Ideas on a decentralized, inclusive and traceable nuclear data future

Georg Schnabel

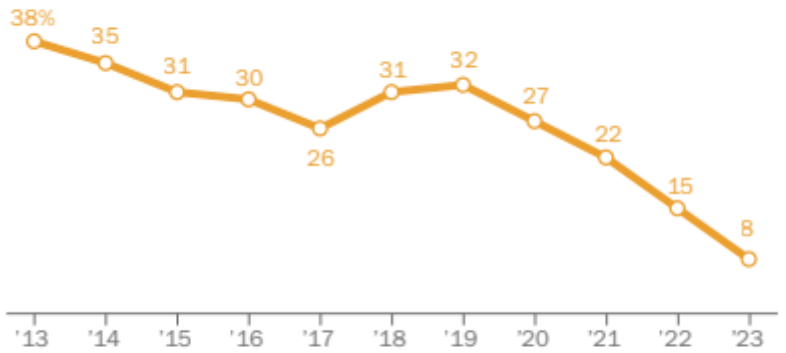
NAPC-Nuclear Data Section, IAEA

TM on Nuclear Data Retrieval, Dissemination, and Data Portals

November 2024, Vienna

38% of webpages from 2013 are no longer accessible

% of links from each year that are no longer accessible as of October 2023



Source: Pew Research Center analysis of a random selection of URLs collected by the Common Crawl web repository (n=999,989) and checked using page and DNS response codes. Web pages defined as inaccessible if they returned a status code of 204, 400, 404, 410, 500, 501, 502, 503, 523 or did not return a valid status code.
"When Online Content Disappears"

PEW RESEARCH CENTER

- **23% of news webpages contain at least one broken link, as do 21% of webpages from government sites.** News sites with a high level of site traffic and those with less are about equally likely to contain broken links. Local-level government webpages (those belonging to city governments) are especially likely to have broken links.

https://www.pewresearch.org/wp-content/uploads/sites/20/2024/05/pl_2024.05.17_link-rot_report.pdf

EVALUATION OF THE Cf-252 FISSION NEUTRON SPECTRUM BETWEEN 0 MeV AND 20 MeV

W MANNHART
Physikalisch-Technische Bundesanstalt,
Braunschweig, Federal Republic of Germany

Abstract

The results of seven recent measurements of the Cf-252 neutron spectrum were used in the evaluation. Based on the available information, for each experiment a complete uncertainty covariance matrix was generated. The data were combined by generalized least-squares techniques. The evaluation was carried out with 70 energy grid points between 25 keV and 19.8 MeV. The individual experimental data were extrapolated to these grid points by using the shape of a Maxwellian distribution specific for each experiment. The evaluation gave a value of χ^2 per degree of freedom of approximately unity and indicated no incompatibility between the experiments. The resulting relative uncertainty of the evaluation is smaller than 2 % between 180 keV and 9.3 MeV. A weighted spline interpolation between the discrete data points was used to generate a continuous shape of the evaluated neutron spectrum The result of the evaluation was compared with available theoretical descriptions of the Cf-252 neutron spectrum. None of the existing theories is compatible with the evaluation over the whole energy range.

From: Properties of Neutron Resources, IAEA, Vienna, 1987, IAEA-TECDOC-410

Los Alamos NATIONAL LABORATORY

Reevaluating the ^{252}Cf(sf) PFNS and associated covariances

Denise Neudecker[1], D. Brown[2], A.D. Carlson[2,3], M.J. Grosskopf[1], R.C. Haight[1], K.J. Kelly[1], B. Pritychenko[2], S. Vander Wiel[1], N. Walton[1,4]
[1]LANL, [2]BNL,[3]NIST, [4]UTK

Nuclear Data Week 2024 November 6, 24
LA-UR-24-31684

NNSA Managed by Triad National Security, LLC., for the U.S. Department of Energy's NNSA.

^{252}Cf(sf) PFNS is a standard. It cannot be updated since 1986 because its input data were lost.

Why is this standard important:

- >70% of all other PFNS measurements (including ^{235,238}U and ^{239}Pu!) are measured using the ^{252}Cf PFNS. If its mv or cov are incorrect, we impact PFNS of all actinides.
- New models are often using it as a first test case.
- Dosimetry community uses it to calculate SACS.

