User Identification and Authentication for Geophysical Data Centers: Exploring a Difficult Transition

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The (seismological) world today – paradise, almost…

Open, unrestricted, unconstrained ***anonymous*** access to (waveform) data and associated metadata is a long-standing paradigm in seismology *(to large extents also in other disciplines, e.g. GNSS)* – founded in the realisation that

where global observations are needed to do science, open sharing of data is fundamental

- at the foundation of FDSN (Seismology) and IGS (GNSS)
- implemented in international data centers like IRIS and ORFEUS for decades, also in almost all national / institutional data centers globally
- regarded as a ‘role model‘ in other fields of (Earth) sciences / geophysics, that often adopted a similar approach

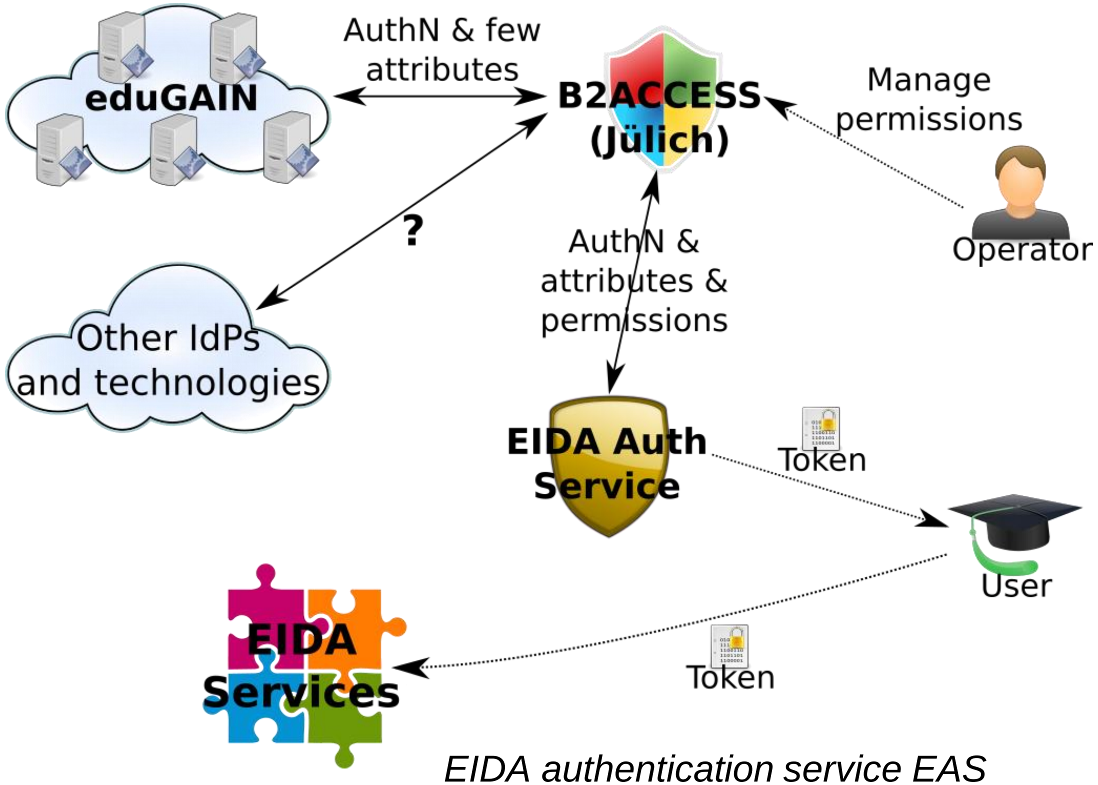
- today‘s tools and services to access and distribute data are built around that paradigm
  - while ***already also enabling the implementation of ‘access restriction***‘ e.g., for embargoed or otherwise restricted datasets or services, usually through specific user authentication and authorisation mechanisms
- in this way serving TB of data every day to the scientific community – and anybody else who would want it
- monitoring usage (if at all) by counting requests, volumes shipped, and (sometimes) their geographical origin

The challenge: *funders and other authorities want to know more… (I)*

Increasingly, data centers are asked by funders or other institutional authorities to report more details on ‘usage‘ of their data and services than they currently capture

To comply with that, ***user identification*** (*authentication*) will have to be implemented for (all) data access

- ✓ technically possible / feasible today (as part of established AAAI methods / infrastructures)
- ✓ partially already implemented as an option (e.g., EIDA authentication mechanism for fdsnws-dataselect, /queryauth request mechanisms)
  - ➢ making use of federated identity provision & management systems (GEANT / eduGAIN / B2access, …)
- but ‘generalisation‘ to any (data) access will be a clear paradigm shift for us (seismologists at least)



EIDA authentication service EAS
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Usage data collection today: *ORFEUS-EIDA Data Centres*

