliographic and citation databases (CC0): OpenCitations Corpus, OpenCitations Indexes, Open Biomedical Citations in Context Corpus
- software: in our GitHub repository, released with open source licenses
- online services: REST APIs, SPARQL endpoints, dumps, and search and query interfaces

OpenCitations: values

Fairness: avoid that institutions and independent scholars having to pay tens of thousands of euros annually (that most of them cannot afford!) for relevant services and data, e.g. commercial access to their own scholarly data

Reuse: licenses to foster maximum discoverability and reuse, so users can re-publish and use, for any purpose, data and software that we provide

Transparency: providing open and freely available knowledge of relevance for the scholarly ecosystem (e.g. for dissemination activities and within research evaluation exercises) to foster transparent and reproducible processes

Governance: crucial to involve the stakeholder community in the governance, to build more confidence that the organisation will take decisions driven by community consensus and consideration of different interests

OpenCitations Indexes

OpenCitations Indexes (http://opencitations.net/index), including COCI (launched in July 2018), the OpenCitations Index of Crossref open DOI-to-DOI citations, currently contains more than

1.18 billion citations between 69 million bibliographic resources

COCI data and services	URL
REST API *results in CSV and JSON*	https://opencitations.net/index/coci/api/v1
SPARQL endpoint *results in several formats*	https://opencitations.net/index/sparql
Dumps *all data in CSV, JSON, RDF*	http://opencitations.net/download#coci

Supporting Open Science Infrastructures

The Principles of Open Scholarly Infrastructure

Governance ● ● ● ● ● ● ● Improve stakeholder involvement in governance and plan for winding-down

Sustainability ● ● ● ● ● Not enough incomes to generate surplus and contingency fund to support 12 month operations
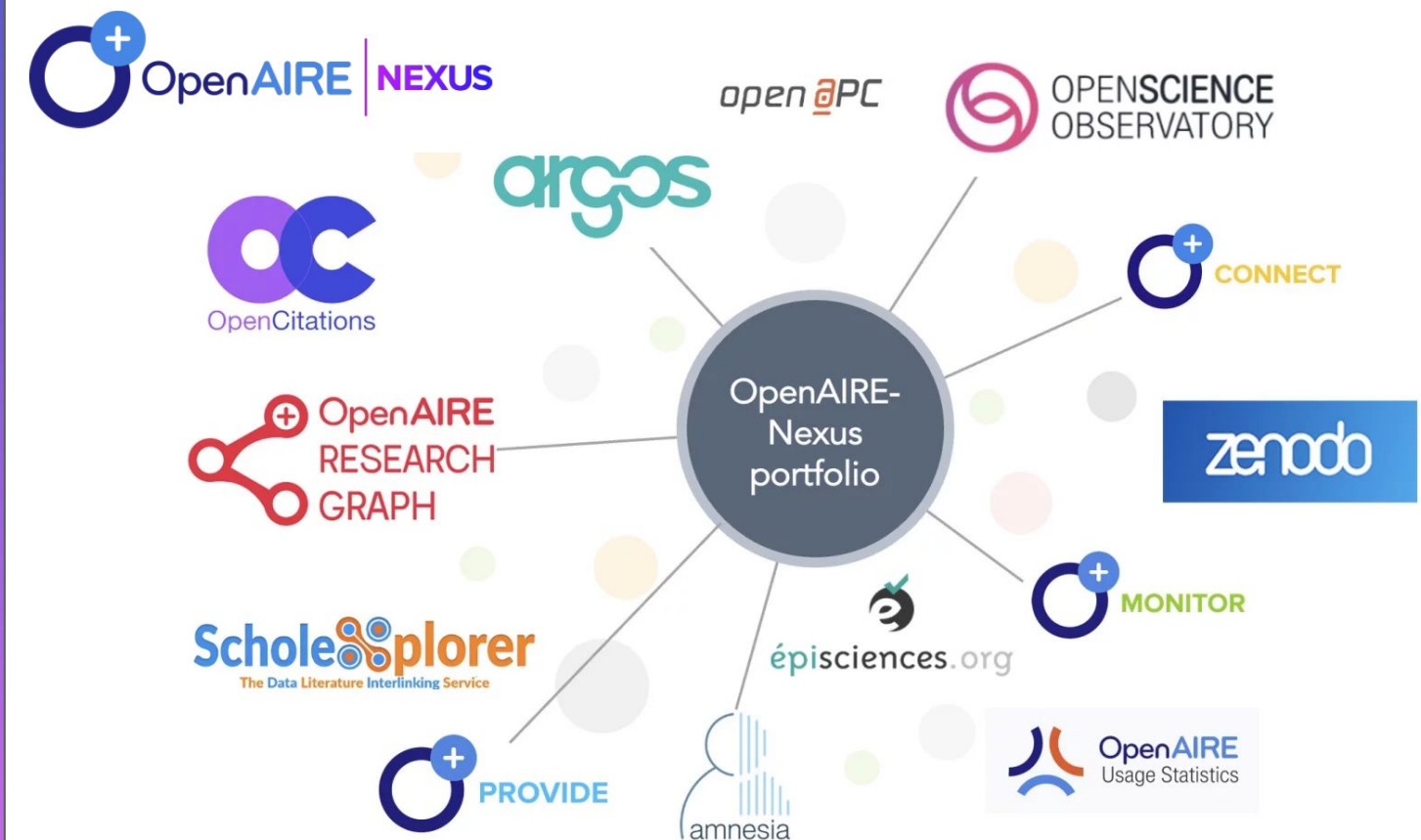
Insurance ● ● ● ● Nothing to declare :-)