Our current ***standards*** evaluation by Mannhart is ***not reproducible*** because:

- Input data are lost,
- Code is lost (executable exists but no PPP correction).

Impact of not having the data:

- New experimental data (7 sets) have been measured that we cannot add,
- No way to link ^{235}U PFNS and SACS to ^{252}Cf(sf) PFNS.

https://indico.bnl.gov/event/24320/contributions/97755/

LA-UR-24-31684

Nuclear Data Sheets
Volume 120, June 2014, Pages 272-276

Towards a More Complete and Accurate Experimental Nuclear Reaction Data Library (EXFOR): International Collaboration Between Nuclear Reaction Data Centres (NRDC)

N. Otuka [a], E. Dupont [b], V. Semkova [a], B. Pritychenko [c], A.I. Blokhin [d], M. Aikawa [e], S. Babykina [f], M. Bossant [b], G. Chen [g], S. Dunaeva [h], R.A. Forrest [a], T. Fukahori [i], N. Furutachi [e], S. Ganesan [j], Z. Ge [g], O.O. Gritzay [k], M. Herman [c], S. Hlaváč [l], K. Katō [e], B. Lalremruata [m]... Y. Zhuang [g]

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https://doi.org/10.1016/j.nds.2014.07.065 Get rights and content

Article

Japanese evaluated nuclear data library version 5: JENDL-5

Osamu Iwamoto, Nobuyuki Iwamoto, Satoshi Kunieda, Futoshi Minato, Shinsuke Nakayama, Yutaka Abe, ...show all

Pages 1-60 | Received 16 May 2022, Accepted 18 Oct 2022, Published online: 03 Feb 2023

Cite this article https://doi.org/10.1080/00223131.2022.2141903 Check for updates

Short User Guide of Generalised Least Squares Code GMAP

B. Marcinkevicius[1], S. Simakov[1], V.Pronyaev[2]

[1] Nuclear Data Section, IAEA
[2] IPPE, Obninsk, RF

Eur. Phys. J. A (2023) **59**: 131
https://doi.org/10.1140/epja/s10050-023-01034-3

Review

TALYS: modeling of nuclear reactions

Arjan Koning[1a], Stephane Hilaire[2,3] and Stephane Goriely[4]

[1] Nuclear Data Section, IAEA, Wagrammerstrasse 5, 1400, Vienna, Austria
[2] CEA, DAM, DIF, 91297, Arpajon, France
[3] Université Paris-Saclay, CEA, LMCE, 91680, Bruyères-le-Châtel, France
[4] Institut d'Astronomie et d'Astrophysique, Université Libre de Bruxelles, Campus de la Plaine, CP-226, 1050, Brussels, Belgium

Open Access

Issue	EPJ Web of Conf. **Volume** 284, 2023 15th International Conference on Nuclear Data for Science and Technology (ND2022)
Article Number	14010
Number of page(s)	4
Section	Nuclear Data Libraries, Processing, Adjustment, Consistency
DOI	https://doi.org/10.1051/epjconf/202328414010
Published online	26 May 2023

EPJ Web of Conferences **284**, 14010 (2023)
https://doi.org/10.1051/epjconf/202328414010

Managing and Processing Nuclear Data Libraries with FUDGE

Caleb Mattoon*, Bret Beck and Godfree Gert

7000 East Avenue L-059, Livermore, California, United States of America

Computer Physics Communications
Volume 303, October 2024, 109245

Computer Programs in Physics

ENDFtk: A robust tool for reading and writing ENDF-formatted nuclear data ☆, ☆☆

W. Haeck, N. Gibson, P. Talou

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https://doi.org/10.1016/j.cpc.2024.109245 Get rights and content

Challenges of interconnected resources (part 1)

- How is their identity established?
- Where are they located?
- How can they be accessed?