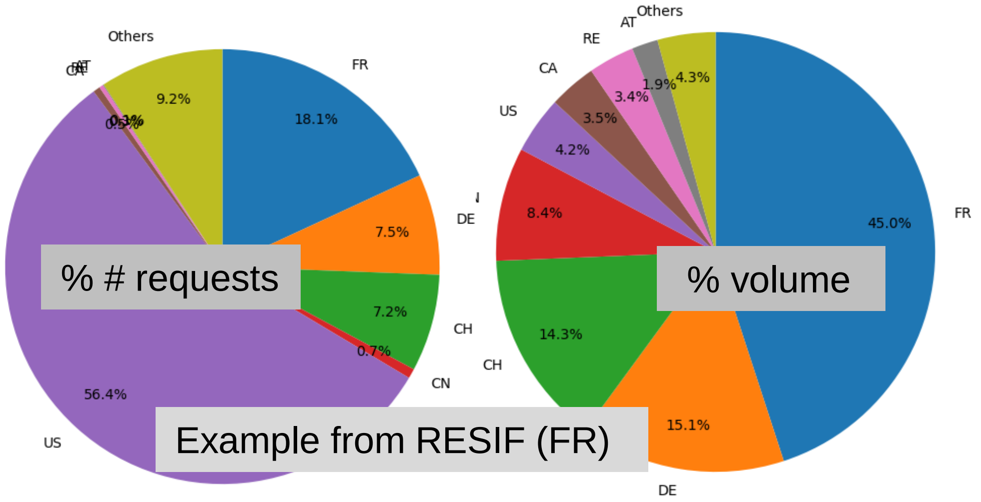
For **access to restricted data**, ORFEUS has an Authentication/ Authorization System (EAS) in production supporting eduGAIN (via B2ACCESS).

- If users log in at their home institutions, only attributes provided by eduGAIN are part of their profile.
- These attributes always respect the normatives of each origin region (e.g country, institution).
- Users receive a token to access the data.
- After some short time logs of the requests received are anonymized and stored in cumulative form

For open access, only IP-address of requester is logged, but also anonymized and deleted after some time.

Statistics are collected and hosted on a single database allowing analysis about

- use of each datacenter
- data distribution from shared networks (like AlpArray)



Statistical information logged (anonymized)

Datacentre,
Date,
Seismic Network,
Station Code,
Location,
Channel,
Country,
Cumulative amount of:
    Bytes,
    Requests,
    Successful requests,
    Failed Requests.

The challenge: *funders and other authorities want to know more… (II)*

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- what information exactly is expected by those asking is often not clearly defined (yet?)
  - levels of usage characterisation / user individualisation; counting requests and/or volumes; access 'by dataset'; … => ***potential issues with PII / GDPR*** => (data) management overhead
  - authentication alone (***confirming an identity***) ***may not be enough*** – profiling (purpose of use) needs even more information (and may change for same user from access to access)
- (anecdotal) experience of others indicates that ***usage may drop with enforced authentication***
- requiring authentication is an access restriction that may not be in line with open science 'best practice' (debatable)

  and likely creates at least some issues e.g. for 'ad-hoc' group activities involving access (teaching, training, outreach)

The consequences

Implementing user identification at data centers meets with some technical and managerial issues:

- ! Information management, privacy & security:
  - ? how to **avoid** / minimize the **collection of ‘sensitive personal data‘** (different interpretation in different legislations…)
  - ? what is needed to ‘manage‘ the **unavoidable personal data collections** (legal compliance of technical and managerial setups) => ref. personal identifyable information PII in particular in Europe / GDPR context
- ! user experience:
  - ? how to **ensure** that ‘**everybody**‘ (anybody on Earth with access to a computer) – even ‘non-individuals‘ (independent machines / software agents…) **can authenticate** & access – at **any time**
  - ? what does it take to adapt our existing (standard) data access services and the tools built upon & around them
    - In particular as authentication technologies are still evolving fast – adaptation will **not be one-time**
- ! resource needs:
  - even if **implementing user authentication** can be largely streamlined, it **will require** (some) **resources** at the data center - from a usually already strained budget (the more exhaustive the profiling, the more resources…).
    In turn, these resources are **not** available to **improve** user experience and **services**

Hey, but wow … *tracking usage may offer benefits for data centers and users*

There are some (apparent) benefits arising from personalized user tracking
– aside from fulfilling funder requirements

- ✓ informing service & tool development
- ✓ assisting users (with failed or ‘sub-optimal‘ requests)
- ✓ informing data owners / contributors about usage & users
- ✓ identifying the audience and patterns of use by that audience
- ✓ monitoring / managing outbound data volumes per user

Could these benefits also be realized (more effectively) through other means and activities?