Some experiments

Goals:
- How many citations involving a Computer Science publications are included in OpenCitations?
- What are the publishers which are contributing the most?
- What are the publishers receiving more citations by the others?

Material:
- Citations included in COCI September 2021 Dump (https://doi.org/10.6084/m9.figshare.6741422.v11)
- Bibliographic metadata of articles in DBLP October Dump (https://dblp.org/xml/release/dblp-2021-10-01.xml.gz)
- Publisher information via Crossref API (https://api.crossref.org) and DataCite API (https://api.datacite.org)

Data gathered

DBLP used for certifying Computer Science publications (it is an approximation, of course):

- 4,637,865 entities in DBLP (only journal articles, conference proceedings, books and book chapters) with a DOI

COCI used to retrieve all (DOI-to-DOI) citations:

- 80,079,763 citations in COCI that involve a DBLP entity in the previous set
- ~11.8 citations per DBLP citing entity (COCI overall average: ~23.2 citations per citing entity)

All data are available at https://doi.org/10.5281/zenodo.5595388
Software used to gather the data at https://github.com/essepuntato/ecss-2021

Citations from a DBLP publication

Citations to a DBLP publication

23,451,231   31,526,944   25,101,588

54,978,175   56,628,532

31% of citations come from publications not included in DBLP

(from other disciplines?)

Future analysis:
Who cites Informatics?

Publisher	Entities	Outgoing	Incoming
IEEE	1,730,485	18,930,055	21,582,093
Springer	1,012,534	18,482,132	11,179,566
Elsevier	574,860	15,536,207	17,019,716
ACM	433,188	3,695,255	6,050,342
Wiley	89,662	3,350,183	3,357,065

IEEE Open references

0 %

Springer Open references

100 %

Elsevier Open references

100 %

ACM Open references

100 %

Wiley Open references

99 %

Italian NSQ: citation coverage

Italian National Scientific Qualification (NSQ) is a nation-wide research assessment exercise which establishes whether a scholar can apply to professorial academic positions Full Professor (Level 1) and Associate Professor (Level 2)

