



DOME 4.0

Deliverable D1.5 - “Onboarding Services”

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Executive Summary

Various educational content and software tools are created to guide DOME 4.0 users in the onboarding process. Special guidelines are developed specifically for each user type. The user types considered include: Data Consumer (End User), Data Provider, Data and Service Platforms. The website and related tools are available publicly on GitHub and will be revised in tandem with next releases, and accordingly updated/integrated in the platform. The onboarding service covers addressing questions and general user stories such as “as a user, having my own database with my own schema, how do I connect it to DOME 4.0 and make my data FAIR?”. The website and related tools will guide such users in all steps, from the preparation of data, configuring connectors, customizing data interfaces and other associated tasks. Some automation is included in the form of cookie cutter software to guide, for example, the onboarding of data providers via advanced DOME 4.0 connectors. The tools can be accessed through the DOME 4.0 website itself.

Table of Contents

Executive Summary.....	2
Table of Contents.....	3
List of Figures	3
1. Introduction	5
2. The First Step: Register as a User.....	5
3. Onboarding a data end user	10
4. On-Boarding Data Provider/Owner	13
4.1 Onboarding a Data Set Catalogue.....	14
4.2 On boarding a Data Platform	15
4.3 Onboarding Custom Platforms with Specific Connector	17
5. On-Boarding of CLI applications and agents.....	18
6. FAIR Onboarding.....	19
7. Conclusions / Next steps.....	20
8. Lessons learnt	21
9. Deviations from Annex 1.....	22
10. Acknowledgement	23
Annex 1	24
11. Reference-Connector-Template	24
11.1 Generate your project from the template.....	24

List of Figures

Figure 1: The onboarding workflow on DOME 4.0.	6
Figure 2: A typical landing page for unlogged user.....	7
Figure 3: The login page of DOME 4.0. A user can choose to login with GitHub account or Register with a DOME 4.0 account.	8
Figure 4: The DOME 4.0 native user registration form.....	9
Figure 5: The Search Results windows of DOME 4.0.	11
Figure 6: Example of the "more details" results page. This page is currently technical in nature displaying a raw JSON data structure. More human friendly representation is part of the work in progress.....	12
Figure 7: Use the Register submenu item to add a new catalog data, register as provider or register a tool or service.	13

Figure 8: Registering a data catalogue for a specific data set. Note that semantic information can be included only using the keywords. 15

Figure 9: Example of registering the materials project platform provided it supports standard connectors on DOME 4.0. 16

Figure 10: Once a platform is registered (on boarded) it is available under Data Sources and all queries are directed to the platform as well. 17

Figure 11: On-Boarding an API CLI application on DOME 4.0 requires an API access key..... 18

Figure 12: Using the DOME 4.0 from an CLI API application (though the figure shows a GUI used for assisting in testing the API, the actual call is aimed at CLI and API calls from external platforms)..... 19

1. Introduction

A set of onboarding guidelines in the form of educational resources and software tool in the form of a “cookie cutter” (boiler plate template, a standard code that is basis for further development) are provided. This is designed to serve the specific needs of all stakeholders, including data consumers, data owners, data providers, and platforms. The on-boarding service provides users (consumers and providers alike) with the knowledge, tools, and insights required for effective participation in the DOME 4.0 ecosystem. This is the first release of the onboarding tools, and further updates will go in tandem with software enhancements and updates to the platform, as new features are added, new releases will be provided.

The Onboarding process workflow is shown in Figure 1, and it is has two main branches, depending on whether the end user is a consumer or a provider of data. The workflow for a provider of data has two further subbranches, depending on whether it is a platform (data platform) or a user that owns data (data owner) without a platform. The various workflow steps are described in detail in the next chapters.

2. The First Step: Register as a User

The first step in the onboarding process is of course visiting the DOME 4.0 web server at <https://dome.the-marketplace.eu> and registering. Figure 2 shows a typical landing page. This page will show some statistics and general information, including pointers to the FAIR DATA tools and other guides that are part of the onboarding process. Once the user is registered or logged-in we can start the actual onboarding process. DOME 4.0 uses state of the art Open Authorization (OAuth) standards and allows registration on the platform using email address (or using one of a number of popular OAuth services. Currently we support GitHub.com. More services such as those offered, for example, by Google, will be added later). See Figure 3 for the main login and Figure 4 for the DOME 4.0 native (local) user registration form.