Cryptographic hashes as identifiers

A **cryptographic hash function** (**CHF**) is a hash algorithm (a map of an arbitrary binary string to a binary string with a fixed size of n bits) that has special properties desirable for a cryptographic application:[1]

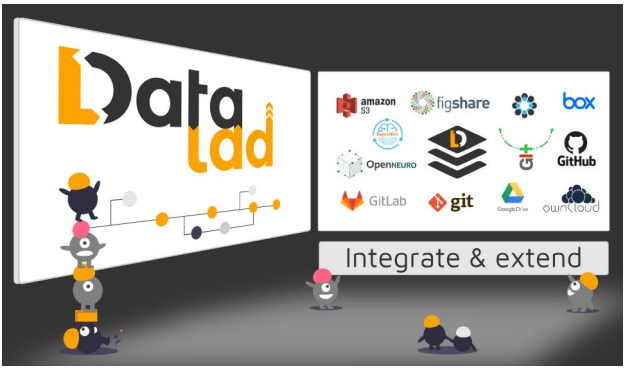
Cryptographic hash function - Wikipedia

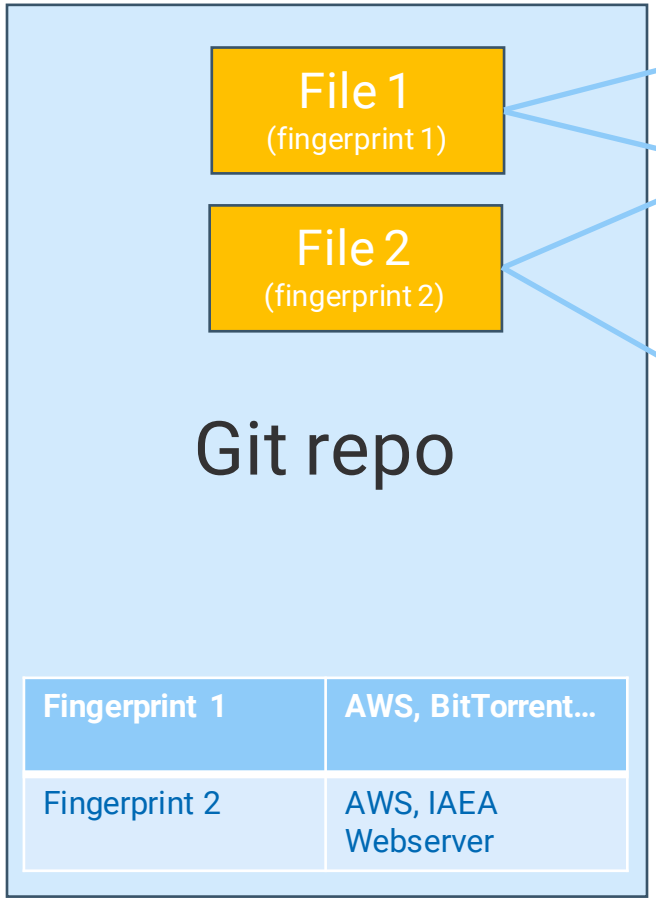
6bd776ce58fe03dd396bcb4aea923343
a8d9b7615e101d2909d234e7f06a75e3

Separation of identity and location (IPFS)

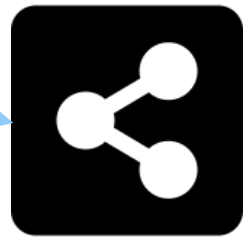
The **InterPlanetary File System** (**IPFS**) is a protocol, hypermedia and file sharing peer-to-peer network for storing and sharing data in a distributed file system. By using content addressing, IPFS uniquely identifies each file in a global namespace that connects IPFS hosts, creating a resilient system of file storage and sharing.[4][5]

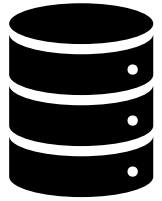
Separation of identity and location (git-annex / Datalad)





