

Research-driven cultivation of contextualized data for plant biology

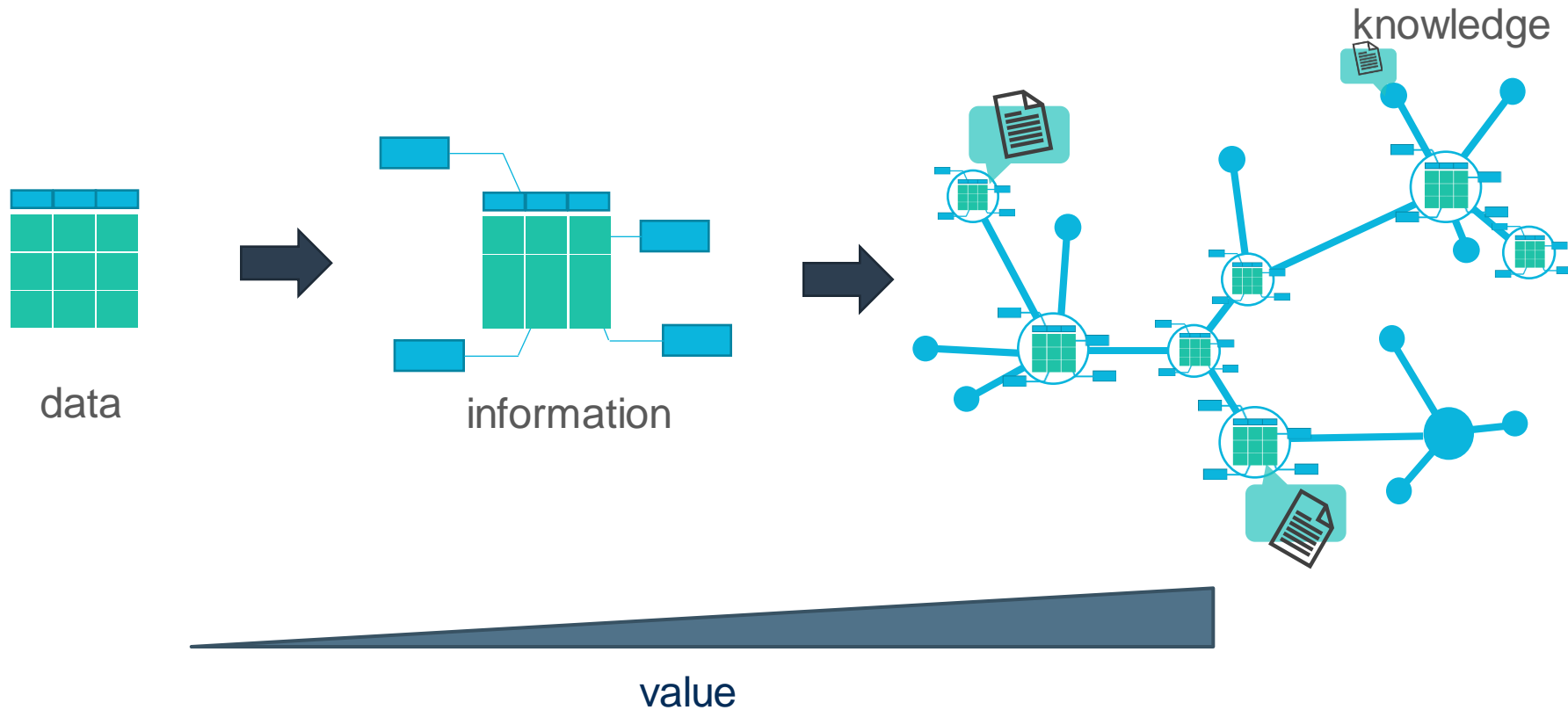
Project INF

David Zimmer

Motivation

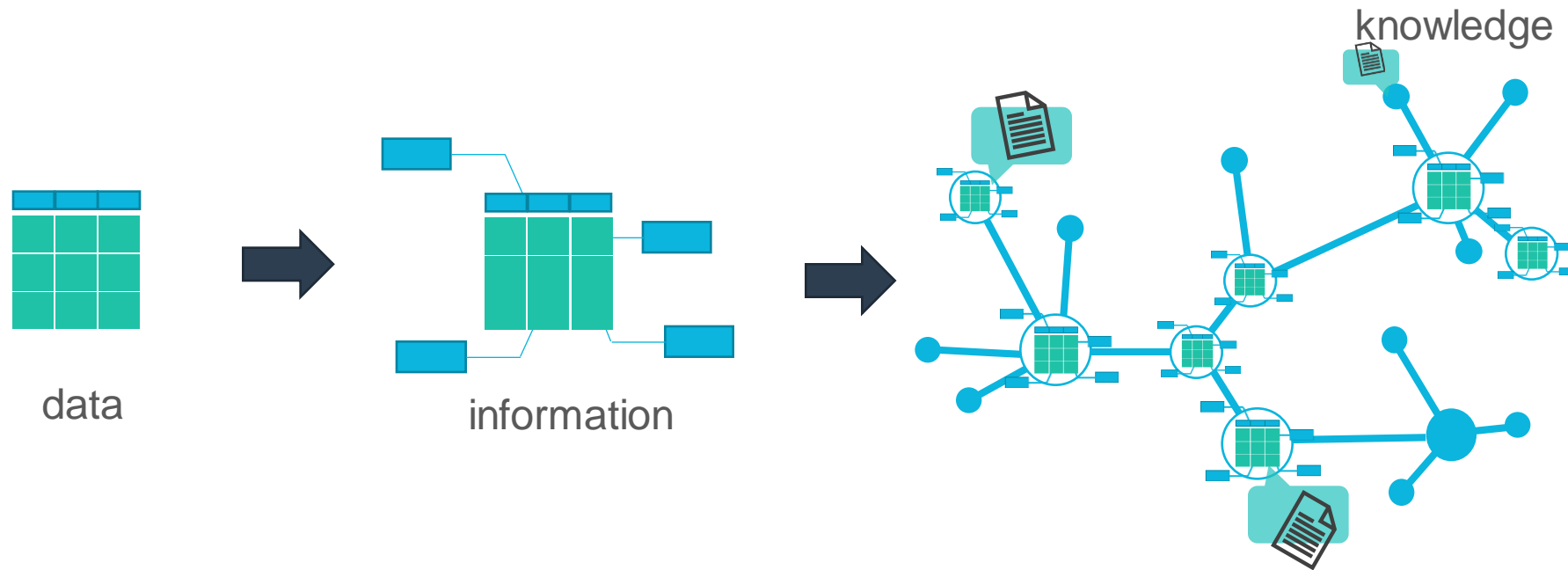
David Zimmer

Motivation



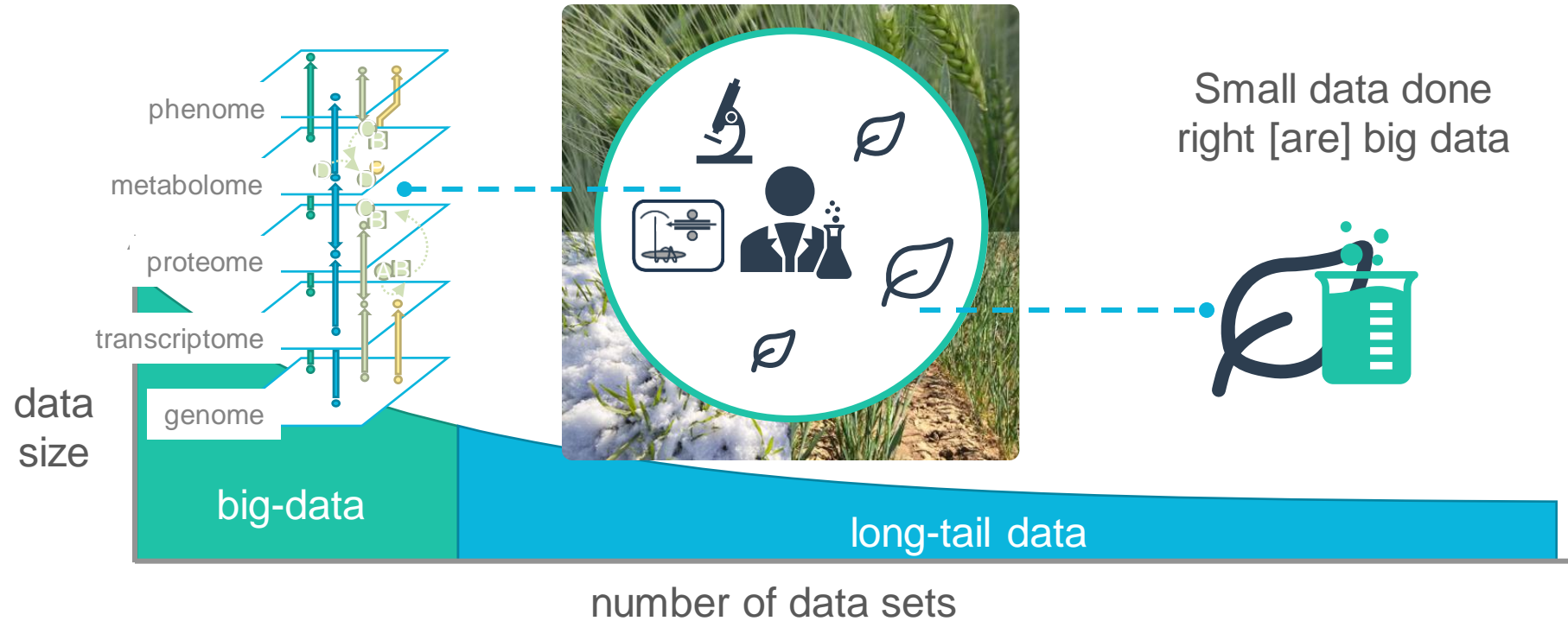
- Data: From primary product to first class citizen

Motivation



- Becoming FAIR will drive plant science

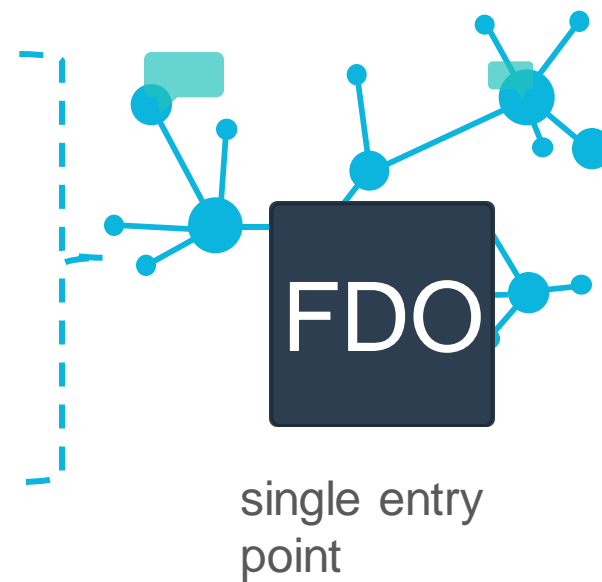
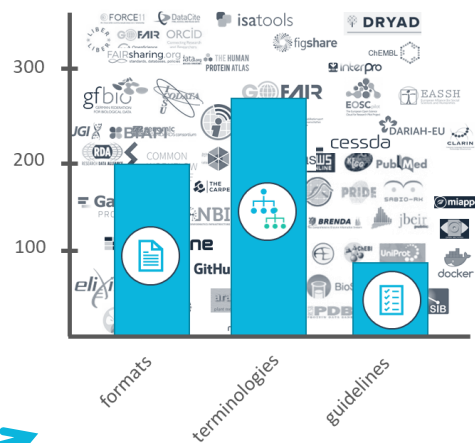
Motivation