Applications are organized according to a governmentally-defined taxonomy of 190 Recruitment Fields (RFs), each assigned to one of the following categories, citation-based (CD) and non-citation-based (ND), depending on the use of citations for the evaluation

Web of Science and Scopus are used to gather bibliographic metadata and citations

The coverage of open citations (from COCI December 2020 Dump) not sufficient to replace proprietary databases

Future analysis: repeat the experiment with new COCI dump, that also include Elsevier citations (missing in the previous experiment)

F. Bologna, A. Di Iorio, S. Peroni & F. Poggi (2021). Can we assess research using open scientific knowledge graphs? A case study within the Italian National Scientific Qualification. https://arxiv.org/abs/2105.08599

RF Informatics

RF Information processing systems
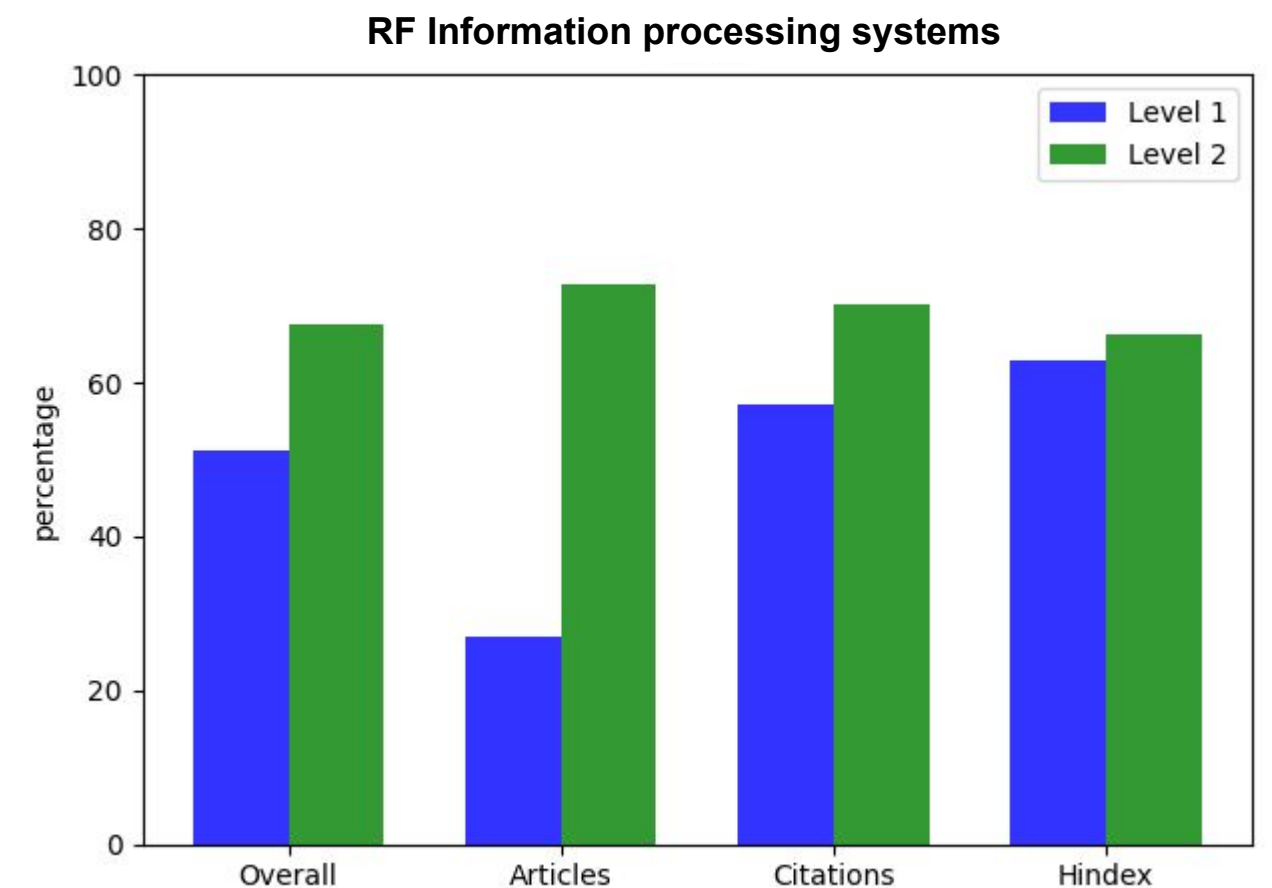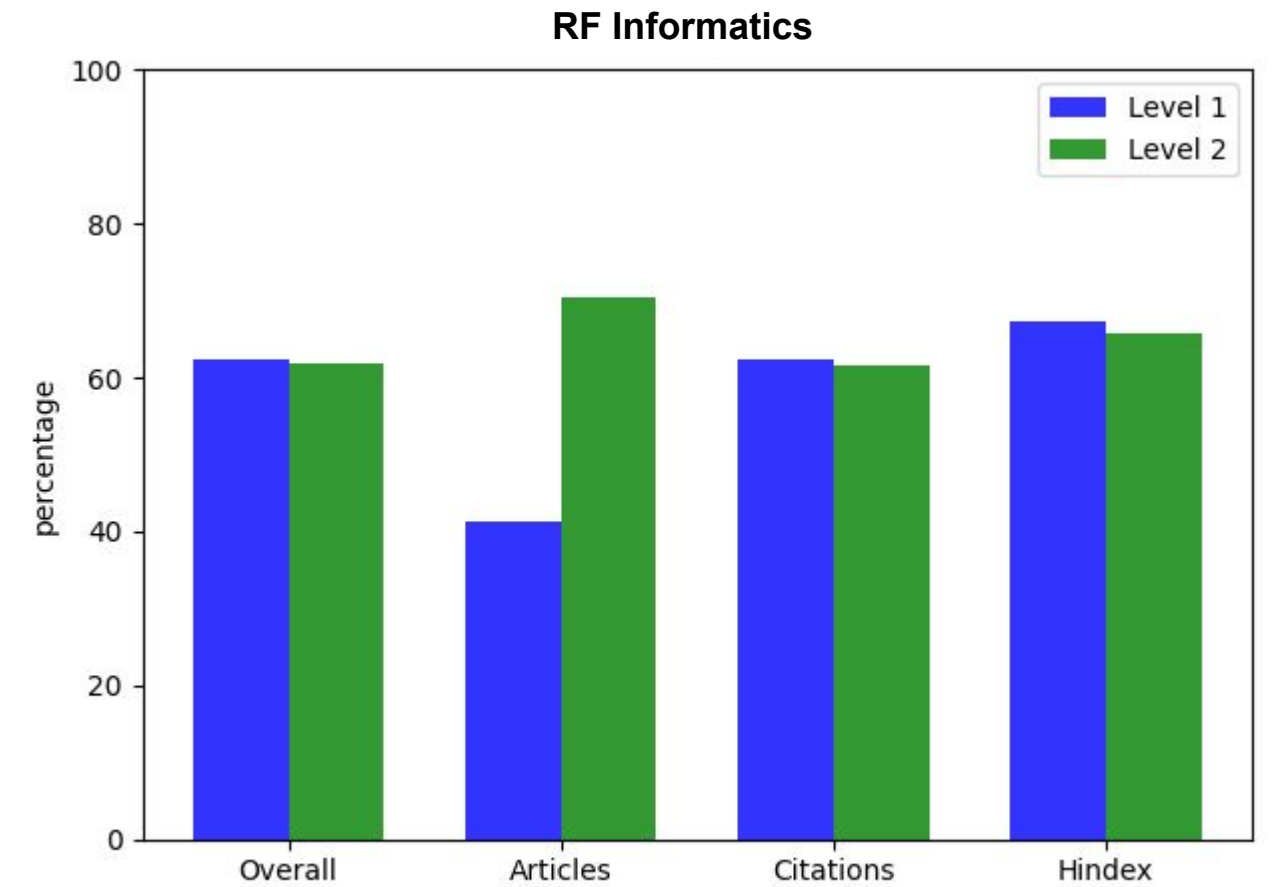
Italian NSQ: article coverage