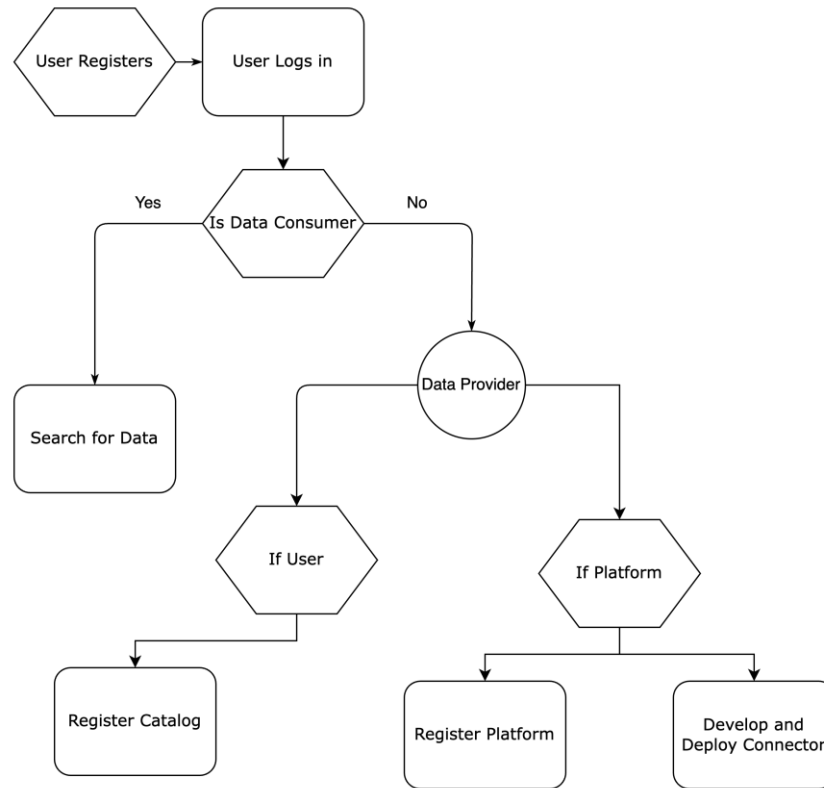
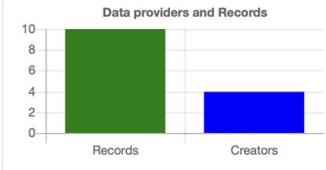


Figure 1: The onboarding workflow on DOME 4.0.

Search DOME

[Advanced Search](#)

Statistics



Category	Count
Records	10
Creators	4

Featured Dataset

Keywords: model_training_data, Delaney, showcase_3

Resource URL :
[https://sintef.sharepoint.com/:f:/r/teams/DOME4.0/Delte%20dokumenter/WP4/T4.1%20Example%20files/Showcase%20%233%20\(Fraunhofer\)/model_training_data?csf=1&web=1&e=Dbybea](https://sintef.sharepoint.com/:f:/r/teams/DOME4.0/Delte%20dokumenter/WP4/T4.1%20Example%20files/Showcase%20%233%20(Fraunhofer)/model_training_data?csf=1&web=1&e=Dbybea)

Upcoming Services

- Updates on FAIR Data Monitoring and Auditing Service
- Updates on Data sovereignty and provenance system
- New features for Data transaction and clearing system

NOTE: The development platform has been created as part of the DOME 4.0 project, funded by Horizon 2020, the European Union's Horizon 2020 Research and Innovation Programme (Grant Agreement no 953163). The demonstrator is for research and innovation purposes at a low technology readiness level (~TRL 4). The project consortium is not responsible for any errors, accuracy or omissions of any information posted on the development platform and shall not be responsible for any decisions made based on such information.