- FAIR for everyone with plant research at center

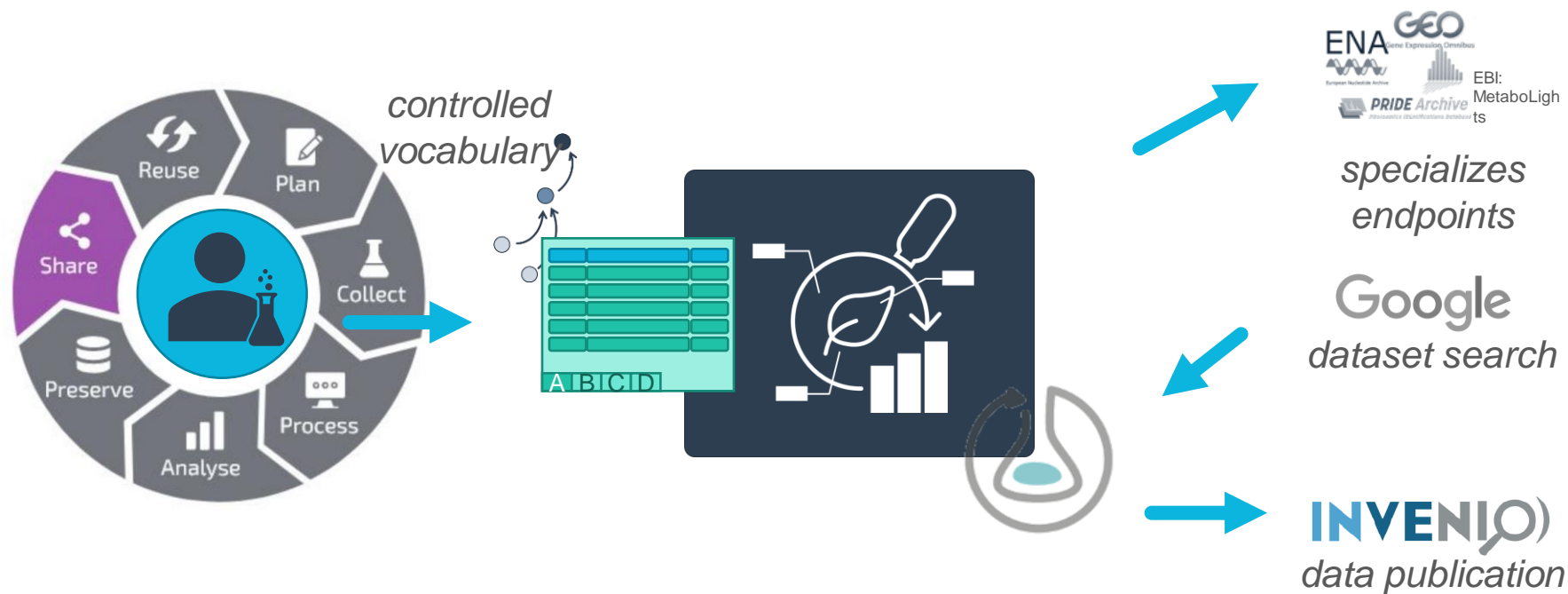
Objectives

Objectives



- FAIR and easy: Simplifying RDM

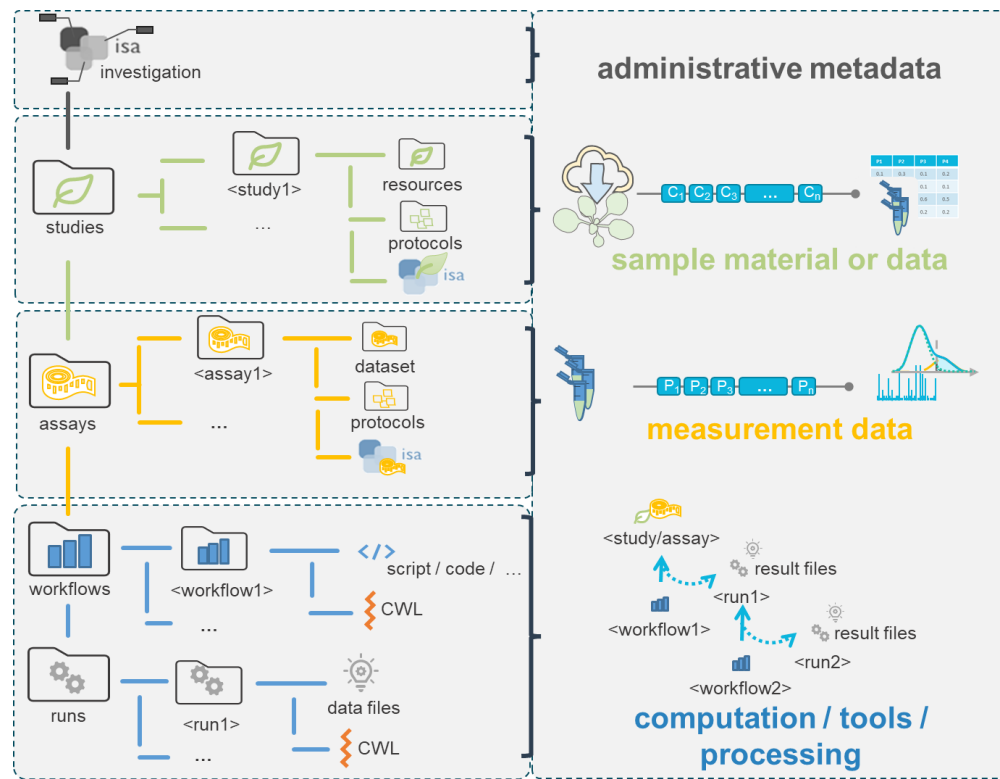
Objectives



- FAIR and easy: Towards intuitive RDM

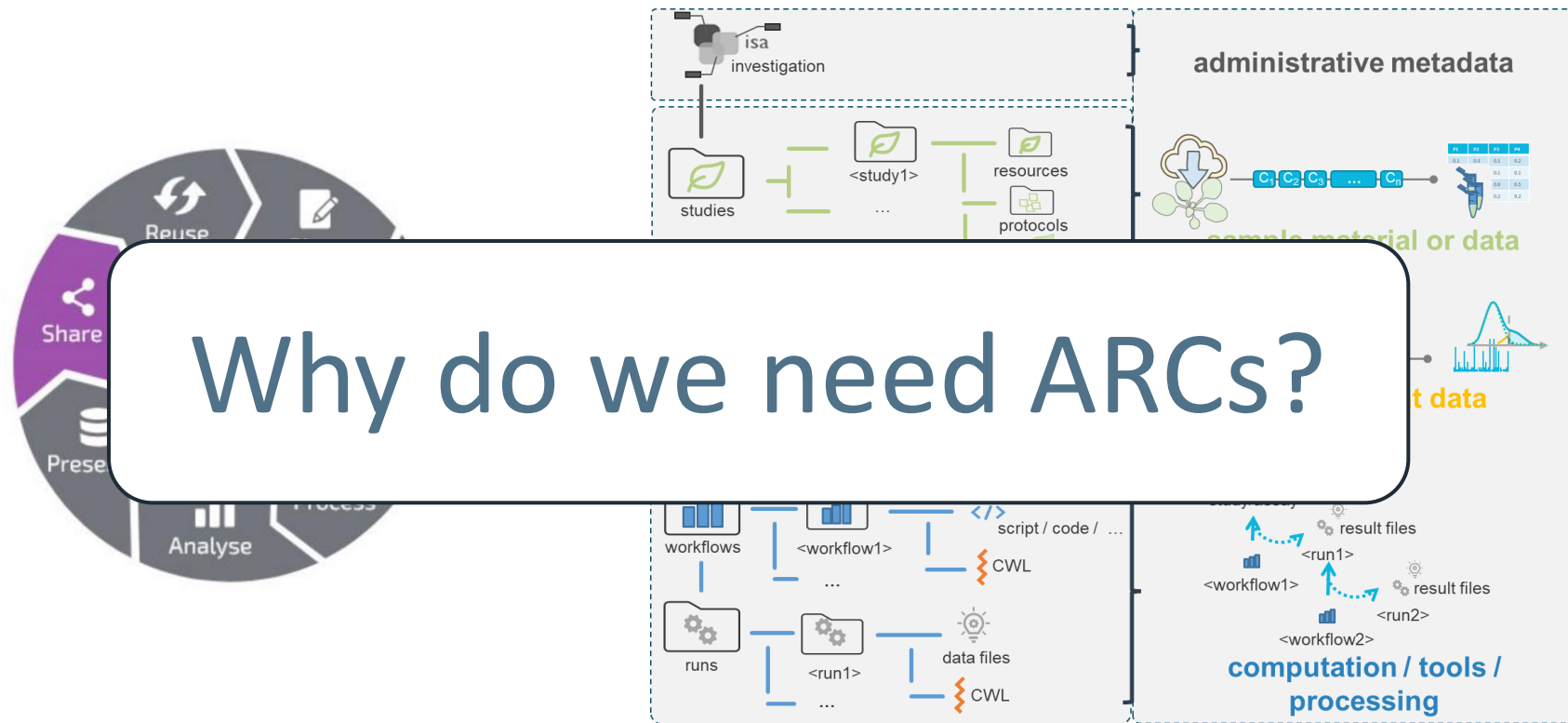
State of the art

State of the art: ARC



- FAIR and easy: The Annotated Research Context

State of the art: ARC



- FAIR and easy: The Annotated Research Context

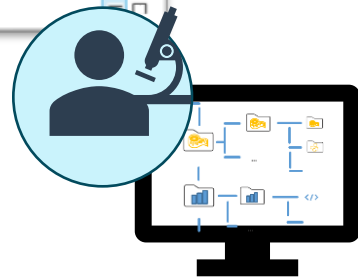
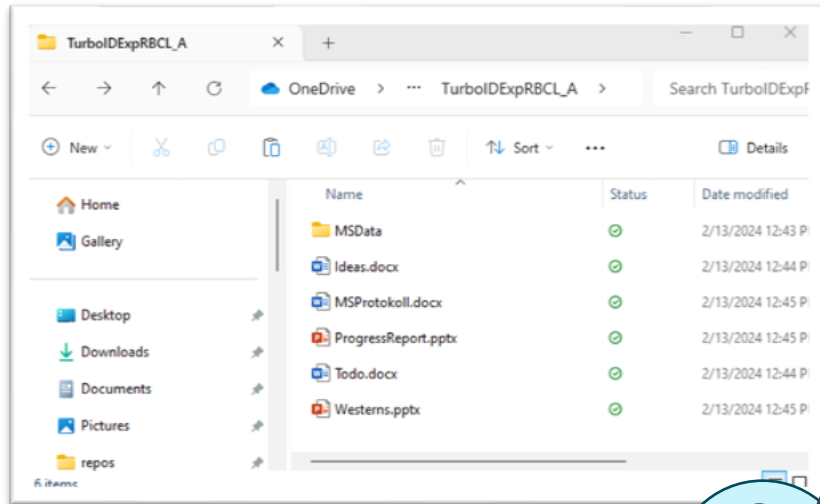
PREVIOUSLY ON

GAME OF THRONES



Legacy RDM

Researcher As data management solution:

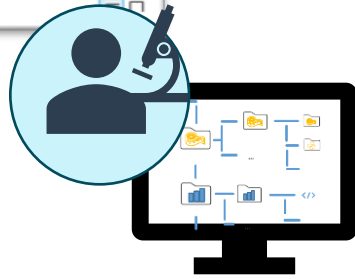
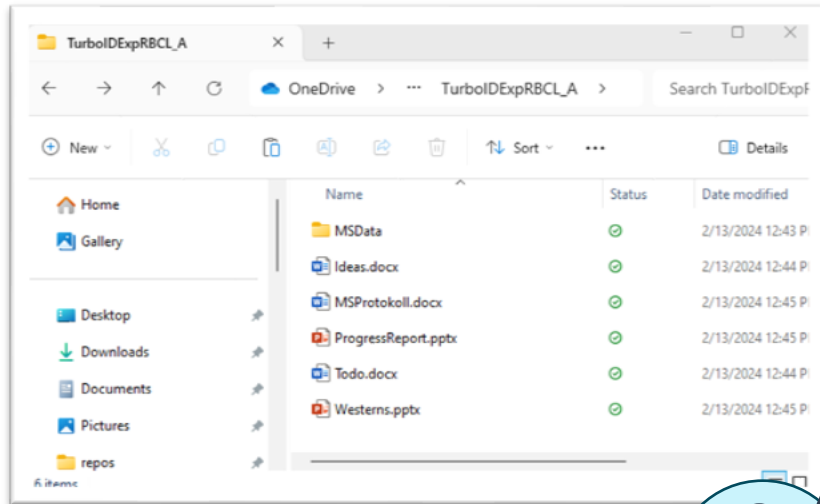


Researcher A

Until recently: Individual RDM solutions

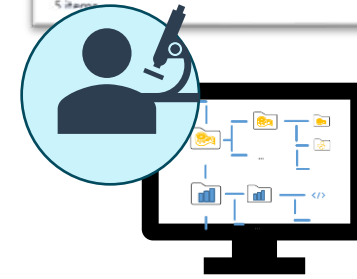
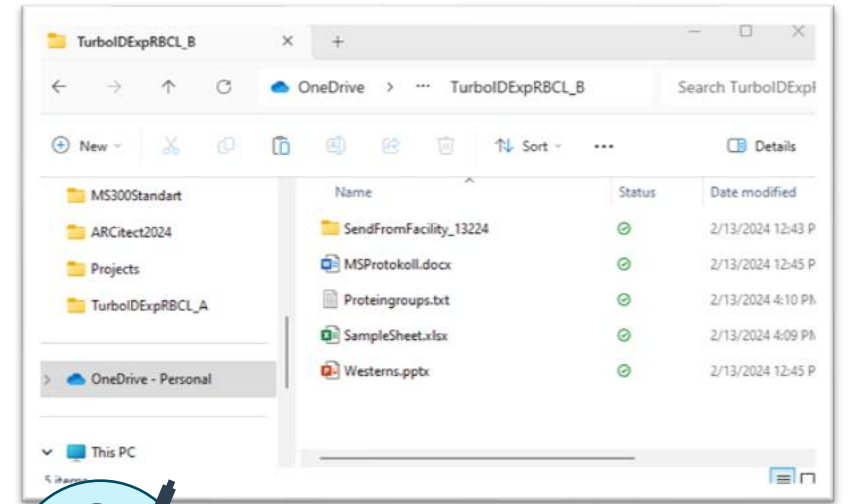
Legacy RDM

Researcher As data management solution:



Researcher A

Researcher Bs data management solution:

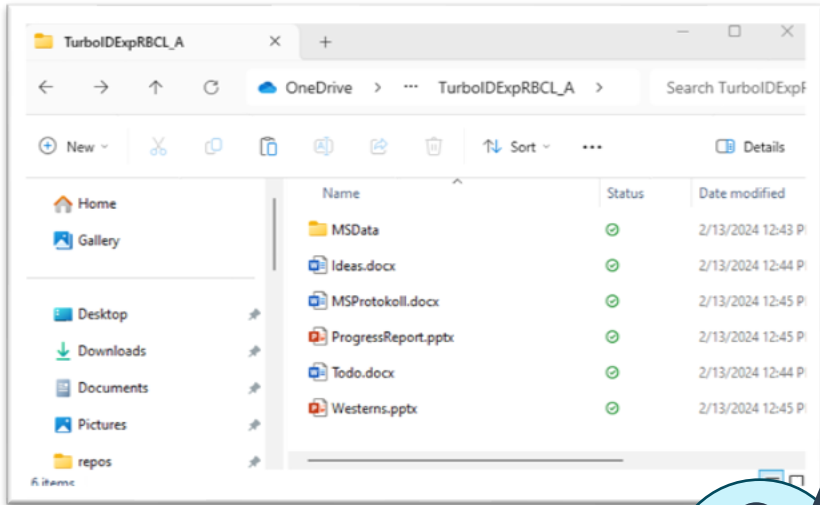


Researcher B

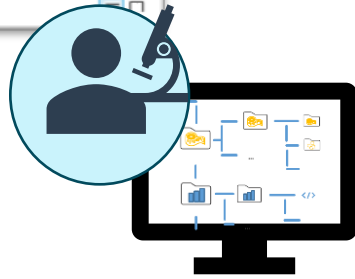
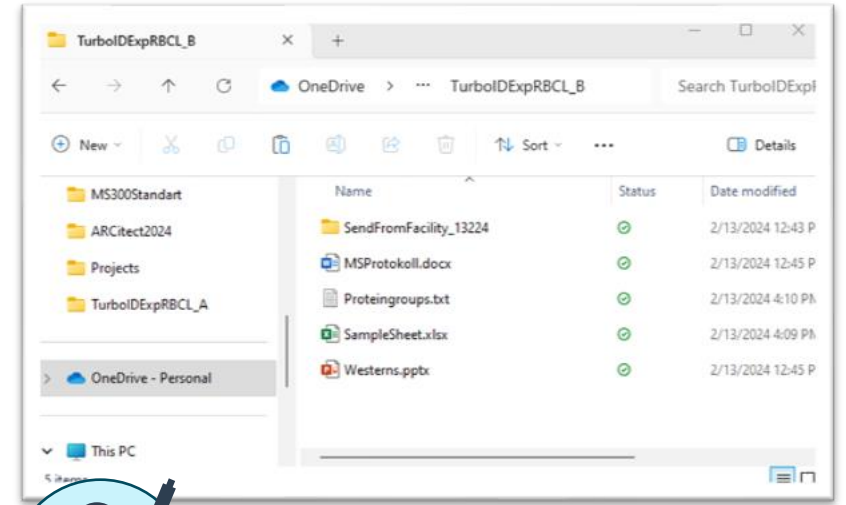
Until recently: Individual RDM solutions

Legacy RDM

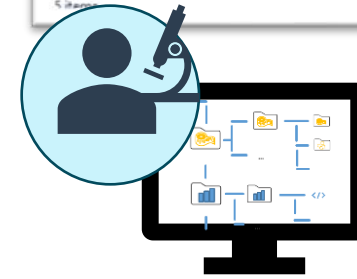
Researcher As data management solution:



Researcher Bs data management solution:



Researcher A

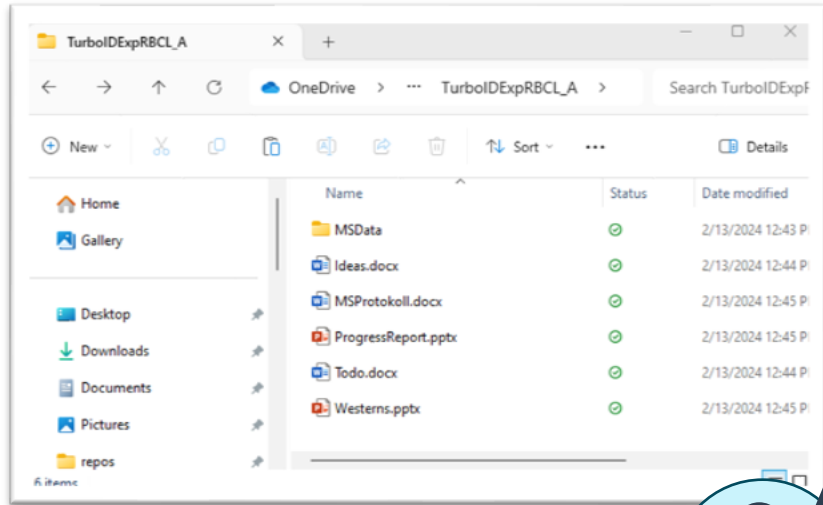


Researcher B

Until recently: Individual RDM solutions

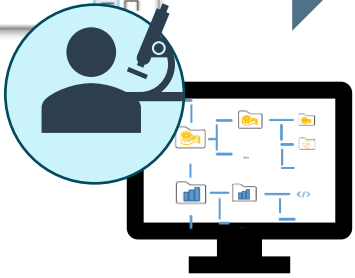
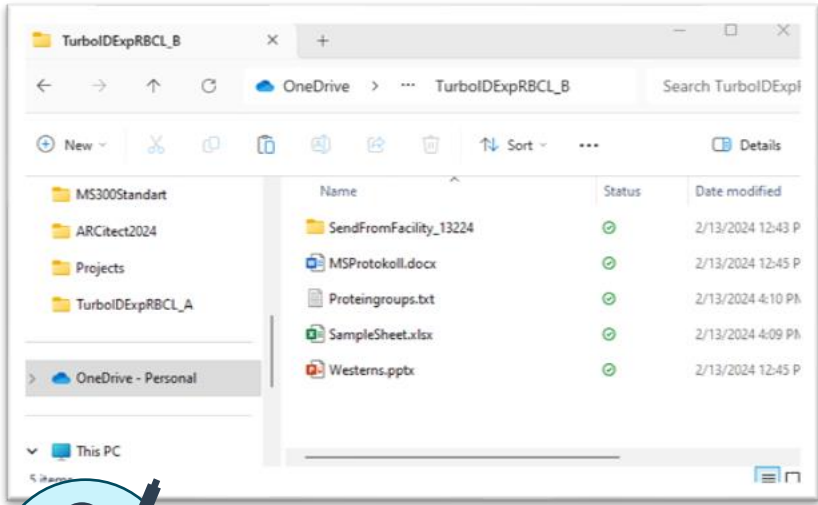
Legacy RDM

Researcher As data management solution:



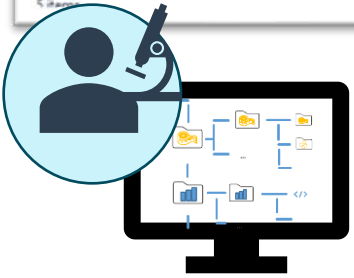
Experimental Data?
Analysis Data?
Meta Data?