Fingerprint 1	AWS, BitTorrent…
Fingerprint 2	AWS, IAEA Webserver



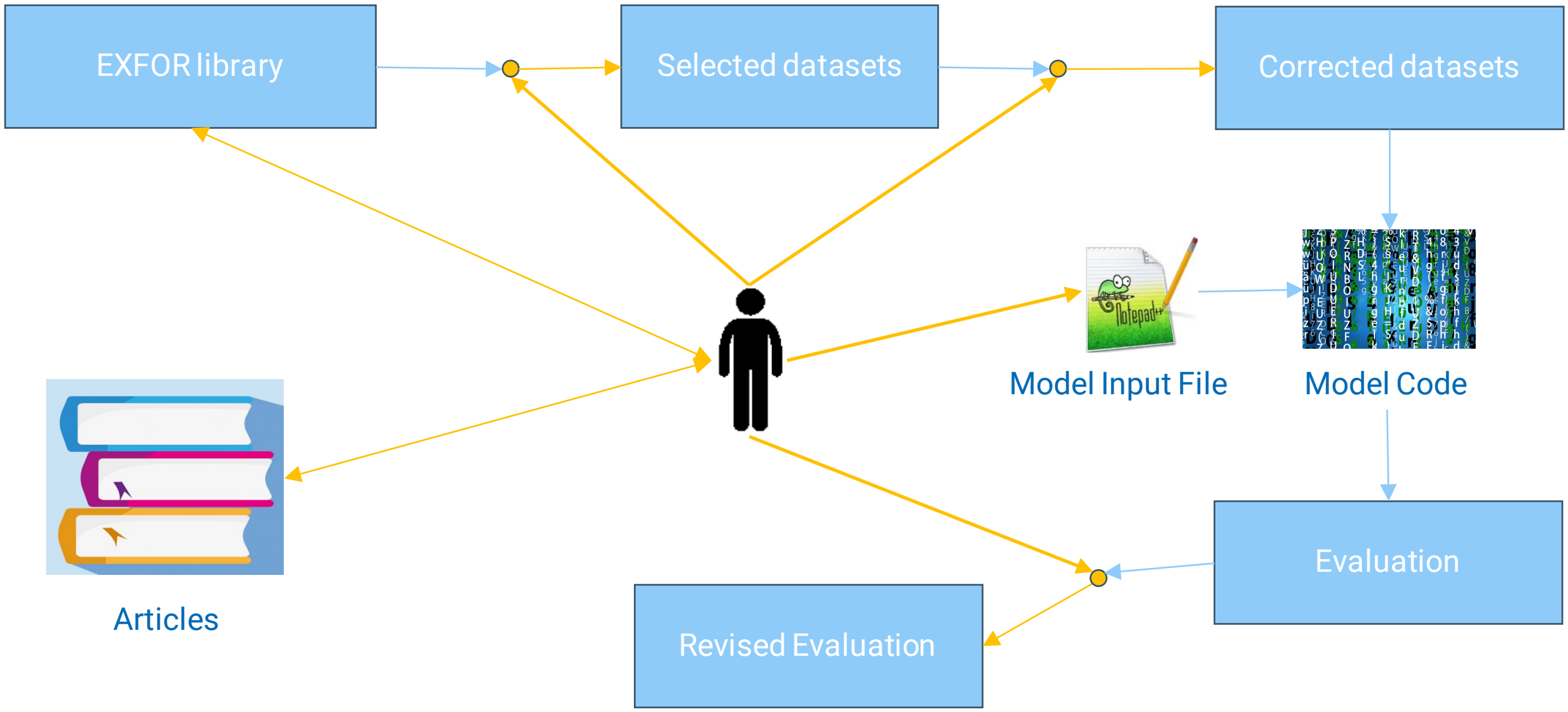