The 190 RFs are organised into 14 Scientific Areas (SAs)

When preparing their applications, candidates can select only publications in Scopus and Web of Science

We wanted to check if we have similar coverage if we use only open metadata retrieved from:
- Microsoft Academic Graph (MAG)
- OpenAIRE (OA)
- Crossref (CR)

CD RFs show better coverage than ND RFs

Very good results for NSQ applications in the SAs including RF Informatics and Information processing systems (very close to 100% coverage compared with Scopus and Web of Science in both the SAs)

F. Bologna, A. Di Iorio, S. Peroni & F. Poggi (2021). Open bibliographic data and the Italian National Scientific Qualification: measuring coverage of academic fields. https://arxiv.org/abs/2110.02111

Coverage by citation-based and non-citation-based disciplines
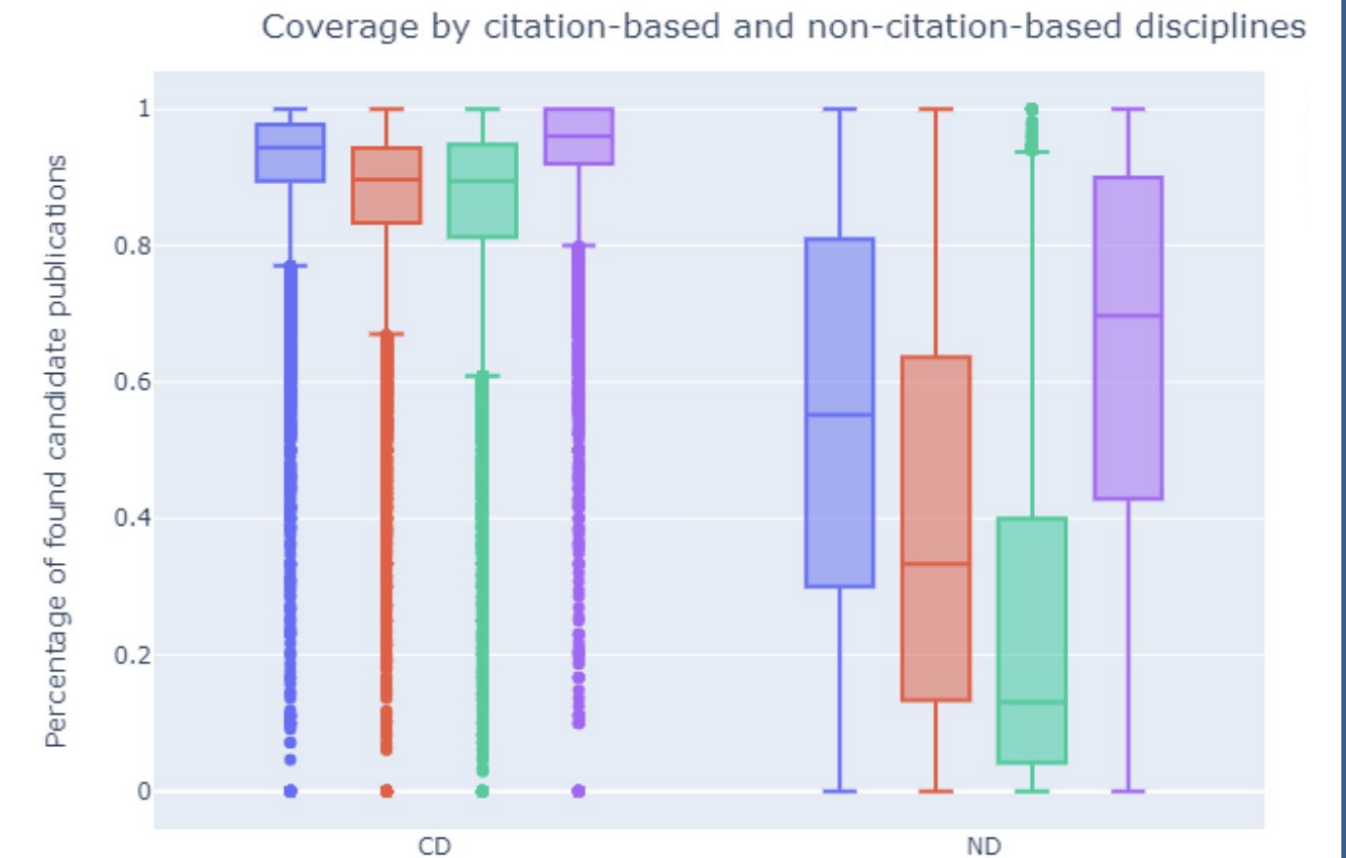
SA Mathematics and Informatics (includes RF Informatics)