Researcher Bs data management solution:



Researcher A

Collaboration

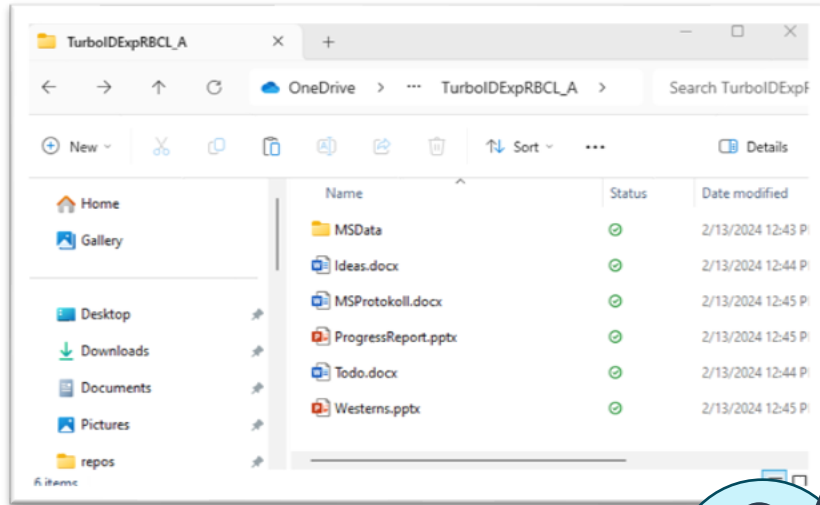


Researcher B

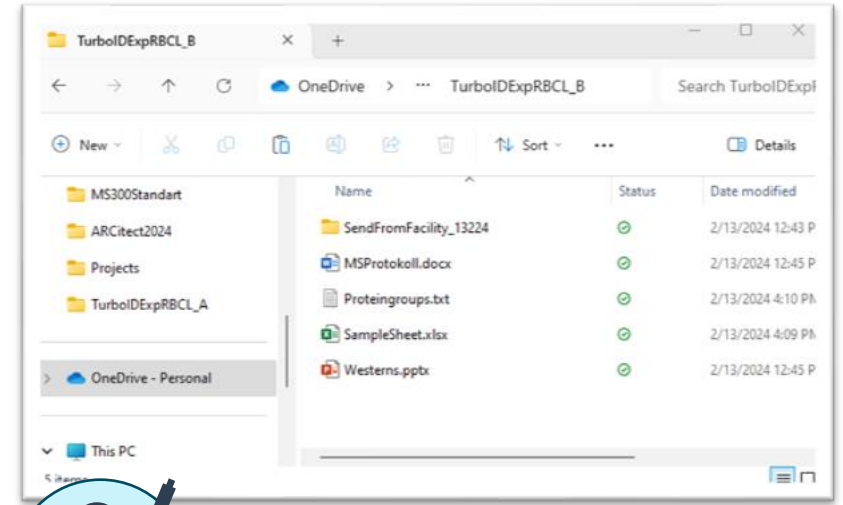
Until recently: Individual RDM solutions

Legacy RDM

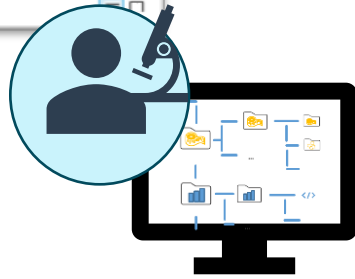
Researcher As data management solution:



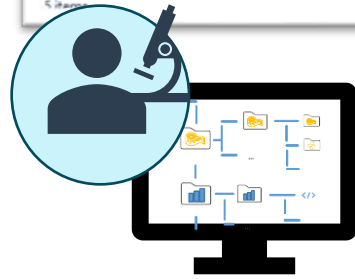
Researcher Bs data management solution:



How do we exchange data?
More Metadata?
Any Updates?



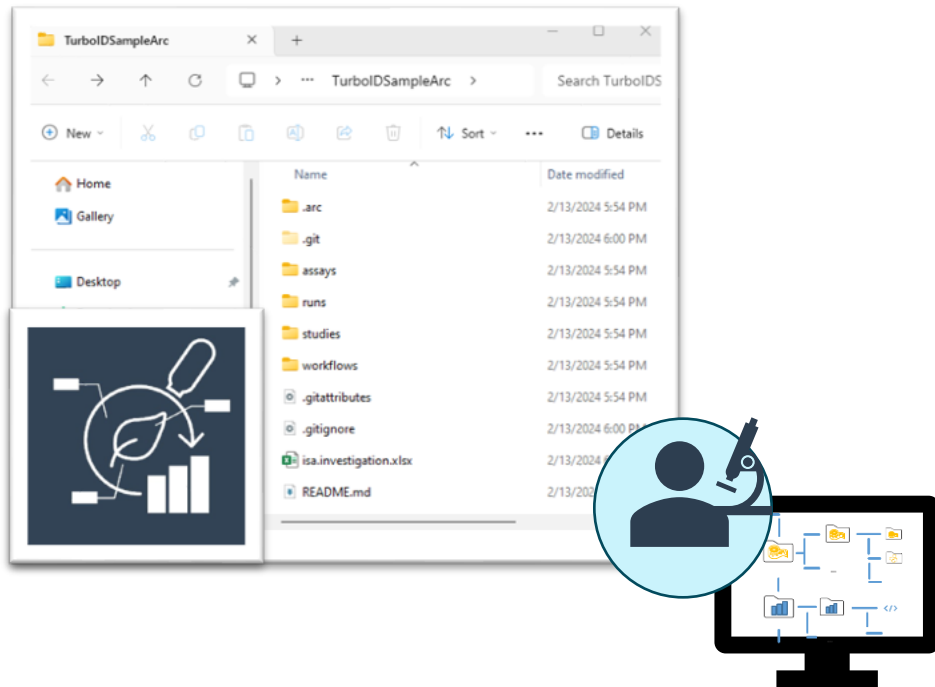
Collaboration



Until recently: Individual RDM solutions

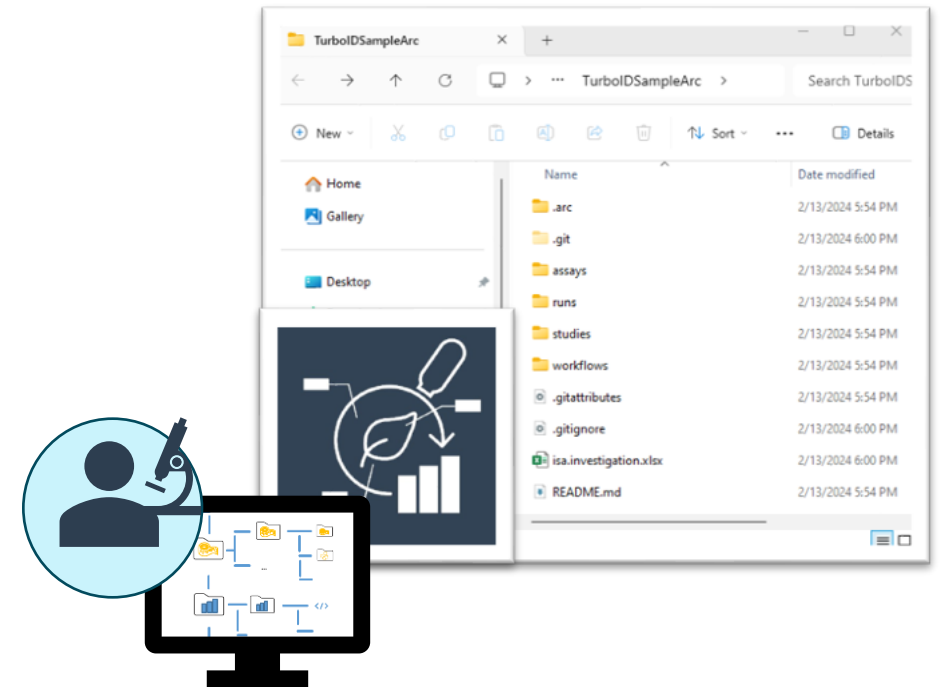
State of the art: ARC

Researcher As data management solution:



Researcher A

Researcher Bs data management solution:



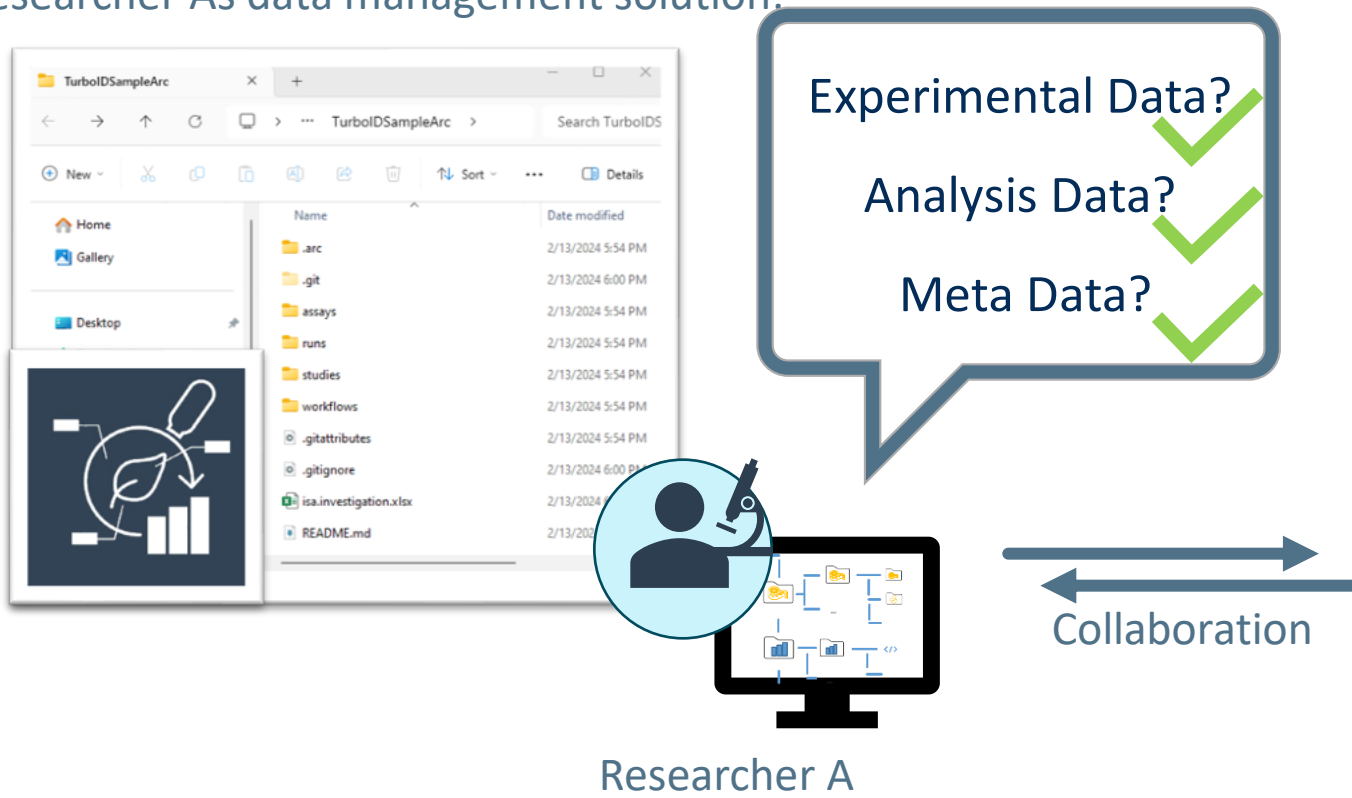
Researcher B

Collaboration

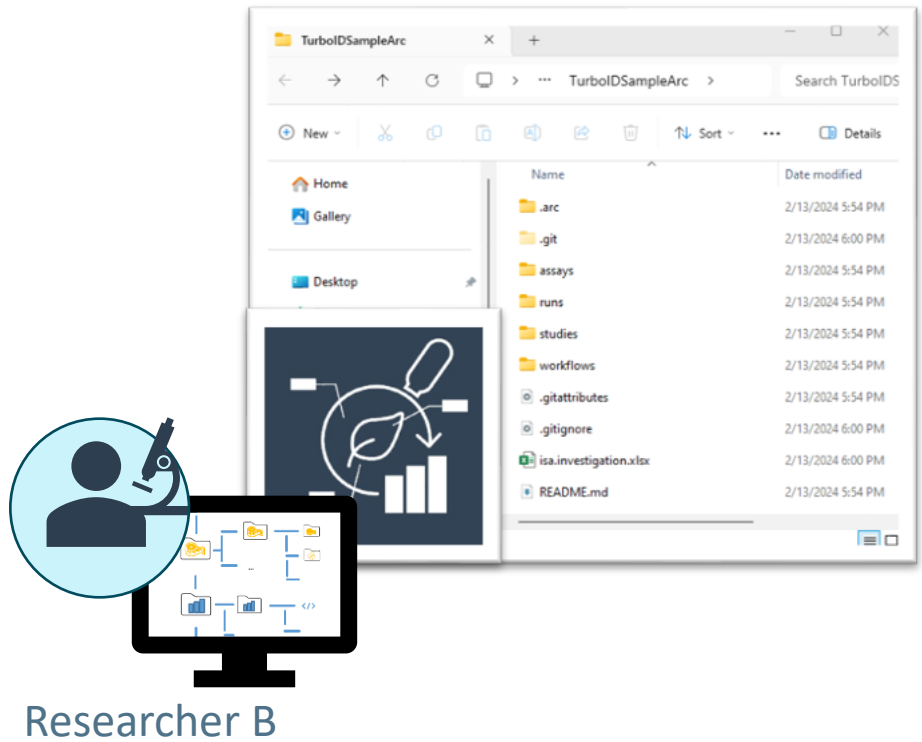
Now: ARCs as a single RDM entry point

State of the art: ARC

Researcher A's data management solution:



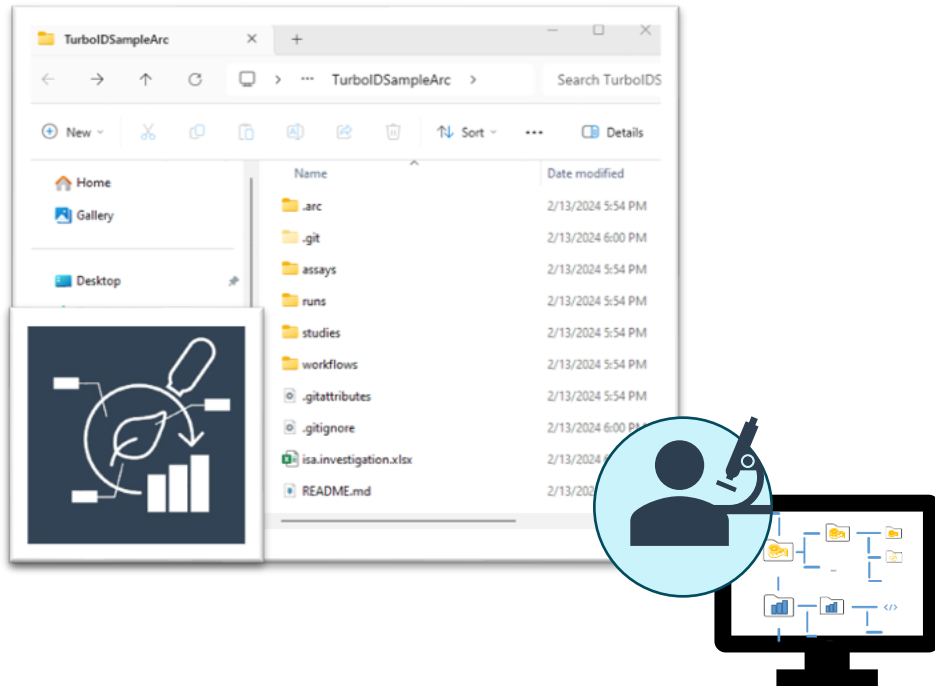
Researcher B's data management solution:



Now: ARCs as a single RDM entry point

State of the art: ARC

Researcher As data management solution:

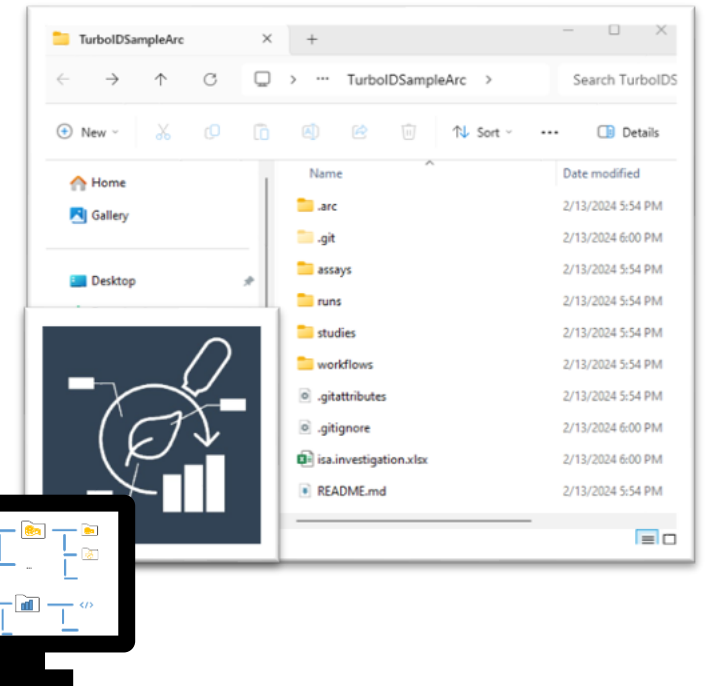


Researcher A

How do we exchange data? ✓
More Metadata? ✓
Any Updates? ✓

← Collaboration →

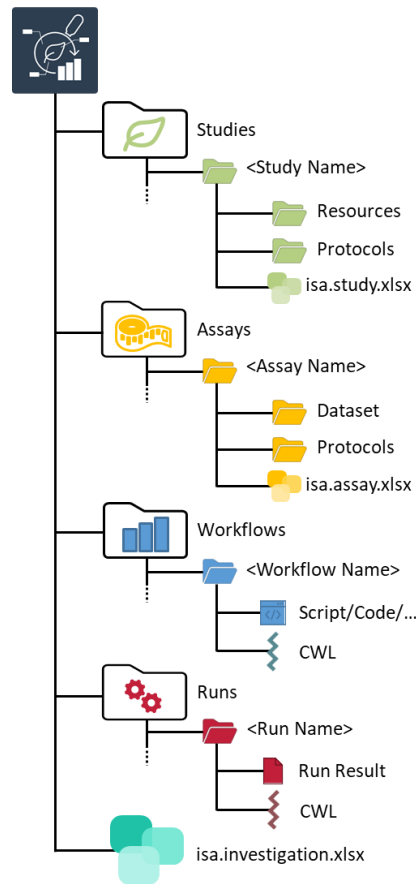
Researcher Bs data management solution:



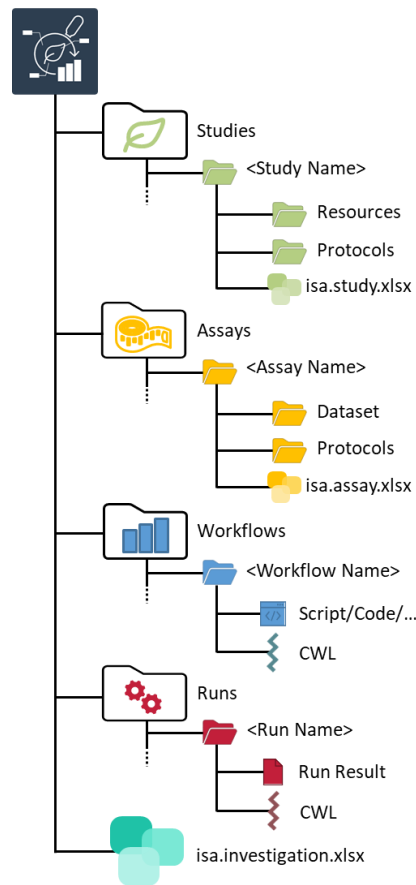
Researcher B

Now: ARCs as a single RDM entry point

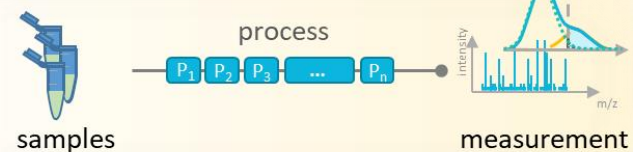
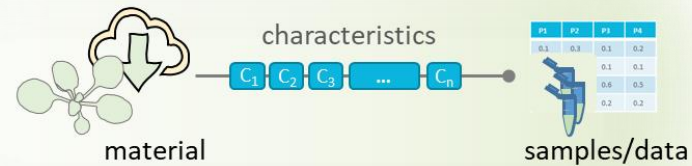
State of the art: ARC