Principle

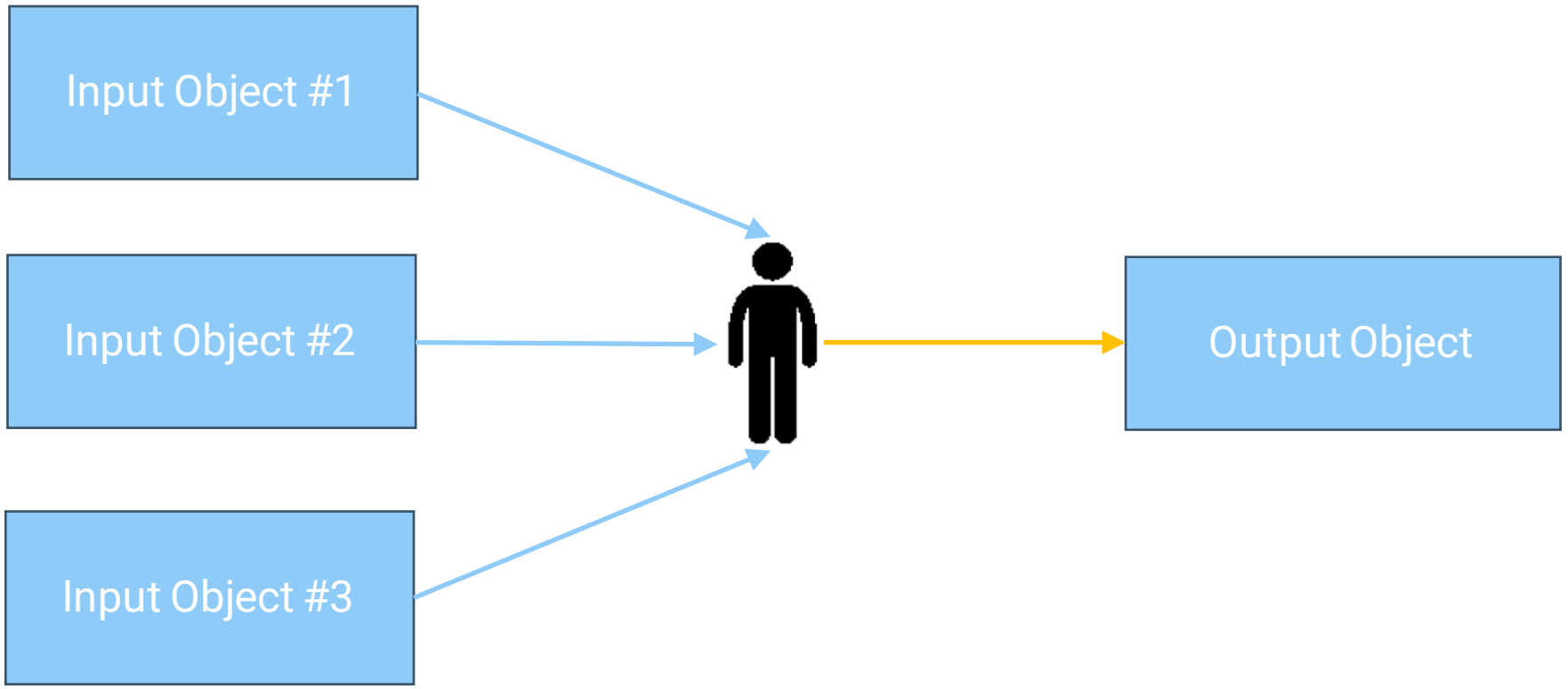
Decouple identity from storage location and way of access