- ❖ improving user feedback and communication mechanisms (fora, blogs, surveys …)
- ❖ promoting application, use and uptake of relevant (persistent) identifiers and solve existing issues (granularity, aggregation, (deep) resolution)
- ❖ …

OK, so let‘s move on …

Authentication & authorisation mechanisms are **required anyway** at our data centers at least **for some services**

- access to restricted data sets, connecting to cloud-based or HPC services, offering personalized work spaces, …

so **let‘s** keep coordinated and **develop common solutions** – in seismology but also beyond

- making use of evolving AAAI standards and technologies, improving ease-of-use as well as ease-of-maintenance

A general / generic user authentication requirement for everything should be (re)viewed very critically

- In dialog with the ‘requesting entity‘ and **mindful of the role of (community) data centers in the research life-cycle**
    - data centers serve as guaranteed long-term repositories for research output (and public data collection), ensuring its FAIRness
    - they are key players in the development and promotion of (community) standards for data and services
- with respect to user equity, implementation and maintenance effort, any other fallout

Usage data collection tomorrow – IRIS data services

IRIS Data Services will soon be implementing an identity management system to:

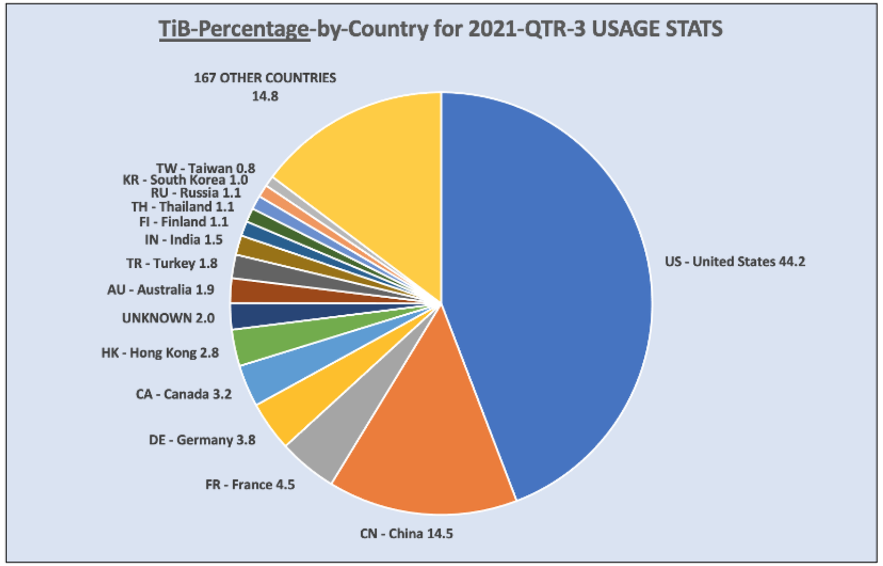
- Provide accountability to stakeholders for the funds we receive
- Gather information on data access to better serve our user community

Users who download data:

- Will register and build a profile
- Will receive a token to access data

Instead of tracking by IP Address:

- We will track by unique identifier codes
- We can understand their purpose of access
- We can tabulate institutional activity



Identity Profile (Example):

Name

Institution

Location

- Country
- State/province
- City

User Class

- Education (grp)
- Academic Res.
- Government
- Commercial
- Public

… and maintain the paradise (sort of)

The authors of this presentation came together in an ad-hoc manner triggered by IRIS‘ announcement that they would implement user identification for their data services by summer 2022.
We are currently discussing both the technical and the governance & strategic issues.

Technical issues will be further discussed and promoted through FDSN mechanisms (for seismology)
– expect some communication there soon

Governance & strategic issues will be further discussed in other upcoming venues (IUGG 2023, …)
and brought to relevant other bodies & initiatives (RDA, CODATA, ISC, …)

- Including all those connected issues in the FAIR data and open science context
  - identifiers, attribution, licenses and IPR, data protection and security, long term curation, long tail of science …

If you are interested to join the discussion, get in touch!

Further reading (suggestions)

The links below point to documents and other resources that we consider relevant and/or interesting in the context of the topic of this presentation

UNESCO recommendations on Open Science, 2021:
https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en

(federated) identity management, FAIR and open access from a different discipline (Biology):
https://www.fim4l.org/wp-content/uploads/2021/03/Open-Access-and-FIM-v4.pdf

two complementary reports by OECD/GSF and ICSU/WDS on international research data networks and sustainable research data repositories:
https://doi.org/10.1787/e92fa89e-en
https://doi.org/10.1787/302b12bb-en

A study from Germany / DFG on issues related to data tracking and use of usage data by academic publishers:
https://www.dfg.de/download/pdf/foerderung/programme/lis/datentracking_papier_en.pdf