State of the art: ARC

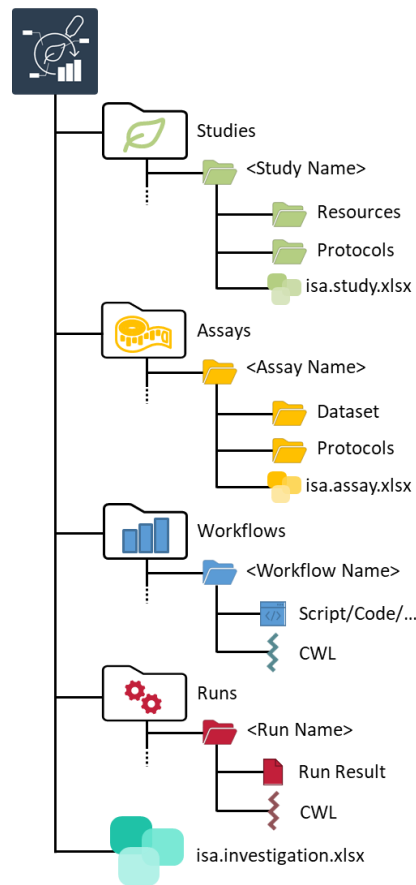


Experimental Data and Meta Data

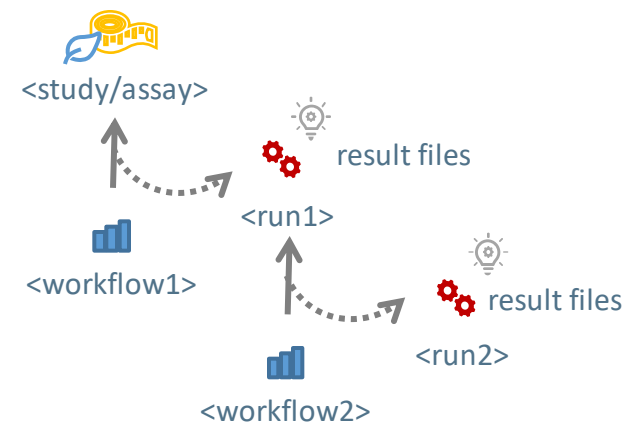


Important ARC Concepts: Structure

State of the art: ARC

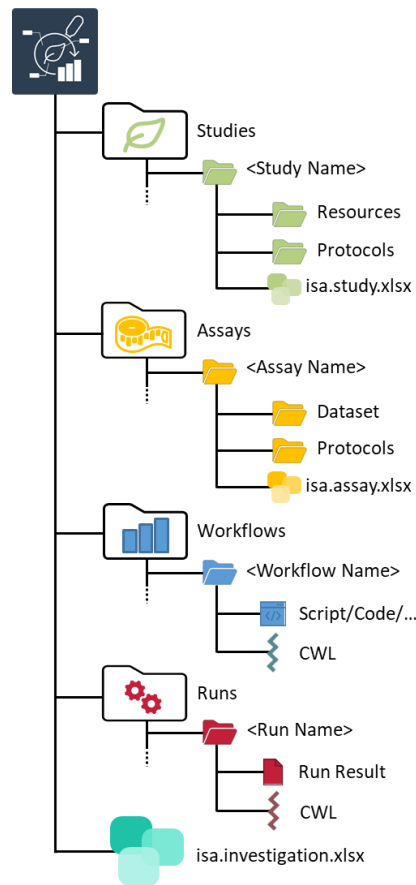


← **Computational
Data and Meta
Data** →



Important ARC Concepts: Structure

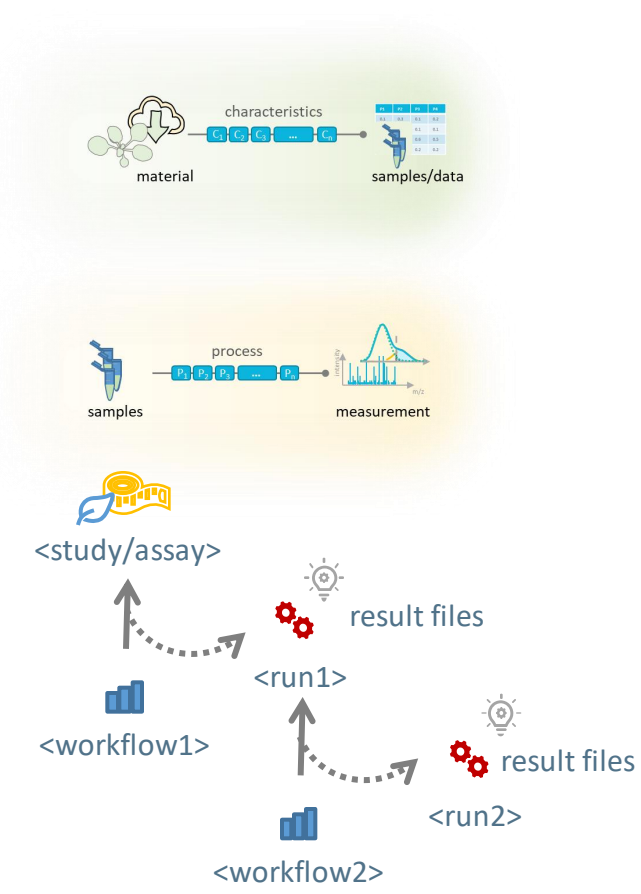
State of the art: ARC



← Experimental Data and Meta Data

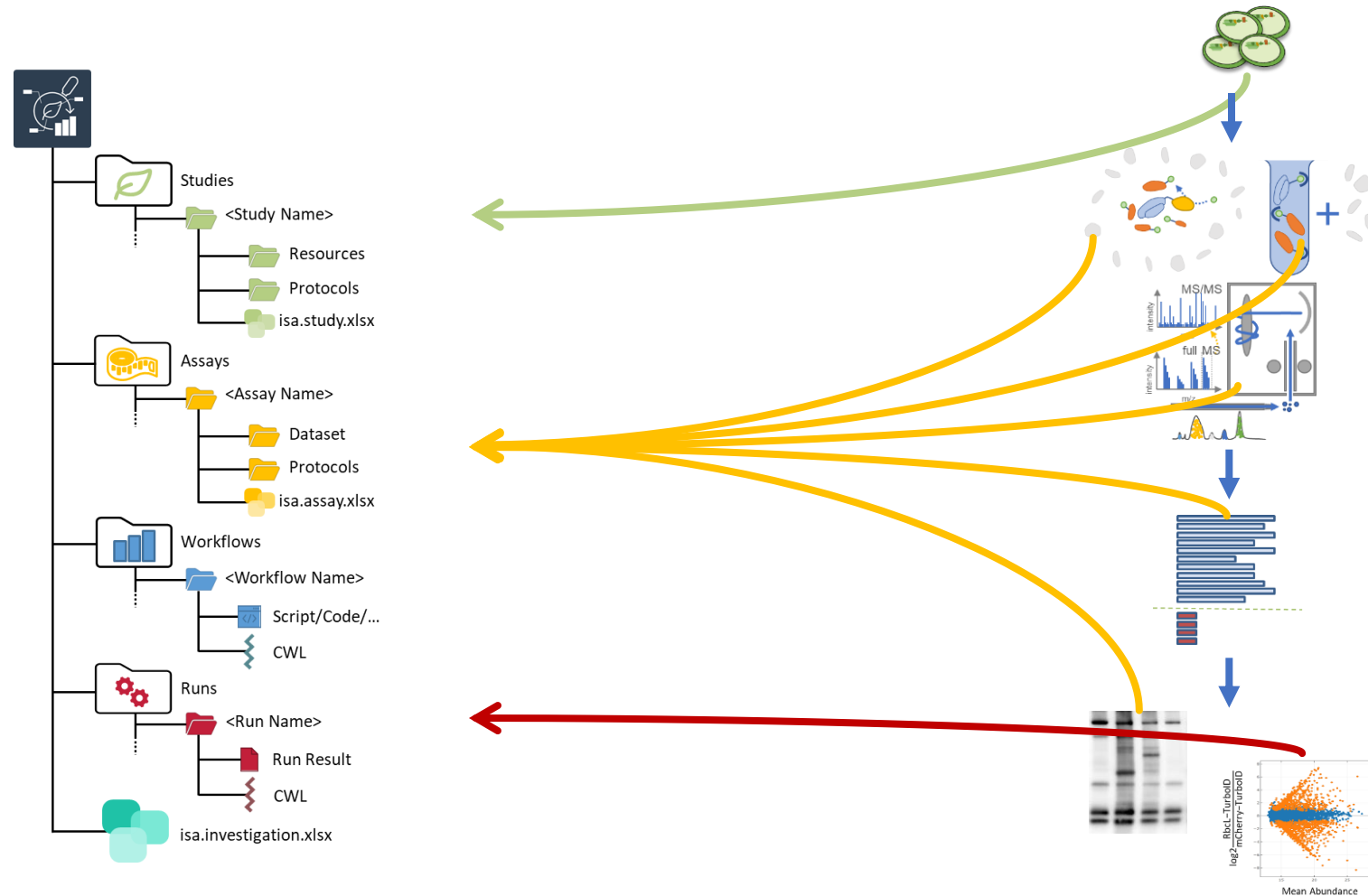
← Computational Data and Meta Data

←



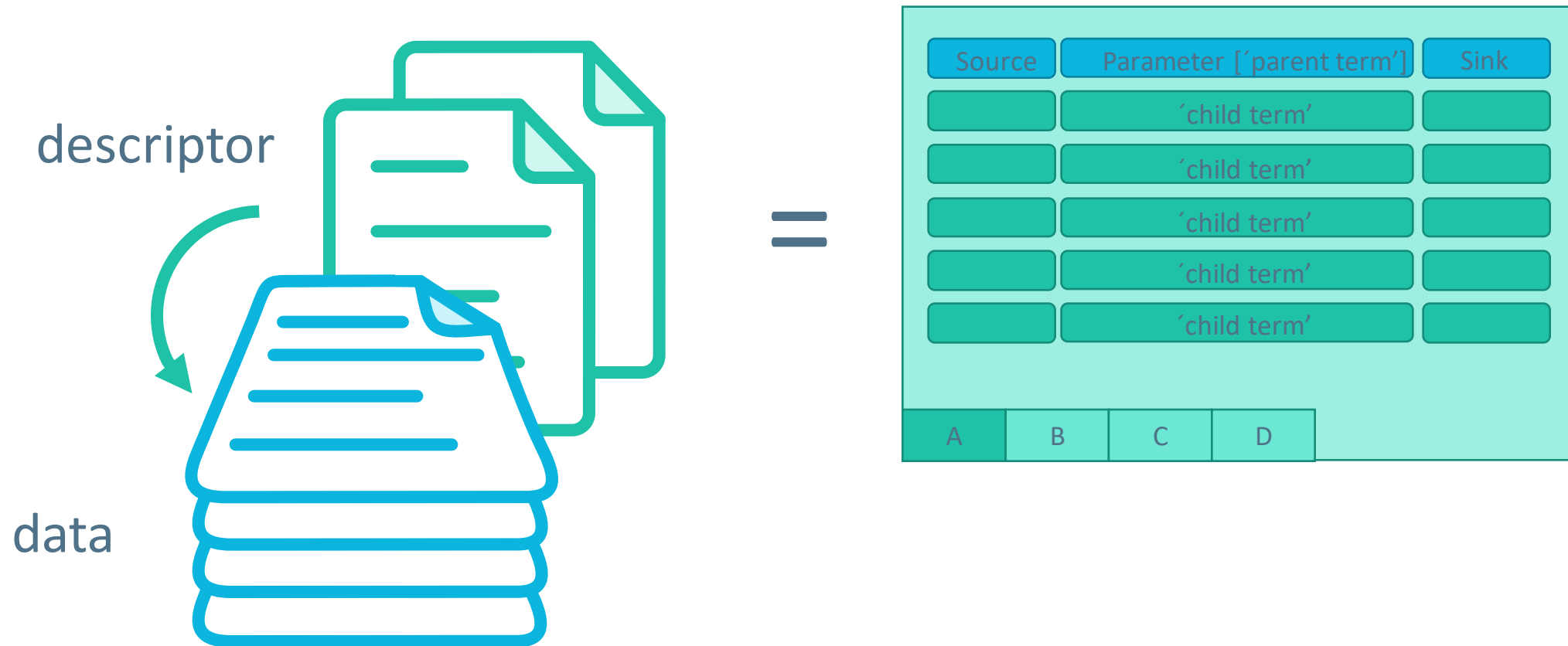
Important ARC Concepts: Structure

State of the art: ARC



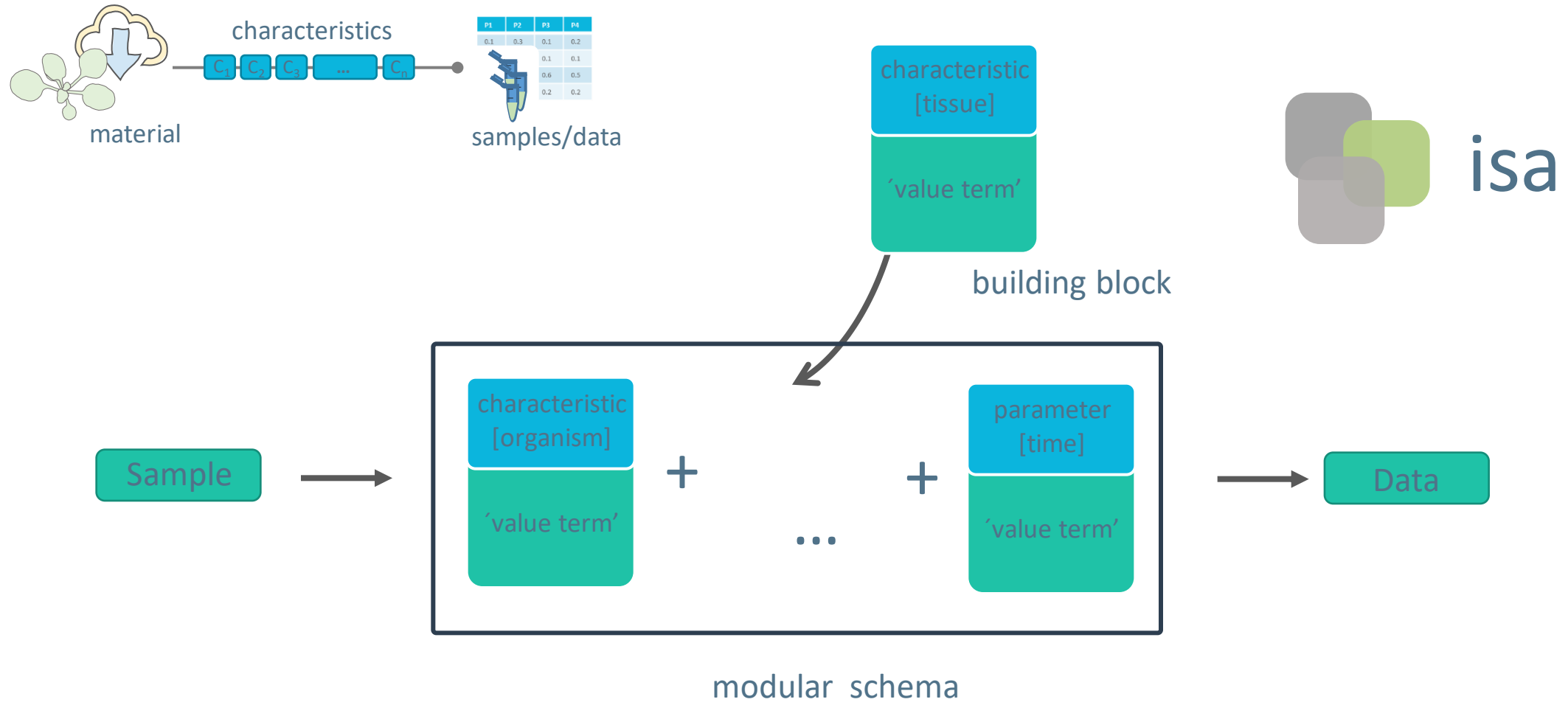
Important ARC Concepts: Structure

State of the art: Meta Data Annotation Principle



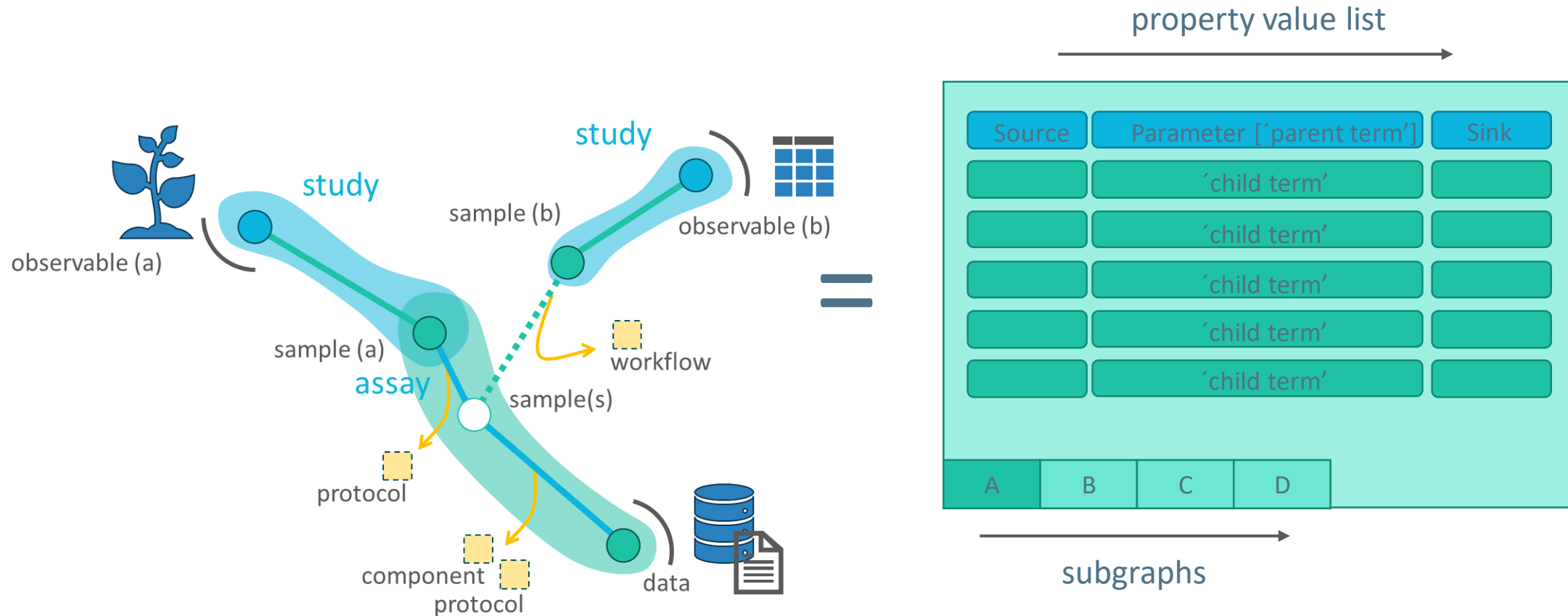
Important ARC Concepts: Meta Data Annotation

State of the art: Meta Data Annotation Principle



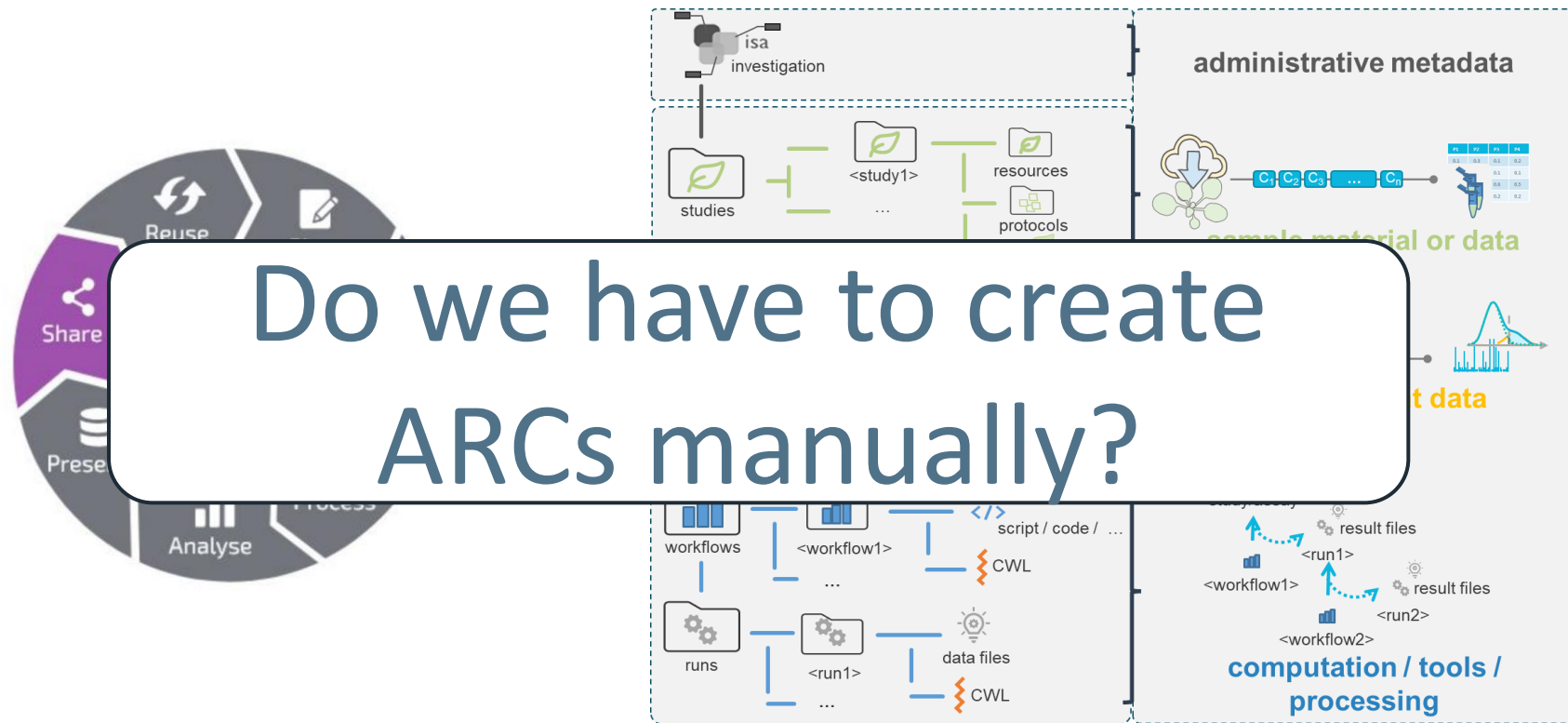
Important ARC Concepts: Meta Data Annotation

State of the art: Meta Data Annotation Principle



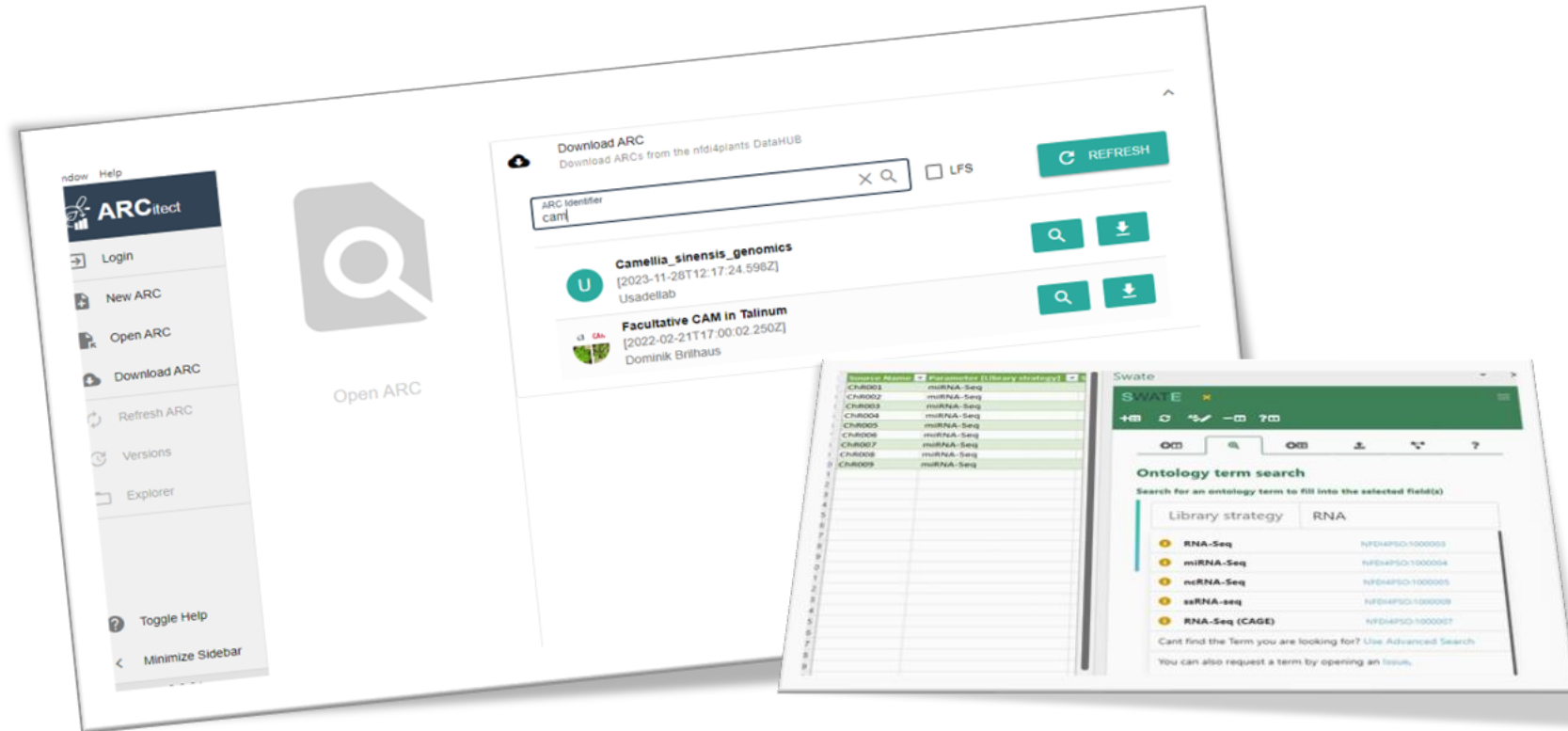
Important ARC Concepts: Meta Data Annotation

State of the art: ARC



- FAIR and easy: The Annotated Research Context

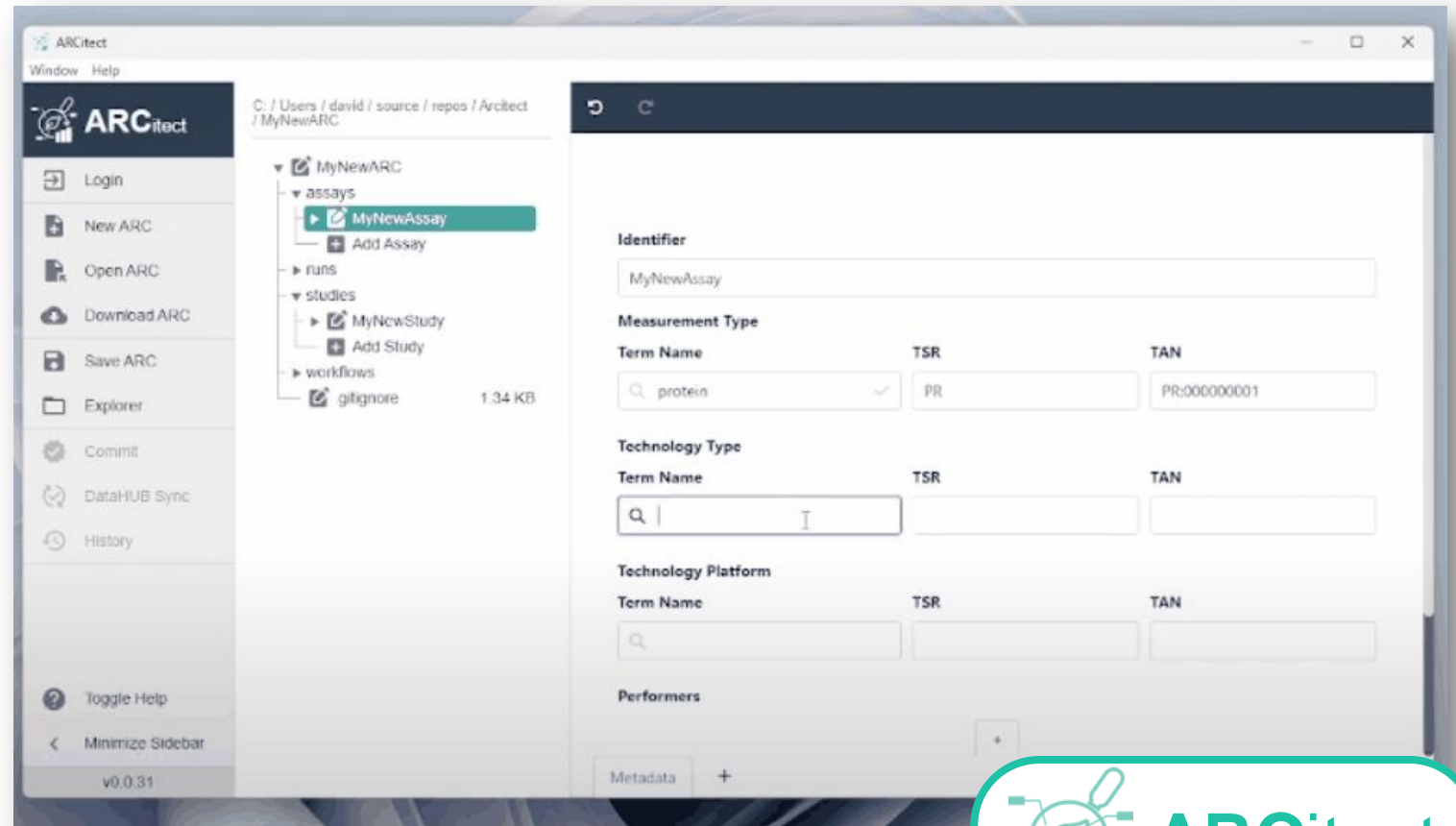
State of the art: Tooling



- Growing technical-digital assistance: From ARCommander and SWATE to ARCitect

State of the art: The ARCitect

- The **ARCitect** offers a simple **Graphical User interface** to create and manage **ARCs**
- Deployed as an Electron App, the **ARCitect** is available on **Windows, Linux and Mac**



State of the art: SWATE

- The **SWATE Tool** eases annotation in line with **ISA standards**
- SWATE is available on **web** and **desktop** platforms, as an independent tool or as a **plugin-based application**

The screenshot displays the SWATE application interface. On the left, a table lists source data with columns for Source Name, Characteristics [sample label], Factor [temperature unit], and Data File Name. On the right, a 'Swate' panel is open, showing a 'new parameter' dropdown menu and a 'notation building block selection' panel. The selection panel lists various instrument-related terms with their corresponding IDs.