The Non-Reproducible Element

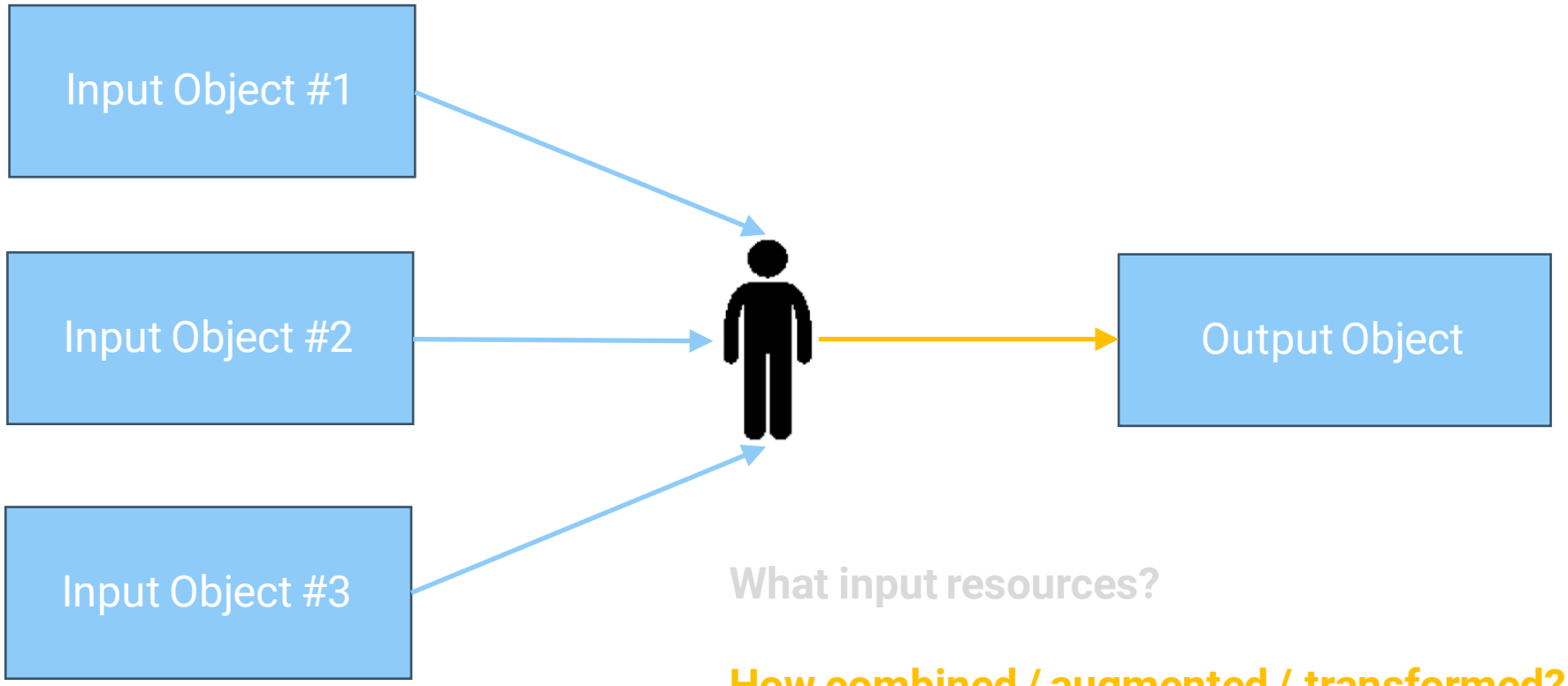
User story: Evaluator



Essential Reproducibility Problem



Essential Reproducibility Problem

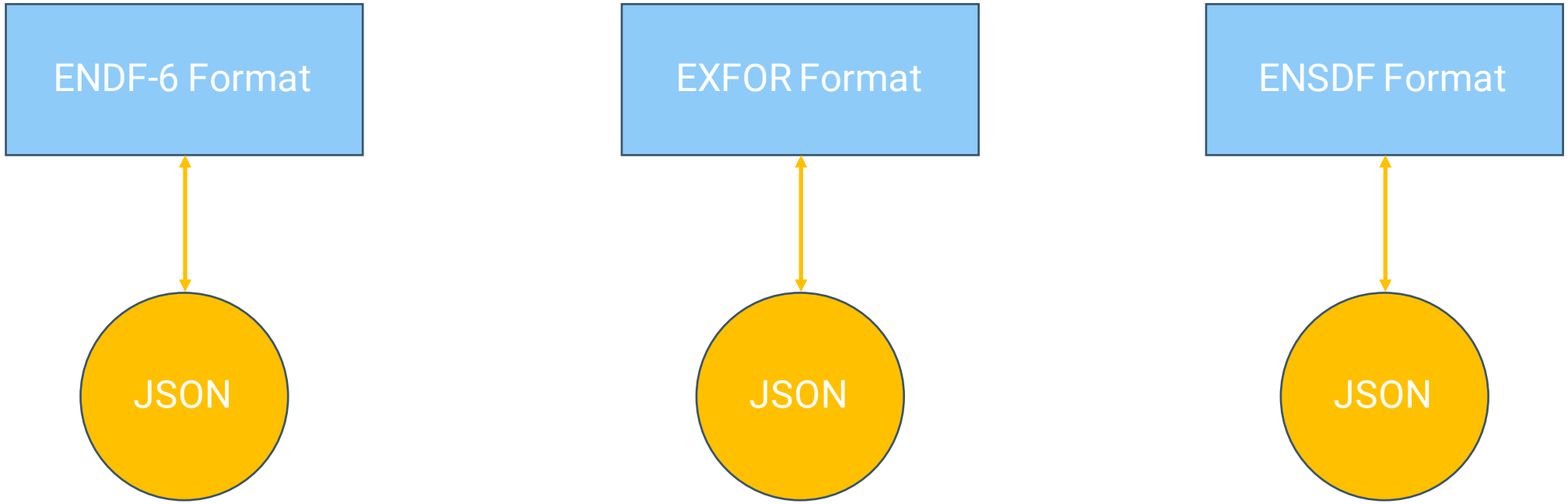


What input resources?