SA Industrial and Information Engineering (includes RF Information processing systems)

dataset=MAG
dataset=OA
dataset=CR
dataset=comb
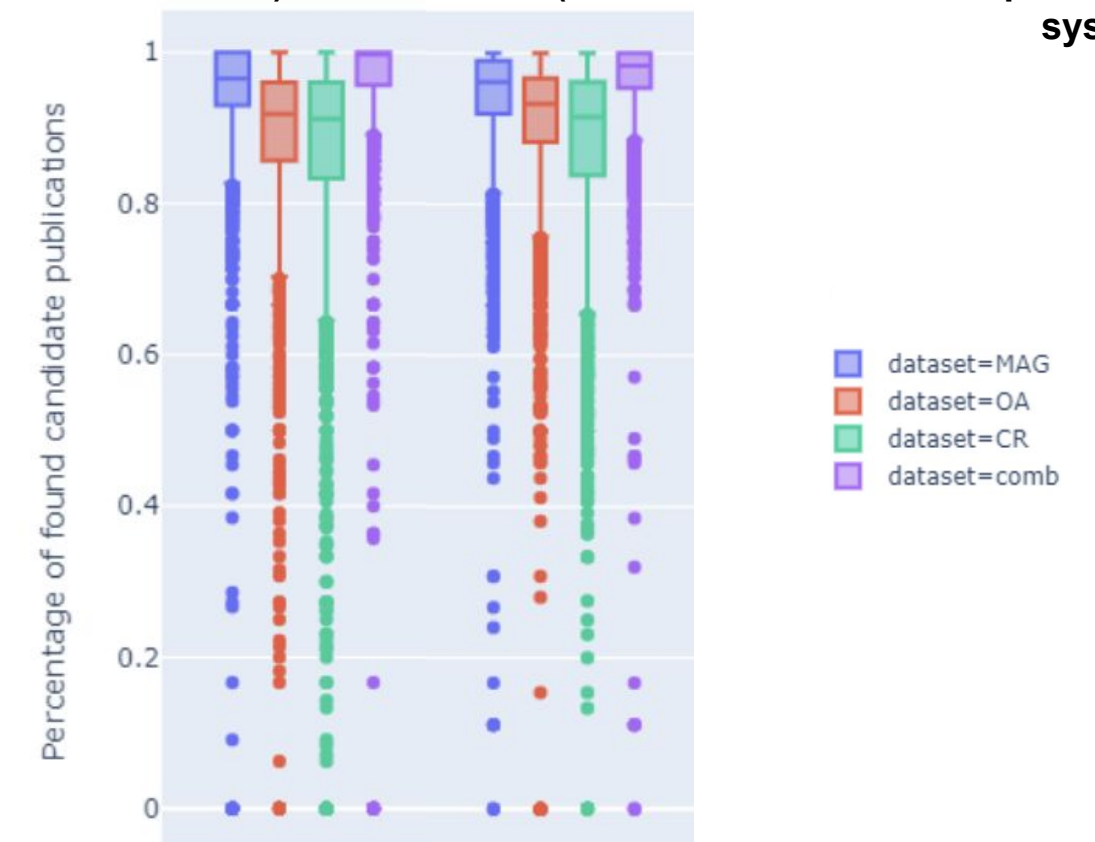
- Open citations are available without charge and under open licences