Source Name	Characteristics [sample label]	Factor [temperature unit]	Data File Name
Heat_15A_OD_R1	15N	32.00 degree Celsius	Heat_15A_OD_R1.wiff
Heat_15A_OD_R2	15N	32.00 degree Celsius	Heat_15A_OD_R2.wiff
Heat_180A_OD_R1	15N	32.00 degree Celsius	Heat_180A_OD_R1.wiff
Heat_180A_OD_R2	15N	32.00 degree Celsius	Heat_180A_OD_R2.wiff
Heat_2880A_OD_R1	15N	32.00 degree Celsius	Heat_2880A_OD_R1.wiff
Heat_2880A_OD_R2	15N	32.00 degree Celsius	Heat_2880A_OD_R2.wiff
Heat_5760A_OD_R1	15N	32.00 degree Celsius	Heat_5760A_OD_R1.wiff
Heat_5760A_OD_R2	15N	32.00 degree Celsius	Heat_5760A_OD_R2.wiff
Heat_5760A_15D_R1	15N	32.00 degree Celsius	Heat_5760A_15D_R1.wiff
Heat_5760A_15D_R2	15N	32.00 degree Celsius	Heat_5760A_15D_R2.wiff
Heat_5760A_180D_R1	15N	32.00 degree Celsius	Heat_5760A_180D_R1.wiff
Heat_5760A_180D_R2	15N	32.00 degree Celsius	Heat_5760A_180D_R2.wiff
Heat_5760A_2880D_R1	15N	32.00 degree Celsius	Heat_5760A_2880D_R1.wiff
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Heat_5760A_5760D_R1	15N	32.00 degree Celsius	Heat_5760A_5760D_R1.wiff
Heat_5760A_5760D_R2	15N	32.00 degree Celsius	Heat_5760A_5760D_R2.wiff
Cold_15A_OD_R1	15N	4.00 degree Celsius	Cold_15A_OD_R1.wiff
Cold_15A_OD_R2	15N	4.00 degree Celsius	Cold_15A_OD_R2.wiff
Cold_180A_OD_R1	15N	4.00 degree Celsius	Cold_180A_OD_R1.wiff
Cold_180A_OD_R2	15N	4.00 degree Celsius	Cold_180A_OD_R2.wiff
Cold_2880A_OD_R1	15N	4.00 degree Celsius	Cold_2880A_OD_R1.wiff
Cold_2880A_OD_R2	15N	4.00 degree Celsius	Cold_2880A_OD_R2.wiff
Cold_5760A_OD_R1	15N	4.00 degree Celsius	Cold_5760A_OD_R1.wiff
Cold_5760A_OD_R2	15N	4.00 degree Celsius	Cold_5760A_OD_R2.wiff
Cold_5760A_15D_R1	15N	4.00 degree Celsius	Cold_5760A_15D_R1.wiff
Cold_5760A_15D_R2	15N	4.00 degree Celsius	Cold_5760A_15D_R2.wiff
Cold_5760A_180D_R1	15N	4.00 degree Celsius	Cold_5760A_180D_R1.wiff
Cold_5760A_180D_R2	15N	4.00 degree Celsius	Cold_5760A_180D_R2.wiff
Cold_5760A_2880D_R1	15N	4.00 degree Celsius	Cold_5760A_2880D_R1.wiff
Cold_5760A_2880D_R2	15N	4.00 degree Celsius	Cold_5760A_2880D_R2.wiff
Cold_5760A_5760D_R1	15N	4.00 degree Celsius	Cold_5760A_5760D_R1.wiff
Cold_5760A_5760D_R2	15N	4.00 degree Celsius	Cold_5760A_5760D_R2.wiff
Highlight_15A_OD_R1	15N	22.00 degree Celsius	Highlight_15A_OD_R1.wiff
Highlight_15A_OD_R2	15N	22.00 degree Celsius	Highlight_15A_OD_R2.wiff
Highlight_180A_OD_R1	15N	22.00 degree Celsius	Highlight_180A_OD_R1.wiff
Highlight_180A_OD_R2	15N	22.00 degree Celsius	Highlight_180A_OD_R2.wiff

new parameter

notation building block selection

factor

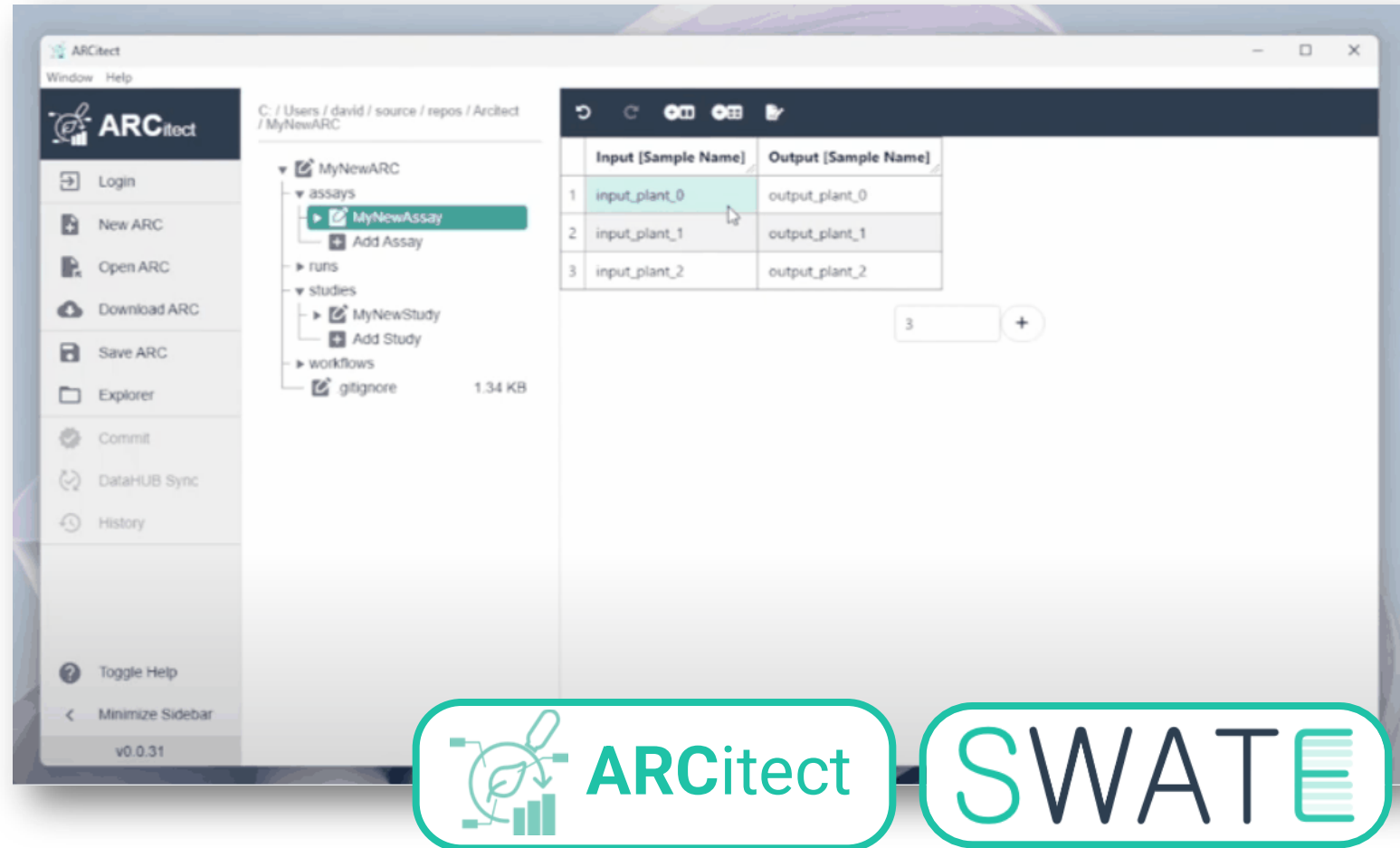
characteristic

datafile / sample

SWATE

State of the art: ARCitect + SWATE

- The **SWATE Tool** eases annotation in line with **ISA standards**
- SWATE is available on **web** and **desktop** platforms, as an independent tool or as a **plugin-based application**



State of the art: PLANTdataHUB

The image shows a screenshot of the PLANTdataHUB interface. On the left, a list of projects is displayed, including:

- Dominik Brihaus / Facultative CAM in Talinum
- Saskia Hiltmann / Evolutionary responses to CuZnSODs inhibition in plants 2023
- Christopher Lux / Carbon Availability Transcriptomics Chlamy
- HHU Plant Biochemistry / Wrobel-2023-CastorBeanEndospermProteome
- David Zimmer / EndocAltoSisSampleArc

On the right, a detailed view of the **Ru_ChlamyHeatstress** project is shown. It includes project statistics (27 Commits, 2 Branches, 2 Tags, 306 KB Project Storage) and a table of recent commits.

Commit	Last commit	Last update
arc	Update	11 months ago
essays	update isa files	1 week ago
publication	add publication, add zScores	10 months ago
runs	add tom data	4 months ago

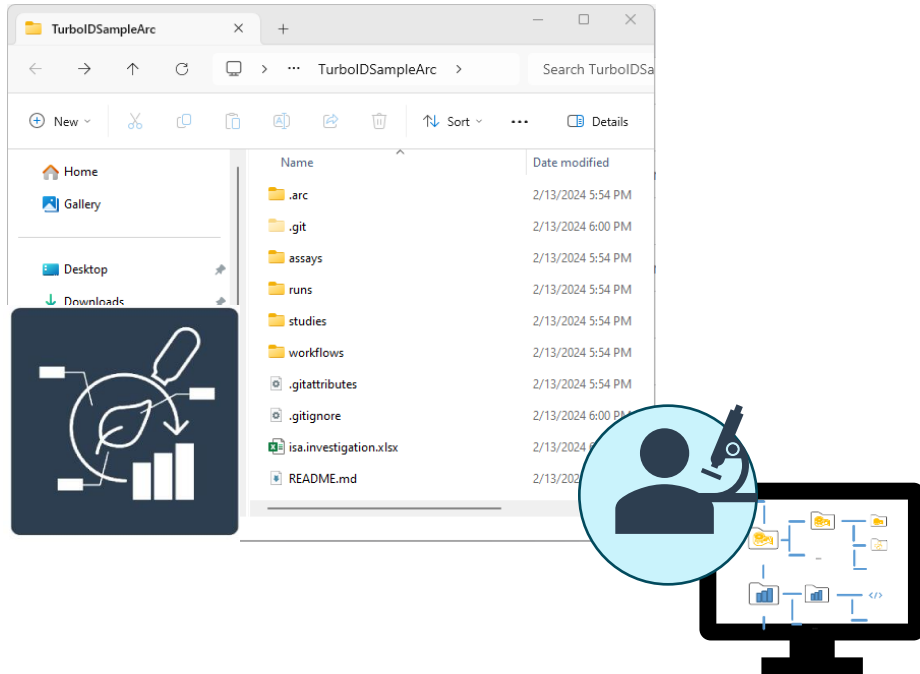
The Plant Journal 2023 <https://doi.org/10.1111/tpj.16474>

- Growing a PLANTdataHUB

- Z01
- A04
- A05
- B02
- B03
- B06
- B08
- C02
- C06
- C07
- D02

Now: ARCs as a single RDM entry point

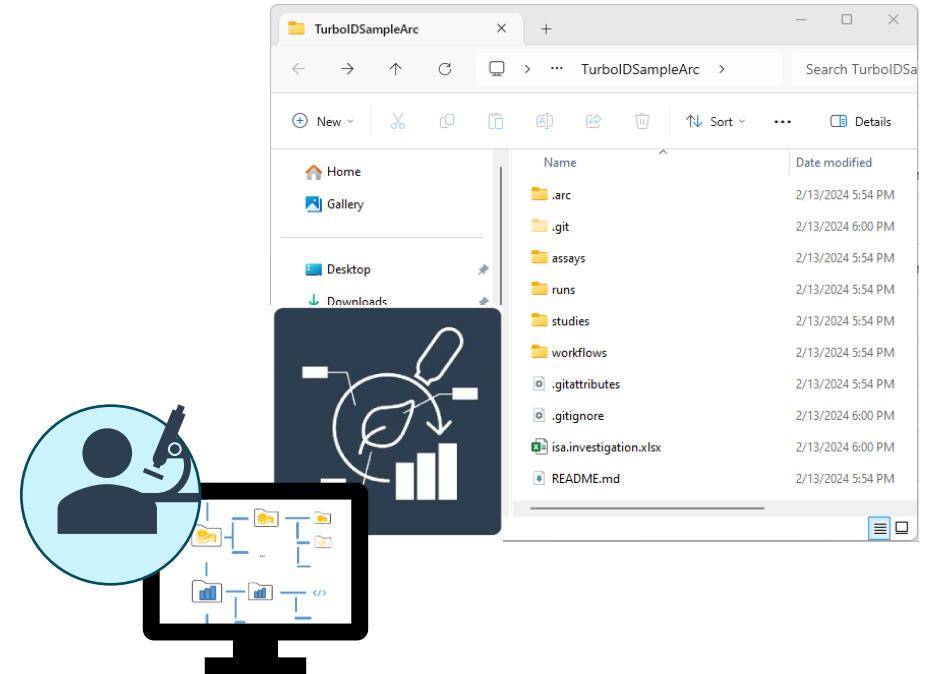
Researcher A's data management solution:
Annotated Research Context (ARC)



Researcher A

← Collaboration →

Researcher B's data management solution:
Annotated Research Context (ARC)