Figure 2: A typical landing page for unlogged user

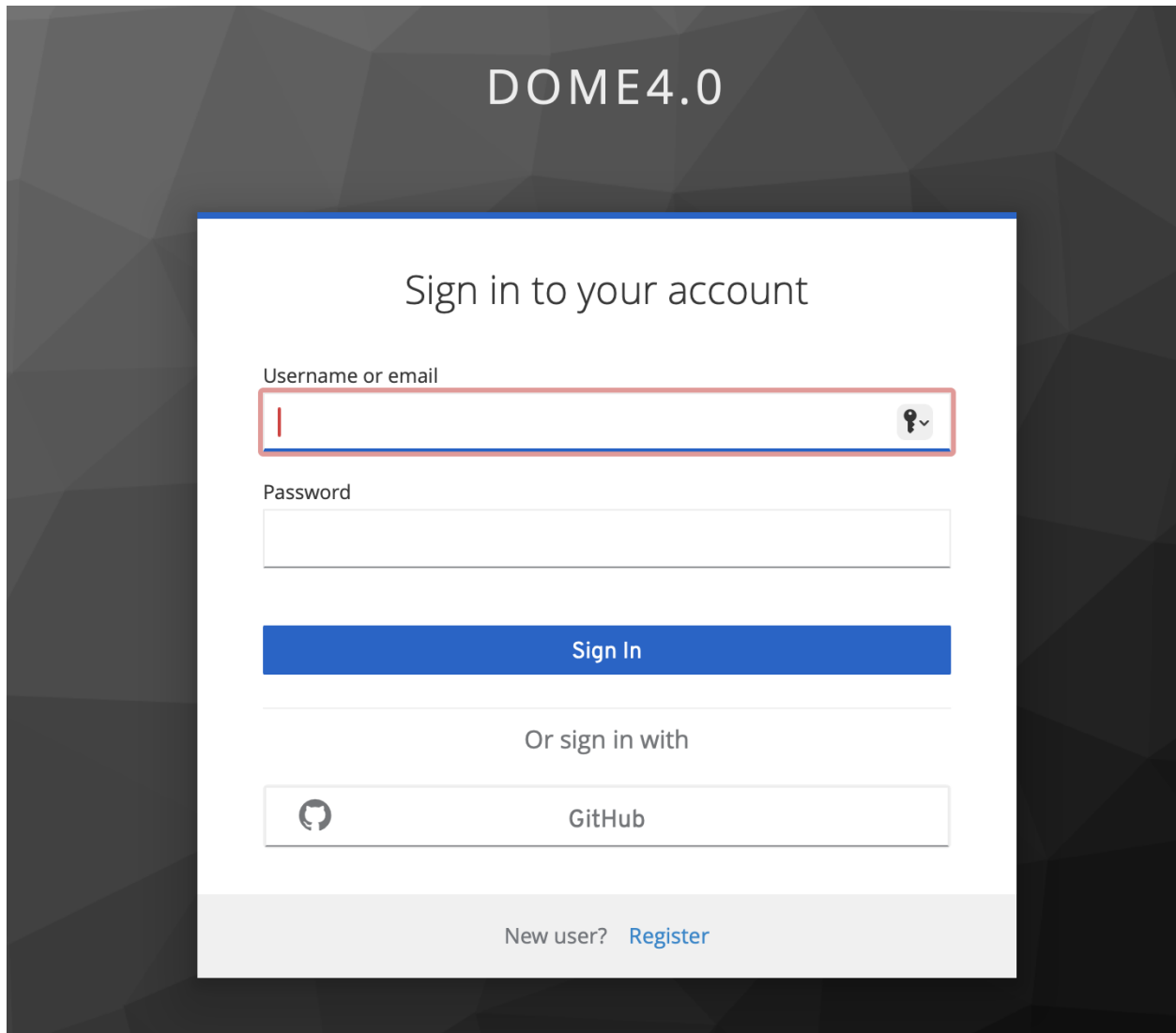
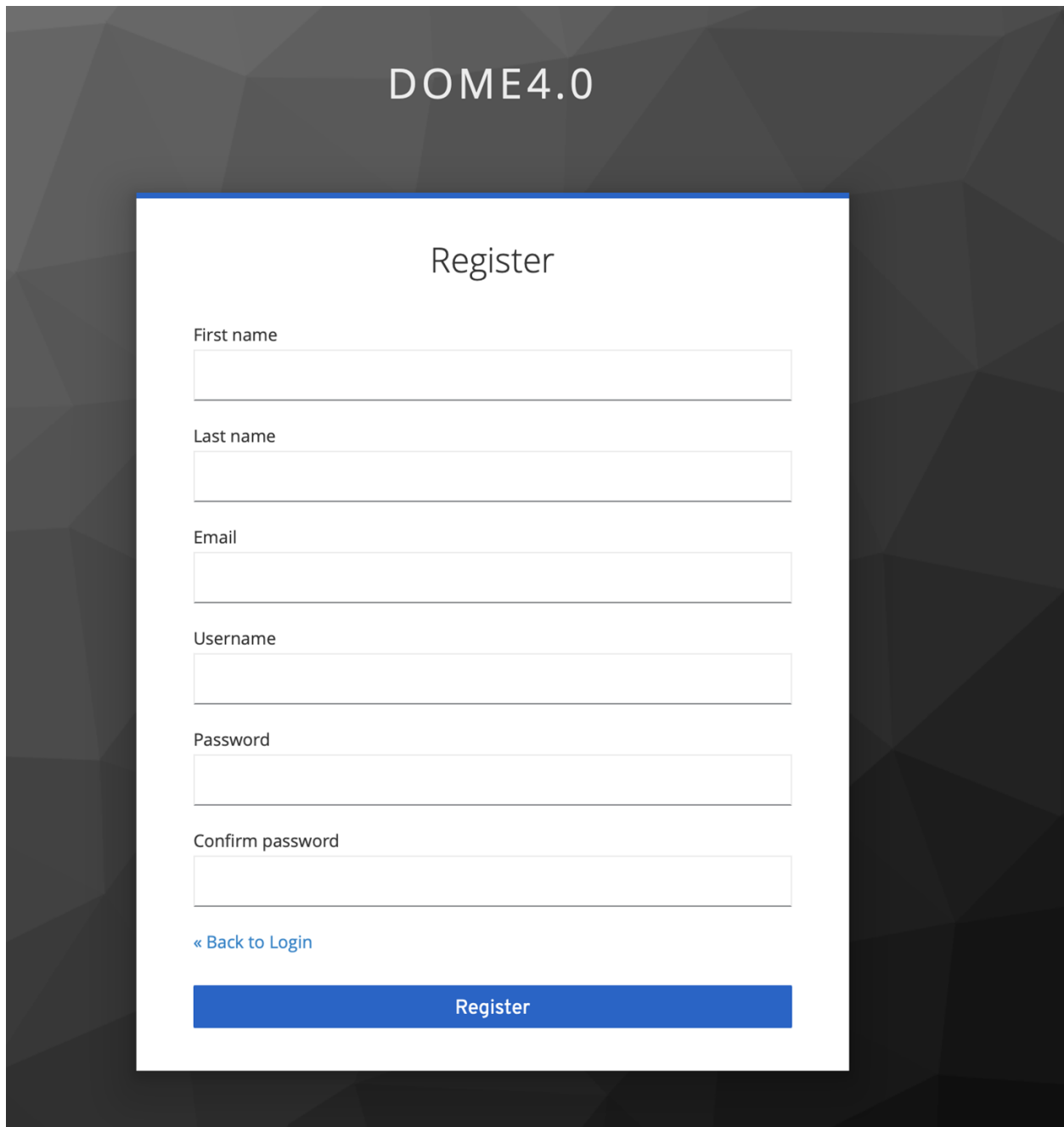