- Goal: data with scope, depth, accuracy and provenance, as a disruptive alternative to traditional proprietary citation indexes

☺

More than 1.18 billion open citations available (even more, if you consider all the existing providers in addition to OpenCitations)

Tools (e.g. API) supporting easy integration with systems

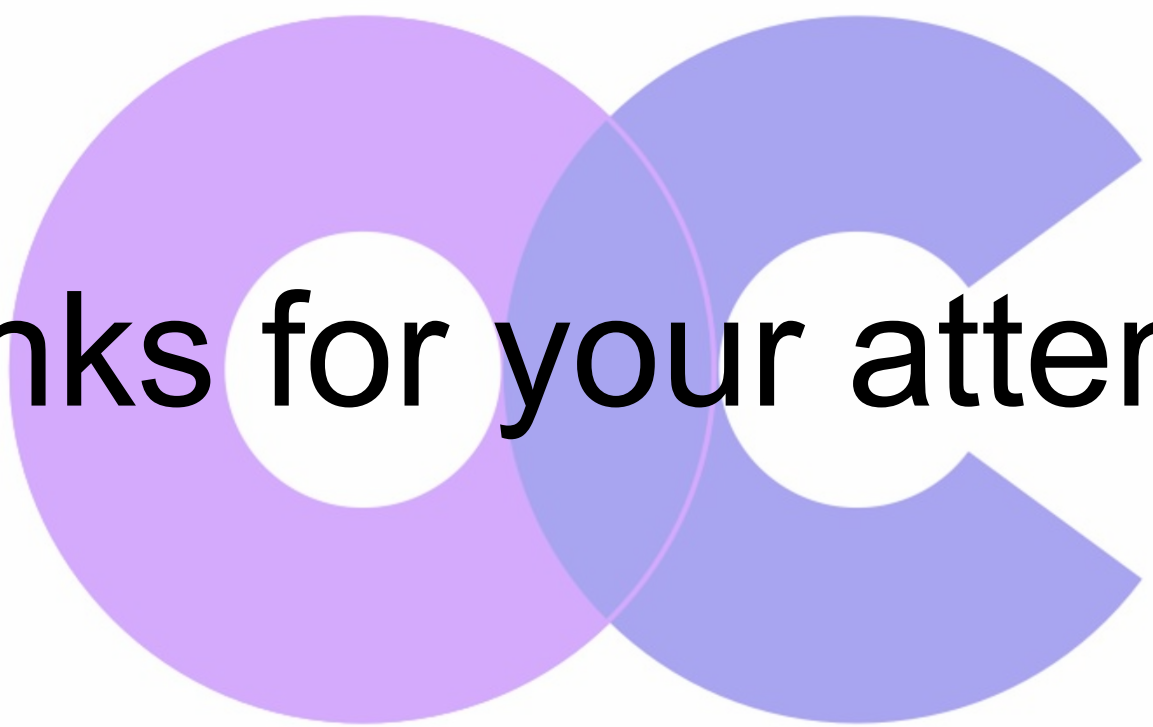Dumps available for huge analysis and usage

☹

Still missing some major publishers

DOI-to-DOI citations do not include several citations, e.g. CEUR Workshop Proceedings citations are all missing in OpenCitations

More (coordinated?) effort needed to have a coverage comparable to proprietary services

Thanks for your attention