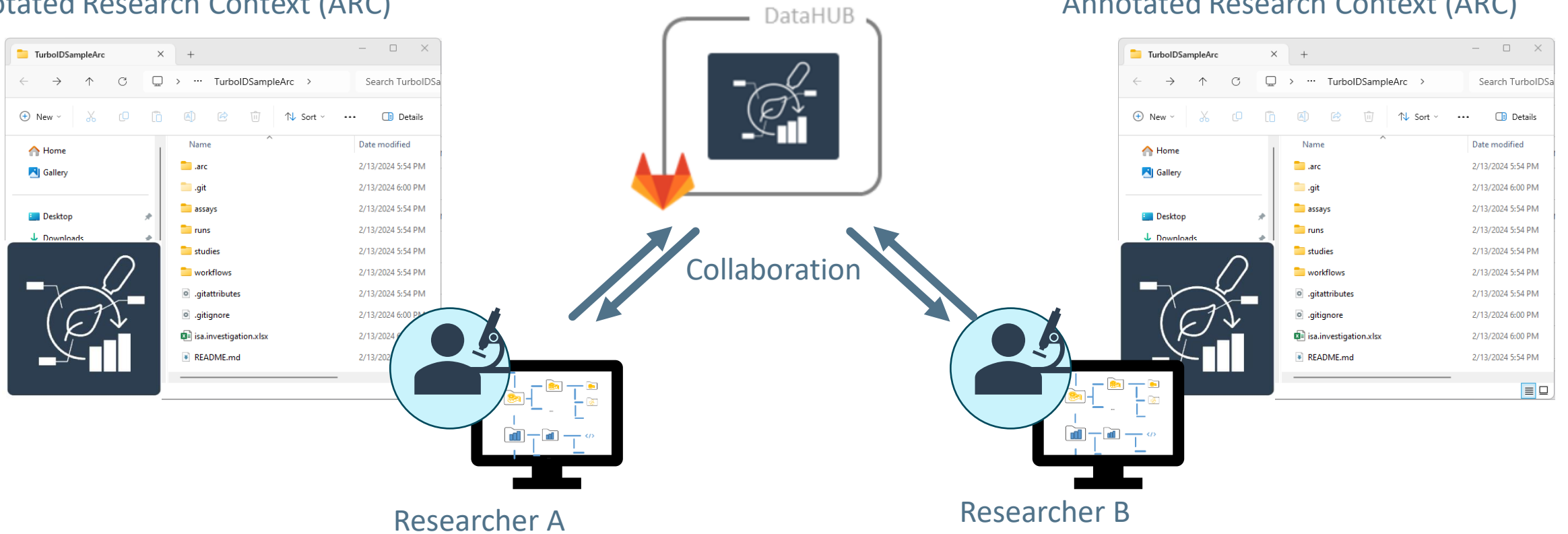


Researcher B

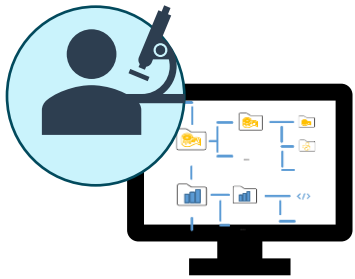
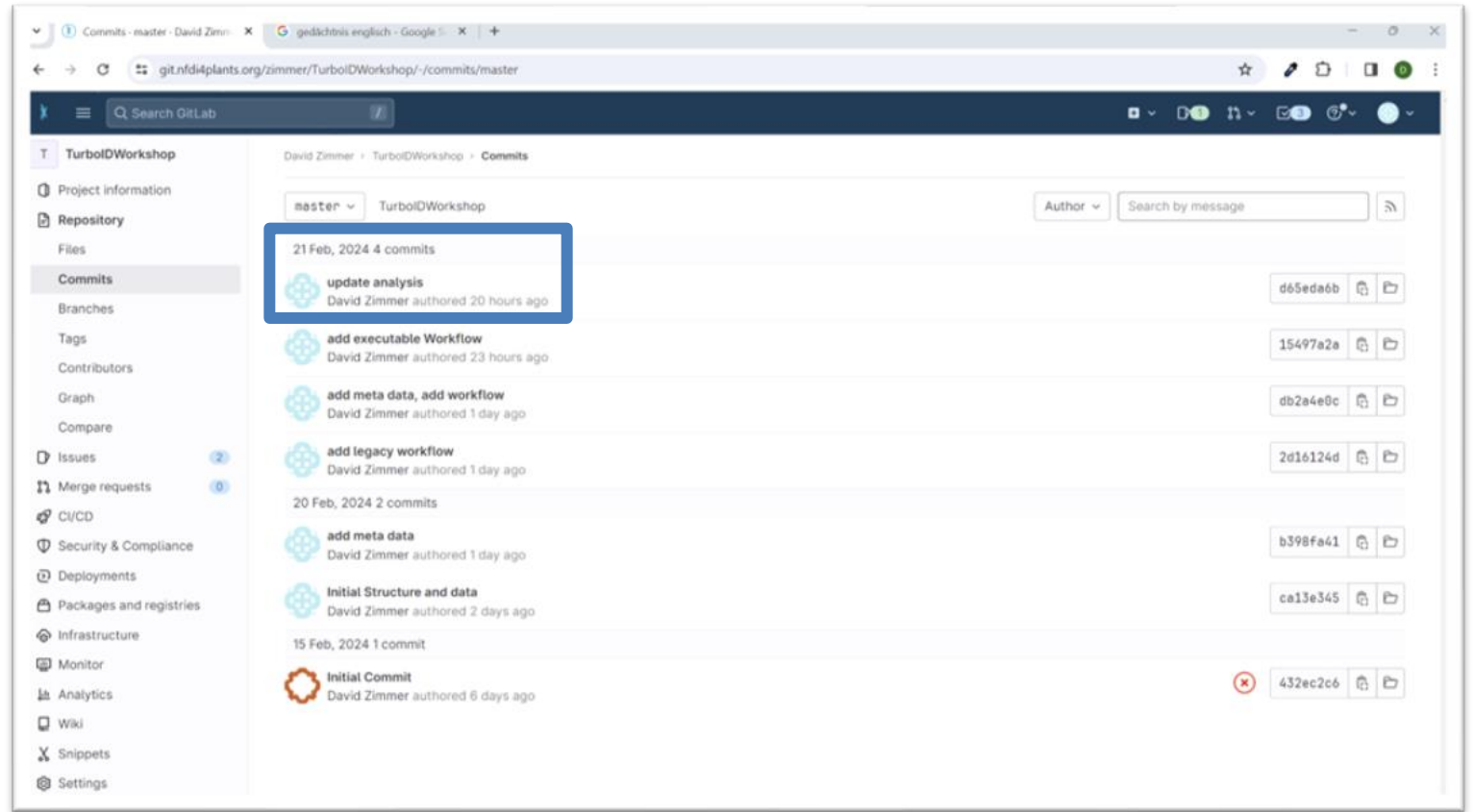
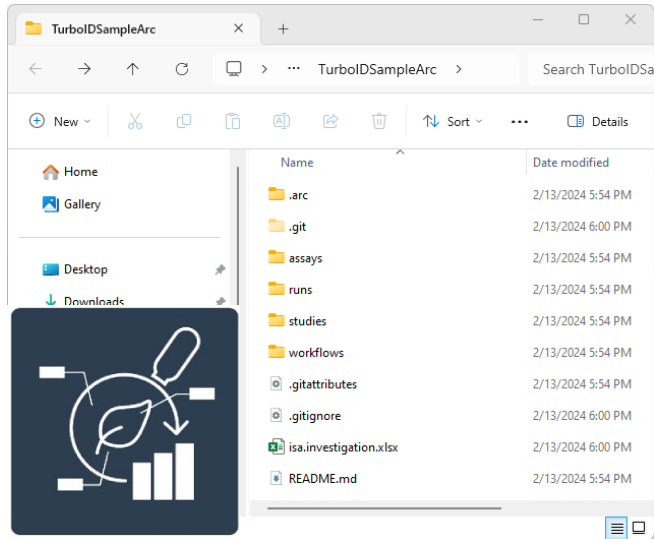
Now: Using the PLANTDataHUB to collaborate

Researcher A's data management solution:
Annotated Research Context (ARC)

Researcher B's data management solution:
Annotated Research Context (ARC)

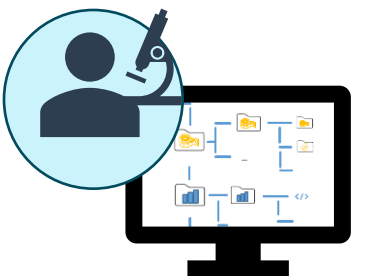
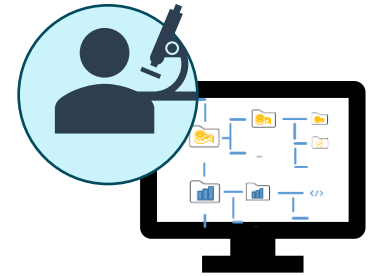
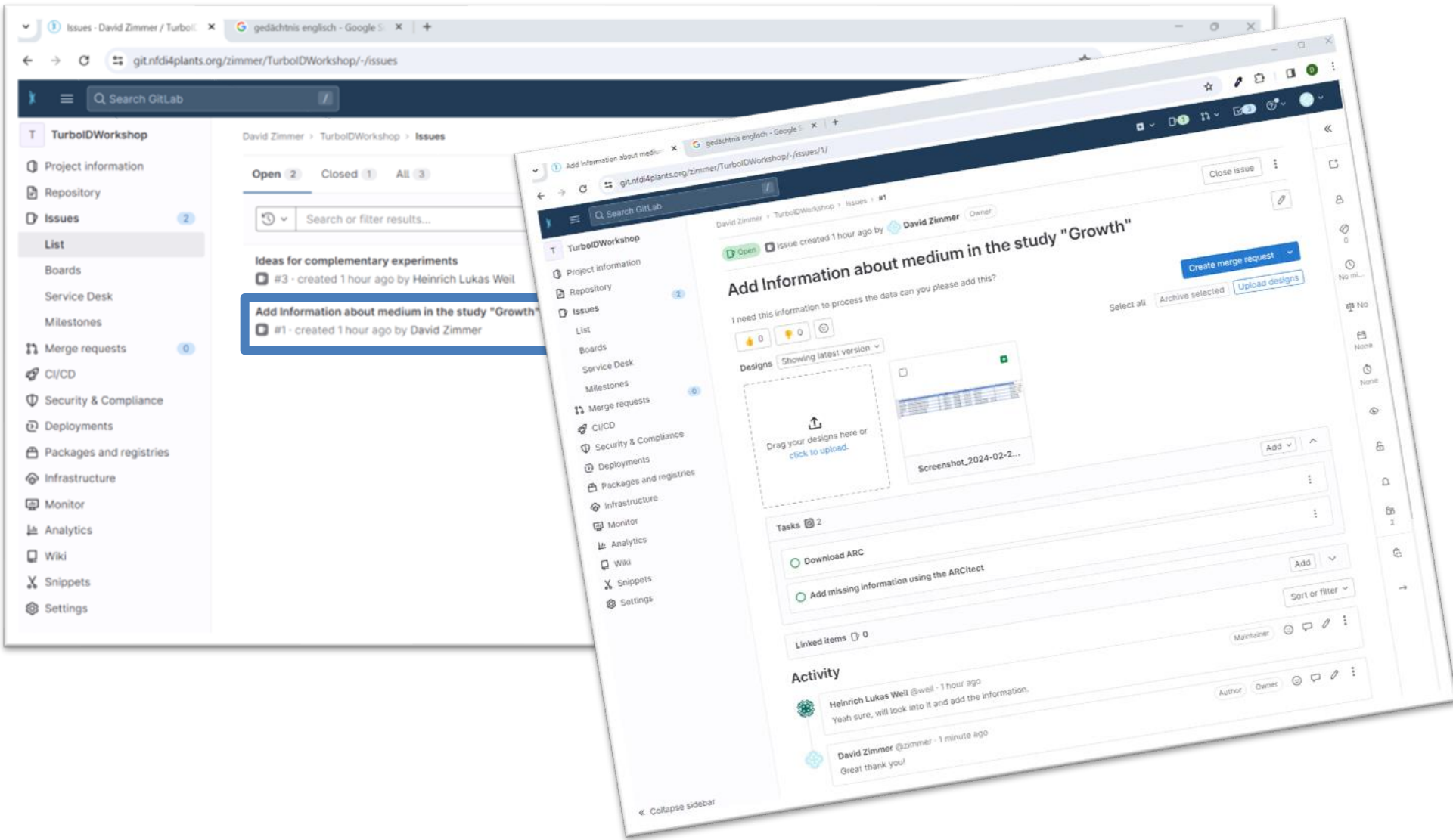


Now: Using the PLANTDataHUB to collaborate



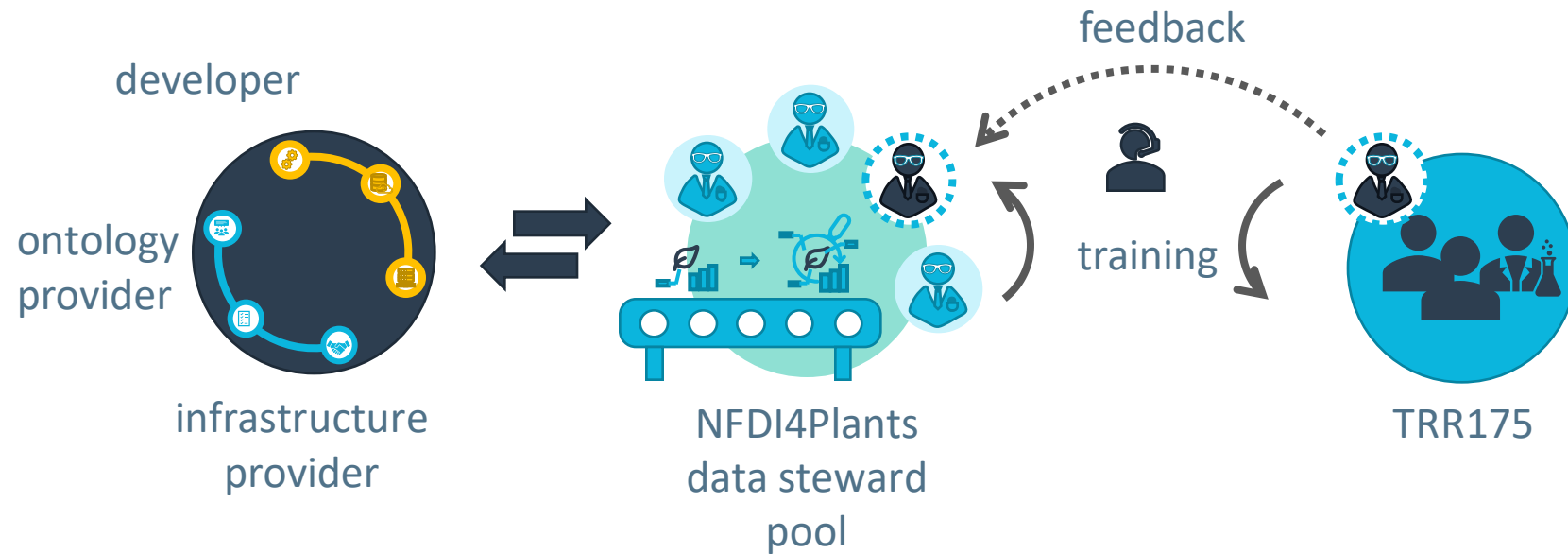
Researcher A

Now: Using the PLANTDataHUB to collaborate



Work Plan

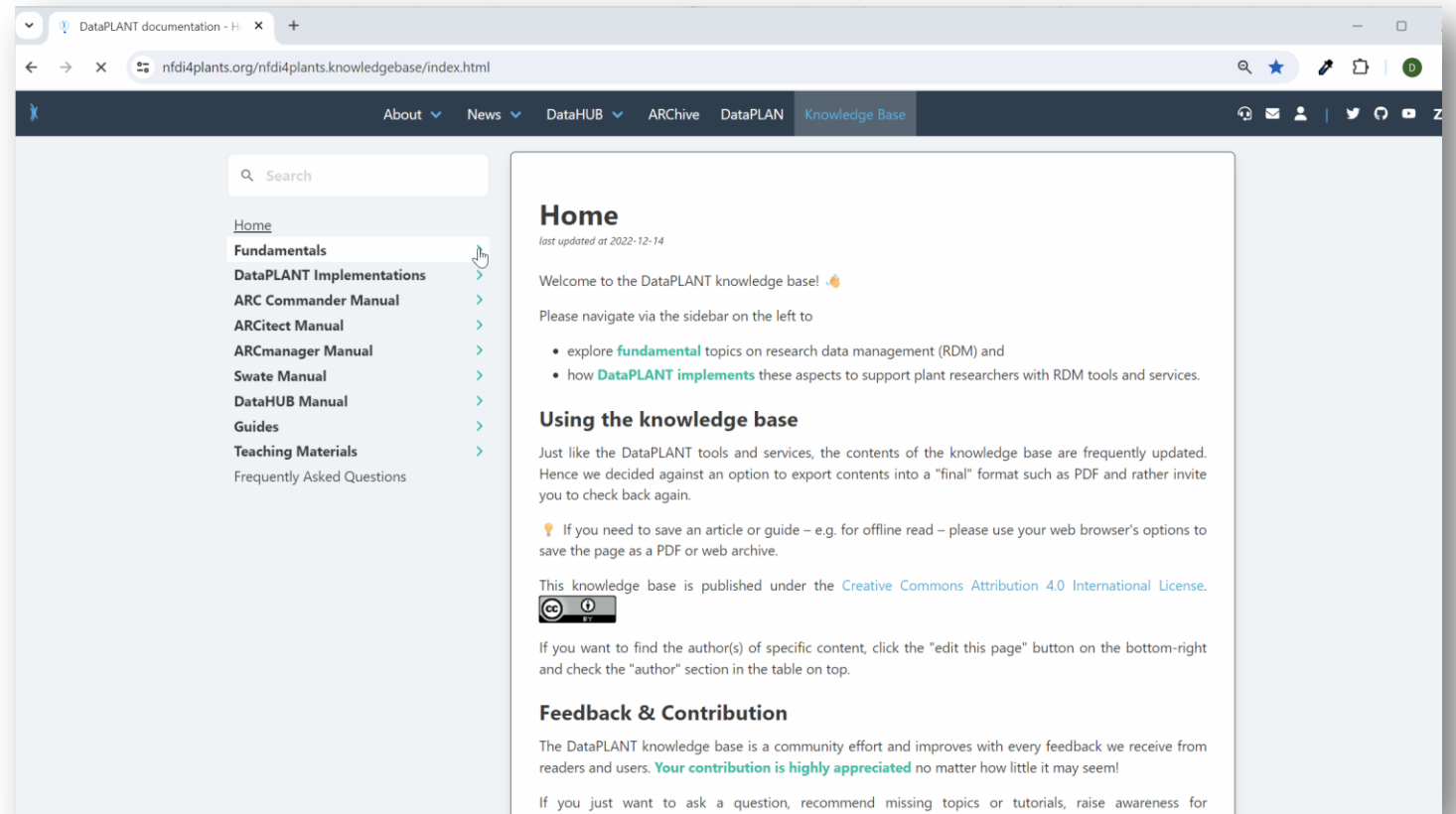
Work plan: Data Stewardship



- Data Stewardship: active support and training of TRR members

Work plan: Data Stewardship

- **Teaching material** will be **continuous** contributed to a **publicly available** **knowledgebase**
- Central **ARCitect** and **SWATE** functionalities are already documented with **video series (>30 videos)**


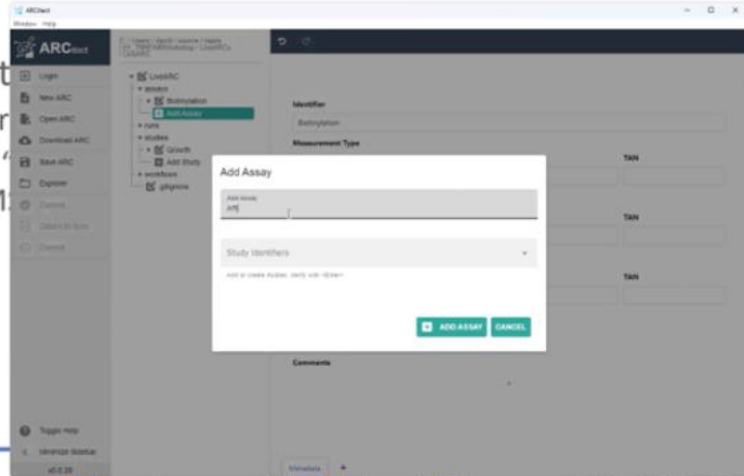


Work plan: Data Stewardship


- Data Stewardship: **active support** and **training** of TRR members
- Research data management **workshops** will be held online as well as on site.