Figure 3: The login page of DOME 4.0. A user can choose to login with GitHub account or Register with a DOME 4.0 account.



DOME4.0

Register

First name

Last name

Email

Username

Password

Confirm password

[« Back to Login](#)

Figure 4: The DOME 4.0 native user registration form

3. Onboarding a data end user

The user story that is covered here is: “as an end user I want to use DOME 4.0 to semantically discover existing data in the marketplace ecosystem so that I can enrich my knowledge”. This user story addresses guiding a potential data user to semantically discover existing data in the marketplace.

Here are the steps and options that are currently supported on DOME 4.0 -vM36 (i.e, the version as of M36).

1. the user can directly use the Search bar on the main page to type search keywords. Currently, the main search of DOME 4.0 is keyword based and text based. As discussed in DOME 4.0 D3.1, we have extended the DCAT standard to seamlessly account for semantic keywords. This is partially supported in DOME 4.0 vM36 and as the ecosystem ontology is further streamlined to explicitly include the semantic keywords the search will enhance and become more semantic without any alterations to the onboarding service. In other words, the keyword typed by the user will be connected under the hood (backend) through the ecosystem ontology to the relevant semantic domains and platforms.

2. Once the user submits the search query, a set of results from various data sources are presented (not shown in the provided snapshot, results from other sources beside zenodo.org, e.g., materialsproject.org and crystallogry.net, are obtained from this search). These are obtained using the connector technology of DOME 4.0. See [Figure 5](#).

3. The user can then hover on a result and a “click for more” link appears, enabling the user to access more information and learn more about the platform and returned data.

4. Once the user clicks on the “click for more”, the user is displayed with further information about the identified data asset and the corresponding platform (if any). Currently, as shown in Figure 6, this information is presented in raw JSON format. This format is textual but is both user and machine friendly allowing the user to process it (see accessing the DOME 4.0 with API below). Depending on the support level and functionality that the platform owner allows, the user may have to register separately into the third-party service for further search, or additional data.

Future updates to the DOME 4.0 platform will develop more user-friendly representation of the results including advanced visualization.