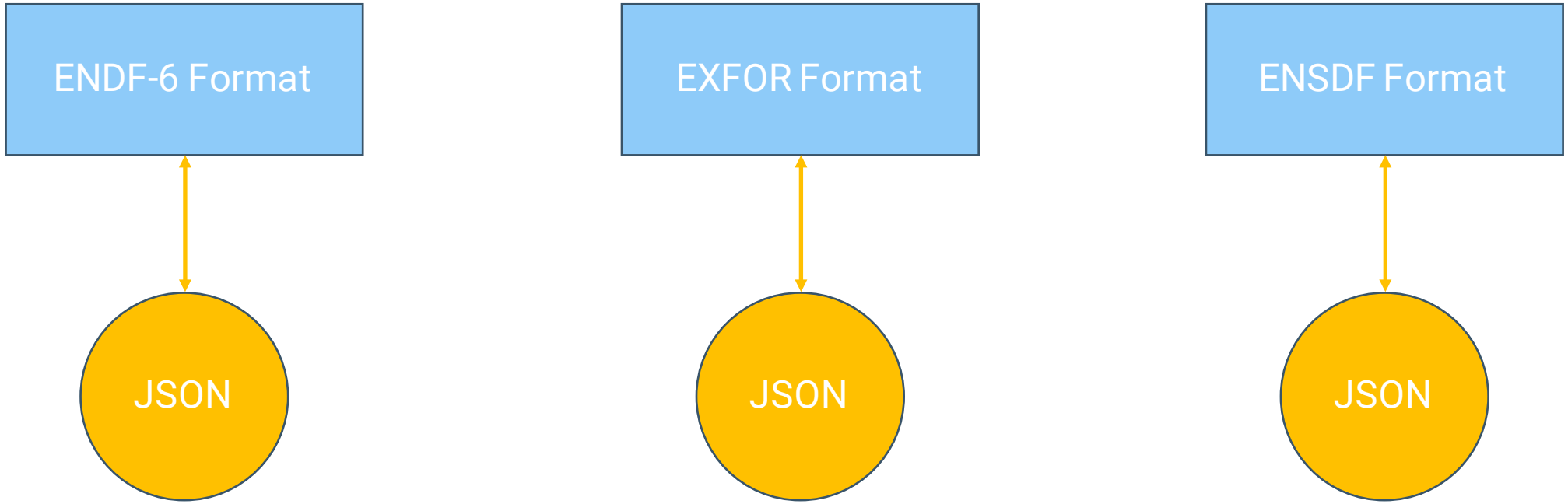
How combined / augmented / transformed?

Why?

Idea #1: Focus on Hierarchical Format



Idea #1: Focus on Hierarchical Format




```
2/151/isotope[1]/range[1]/spingroup[1]/AJ
```

Idea #2: Develop/Adopt a Transformation Language

```
Function TransformUnits(json_obj) {

    if json_obj/Data/Unit/CrossSection == “eV”:
        json_obj/Data/Table/CrossSection *= 1000

    return json_obj
}

Main {
    id(inp_obj) := 6bd776ce58f…
    out_obj = TransformUnits(inp_obj)
    store(out_obj)
}
```