I. Initialize ARC structure and add data

- Inspect our experiment
 - Add one study called gr
 - Add four Assays called "Measurement" and "M

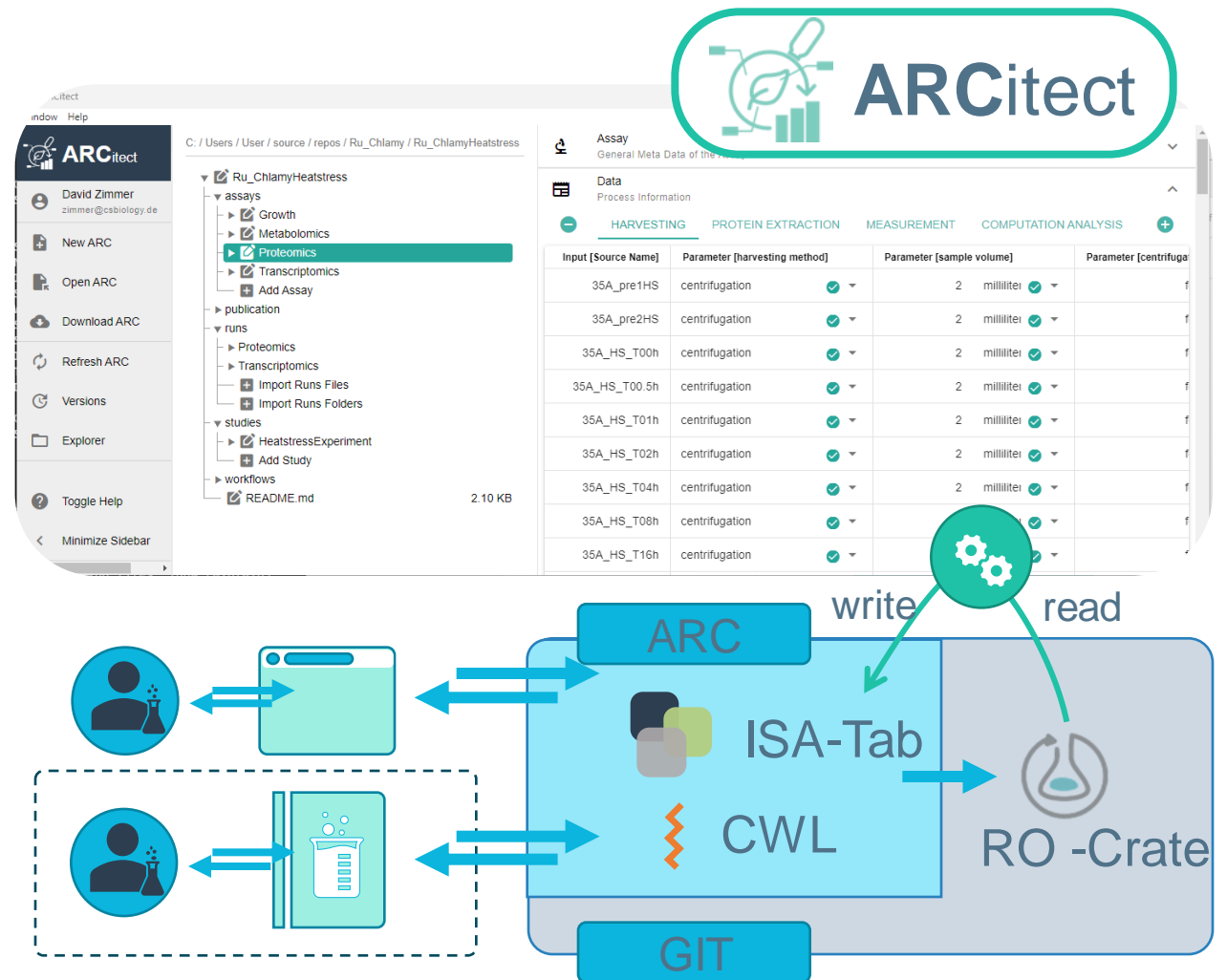


Growth Biotinylation Assay Affinity Purif. MS Measurement MS Analysis



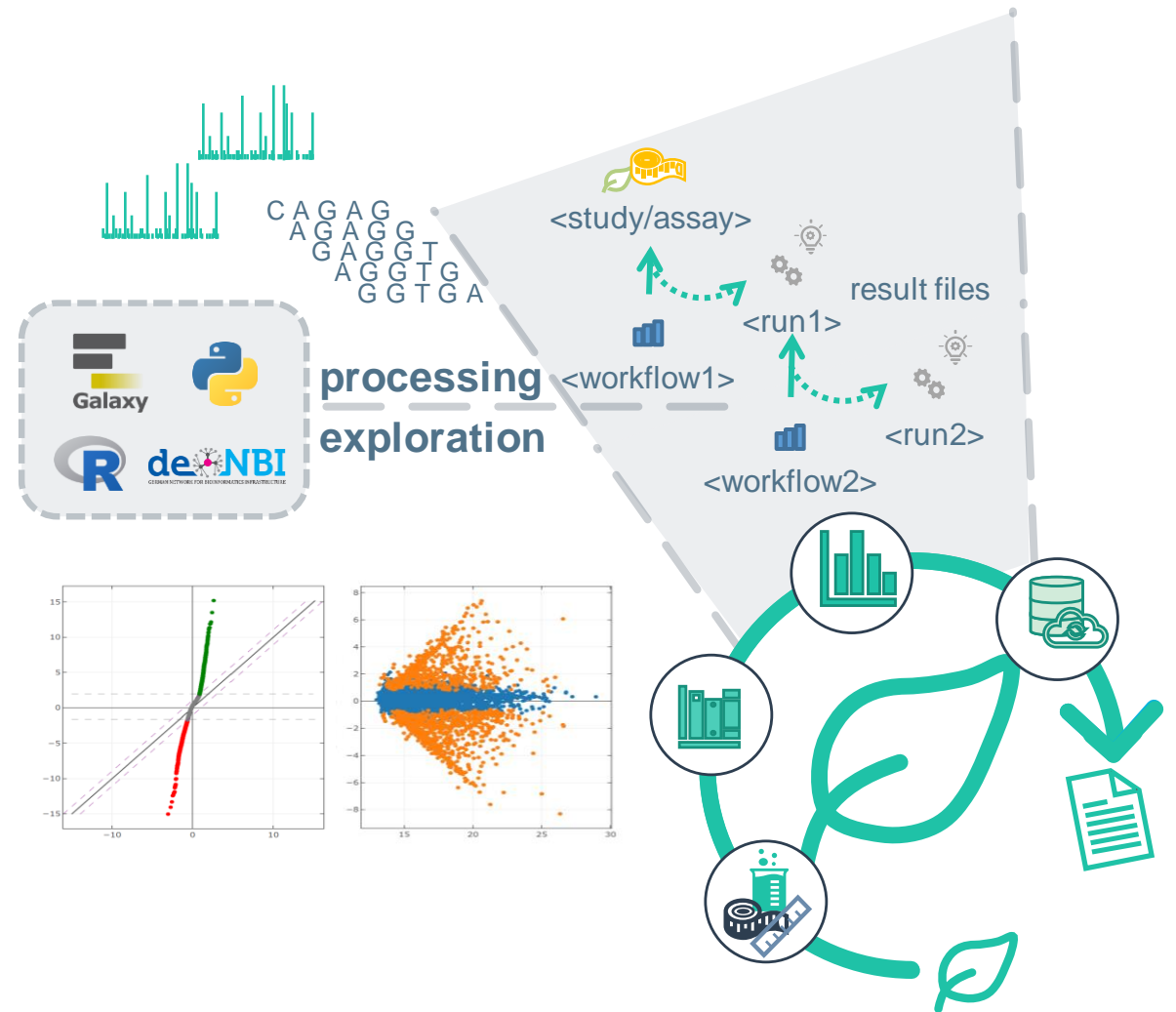
Work plan: Tooling

- **ARCitect** will integrate **SWATE** **ISA** annotation capabilities with **GIT** functionalities
- Extension of the **ARCitect** with **Electronic Lab Book** capabilities



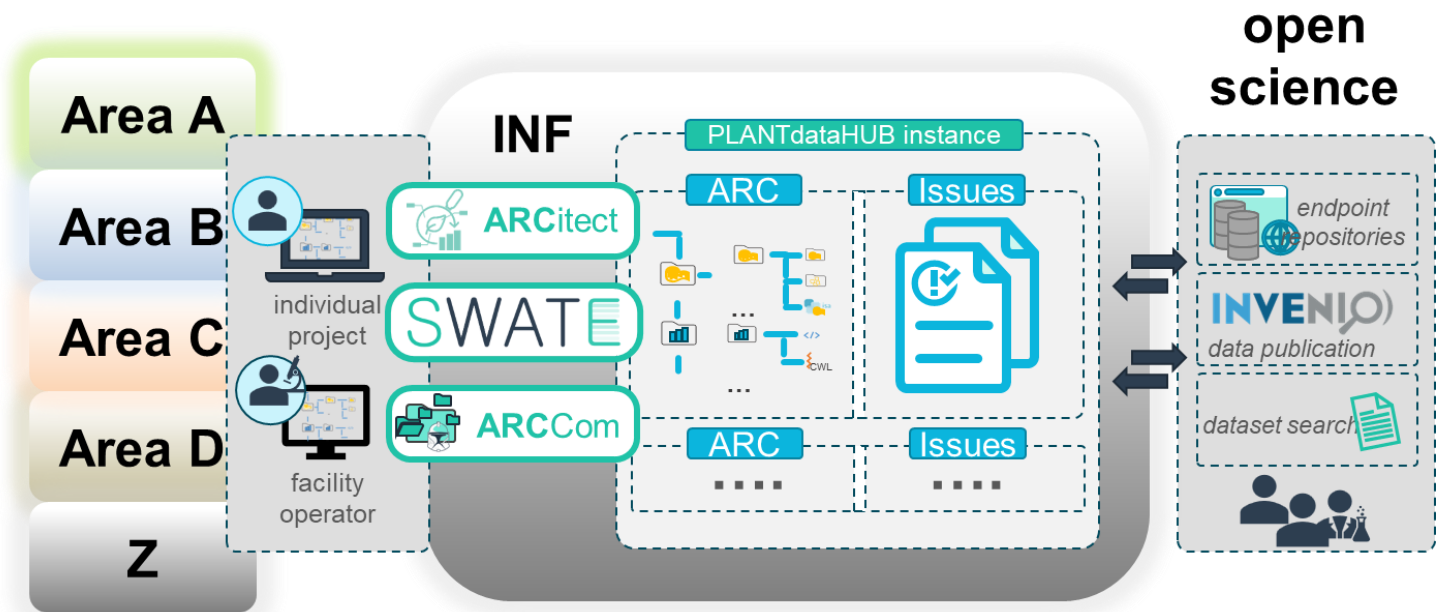
Work plan: FAIR computational workflows

- Utilization of ARCs provides a standardized framework for reusing **FAIR** computational workflows
- Data **processing** and **data exploration** workflows will be developed



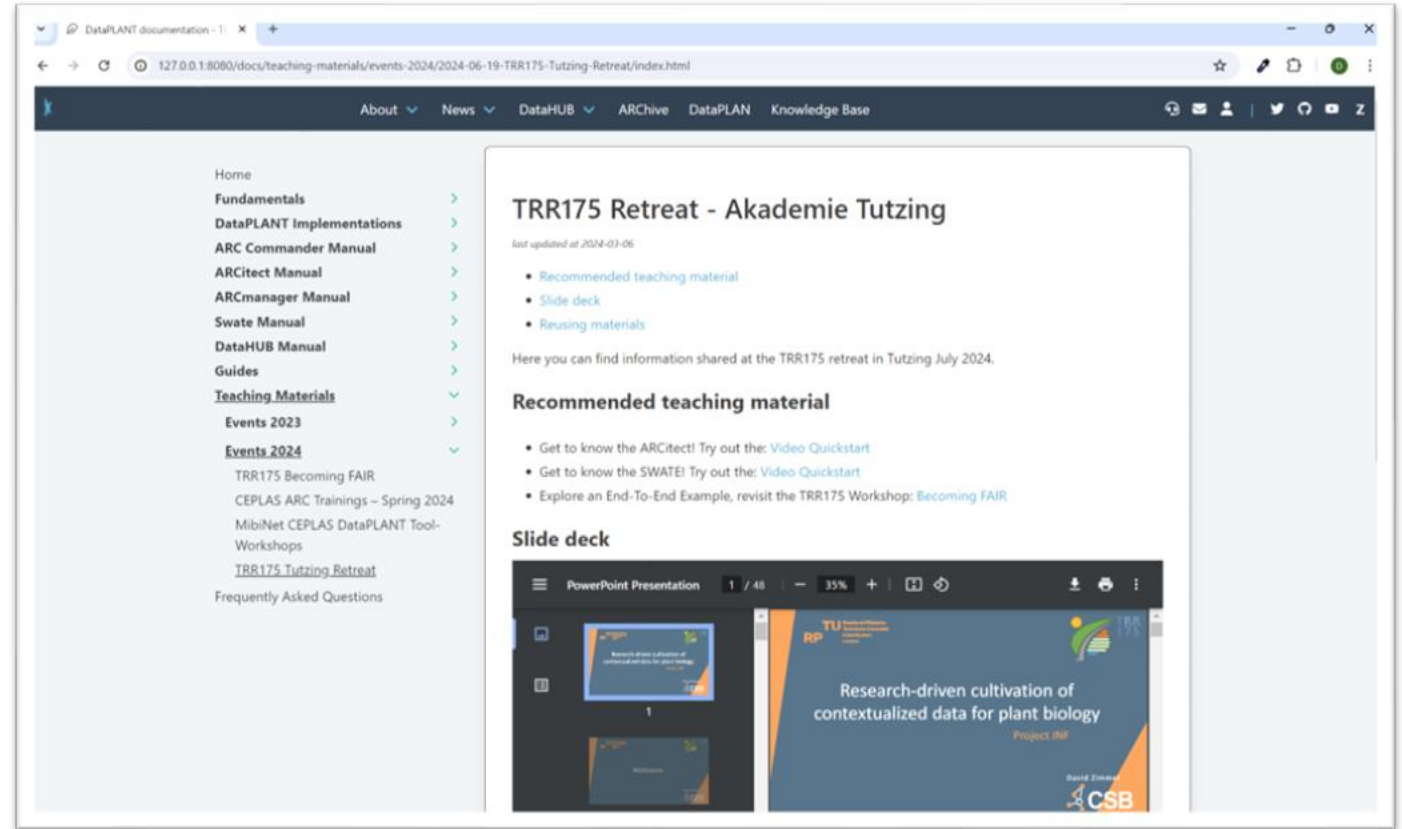
Role within the TRR

- **empower** collaboration within the TRR175
- **enhance** exchange within the TRR175 community and public repositories
- **establish** data integration inside and across communities



TRR175 Resources

- **TRR175** relevant research data management resources are available via the **NFDI4Plants** knowledgebase

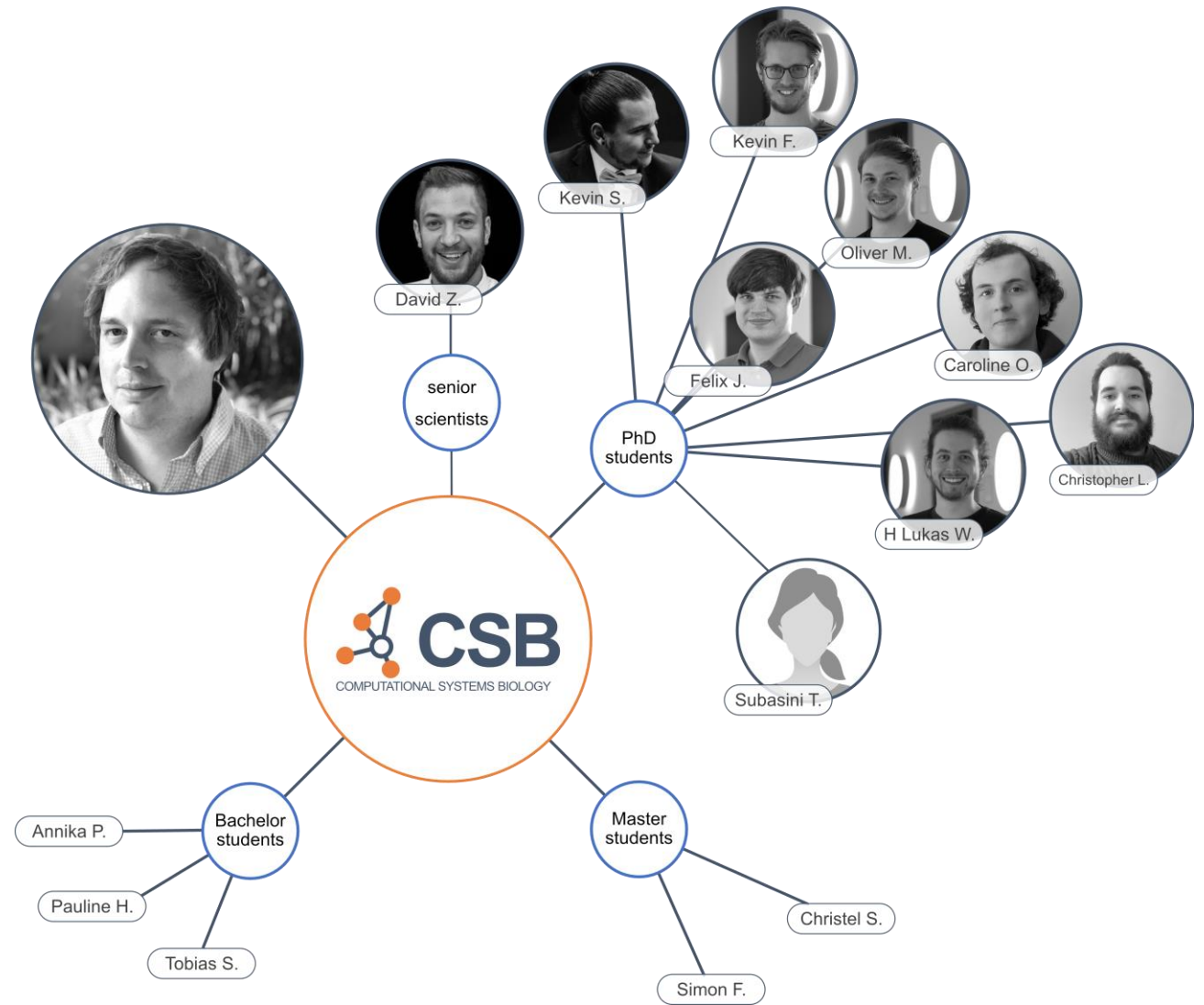


- Checkout:
<https://nfdi4plants.org/nfdi4plants.knowledgebase>

Thank you for your attention!



TRR
175



Thank you for your attention!

David Zimmer

Now: Using the PLANTDataHUB to collaborate