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Main {
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}
```

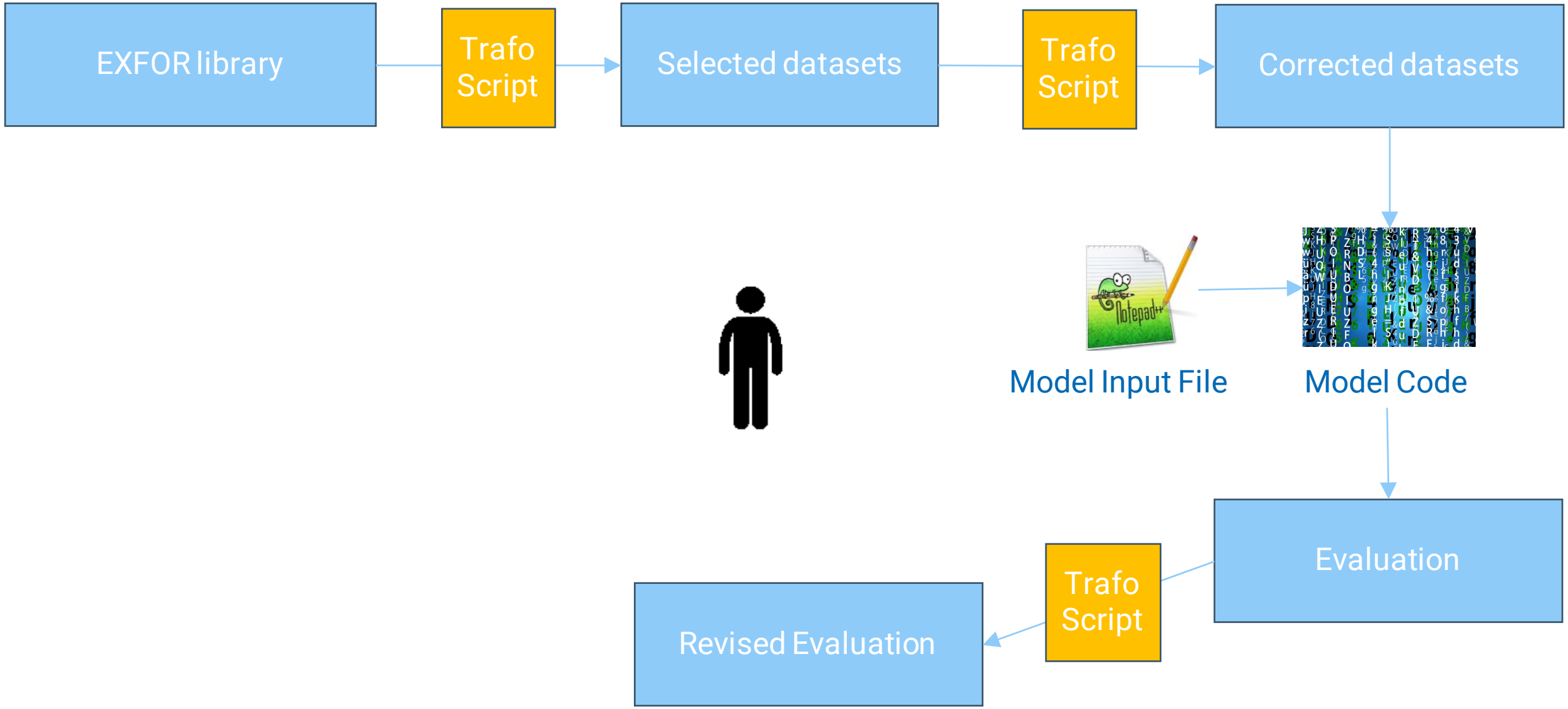
Transformation Language Considerations

- Completely deterministic
- External objects can **only** be referenced by identifier
- Convenient navigation within hierarchical object structure
- Safe by design (e.g. no file system access)

Distributed Hierarchical Dataset

```
{
        “Evaluation”:       6bd776ce58f…
        “Covariance”:       f372add3e1c…
}
```

Revised user story: Evaluator



Complex Data Transformations

EXECUTE SECURELY

Apptainer allows unprivileged users to use containers and prohibits privilege escalation within the container; users are the same inside and outside the container.

SHARE AND MOVE

The single-file SIF container format allows you to reproducibly build, share, and archive your workload from workstations to HPC to the edge.

ENCRYPT IT

Apptainer can encrypt containers and integrates with Vault and other secret management platforms to secure applications, models, and data.

https://apptainer.org/

Trust

Formalized opinions

- Created …
- Endorsed ….
- Not recommended …
- …

… by an institution

… by a person

… by a committee

Web of Trust
Public-Key-Infrastructure

Summary

- Separate identity from location
- Formalize data transformations implemented by a user
- Access to objects solely via cryptographic hashes
- Allow entities to attach opinions to objects (and proof their identity by digital certificates)