Search Results

Keywords: carbon
Creator: zenodo.org

Keywords: carbon
Creator: zenodo.org

Keywords: Enhanced U-Net
Creator: zenodo.org

Keywords: microstructure, gliders, winter water, marginal ice zone, southern ocean
Creator: zenodo.org

Keywords: carbon
Creator: zenodo.org

Search

carbon

Filter ⓘ

Topic

- Cartography
- Engineering and technology
- Medical and health sciences
- Natural sciences
- Meteorology
- Sea vessels
- Navigation systems
- Topography

Product Type

- Experimental data
- Material property
- Modelling data
- Raw material
- Patent
- Equipment
- Software
- Publication
- Observational data

Figure 5: The Search Results windows of DOME 4.0.

Zenodo

A general purpose repository to share open and FAIR research outputs.

Metadata

```
{
  "Dataset": [
    {
      "url": "https://zenodo.org/api/records/4946595/files/Moore_2015_Final_Data.csv",
      "IssueDate": "2016-09-14",
      "License": "cc-zero",
      "Title": "Data from: Interactions among roots, mycorrhizae and free-living bacteria in a grassland soil",
      "URL": "https://zenodo.org/api/records/4946595",
      "dataCreator": "zenodo.org",
      "dataPublisher": "University of Tennessee at Knoxville",
      "keyword": "extra-cellular enzyme activity"
    }
  ]
}
```

Data

```
{
  "conceptrecid": "4946594",
  "created": "2021-06-14T15:21:35.512141+00:00",
  "doi": "10.5061/dryad.pb271",
  "doi_url": "https://doi.org/10.5061/dryad.pb271",
  "files": [
    {
      "checksum": "md5:d8f444e9bfdcd3f556964db489e85b8",
      "id": "674569e7-5948-47d3-af90-5342d26aff71",
      "key": "Moore_2015_Final_Data.csv",
      "links": {
        "self": "https://zenodo.org/api/records/4946595/files/Moore_2015_Final_Data.csv"
      },
      "size": 6974
    }
  ],
  "id": 4946595,
  "links": {
    "access": "https://zenodo.org/api/records/4946595/access",
    "access_links": "https://zenodo.org/api/records/4946595/access/links",
    "access_request": "https://zenodo.org/api/records/4946595/access/request",
    "access_users": "https://zenodo.org/api/records/4946595/access/users",
    "archive": "https://zenodo.org/api/records/4946595/files-archive",
    "archive_media": "https://zenodo.org/api/records/4946595/media-files-archive",
    "communities": "https://zenodo.org/api/records/4946595/communities",
    "communities-suggestions": "https://zenodo.org/api/records/4946595/communities-suggestions",
    "doi": "https://doi.org/10.5061/dryad.pb271",
    "draft": "https://zenodo.org/api/records/4946595/draft",
    "files": "https://zenodo.org/api/records/4946595/files",
    "latest": "https://zenodo.org/api/records/4946595/versions/latest",
    "latest_html": "https://zenodo.org/records/4946595/latest",
    "media_files": "https://zenodo.org/api/records/4946595/media-files",
    "parent": "https://zenodo.org/api/records/4946594",
    "parent_doi": "https://zenodo.org/doi/10.5061/dryad.pb271",
    "parent_html": "https://zenodo.org/records/4946594",
    "requests": "https://zenodo.org/api/records/4946595/requests",
    "reserve_doi": "https://zenodo.org/api/records/4946595/draft/pids/reserve",
    "self": "https://zenodo.org/api/records/4946595",
    "self_doi": "https://zenodo.org/doi/10.5061/dryad.pb271",
    "self_html": "https://zenodo.org/records/4946595",
    "self_iiif_manifest": "https://zenodo.org/api/iiif/record:4946595/iiif-manifest",
    "self_iiif_sequence": "https://zenodo.org/api/iiif/record:4946595/iiif-sequence",
    "versions": "https://zenodo.org/api/records/4946595/versions"
  },
  "metadata": {
    "access_links": "https://zenodo.org/api/records/4946595/access/links"
  }
}
```

Platform Type

DATA_PROVIDER

Free Platform

true

Domain

ENGINEERING_AND_TECHNOLOGY
NATURAL_SCIENCES

Offers

EXPERIMENTAL_DATA
MATERIAL_PROPERTY
PUBLICATION
OBSERVATIONAL_DATA

Home Page

<https://zenodo.org/>

Conforms to standard

None

API Documentation

<https://developers.zenodo.org/>

Query URL

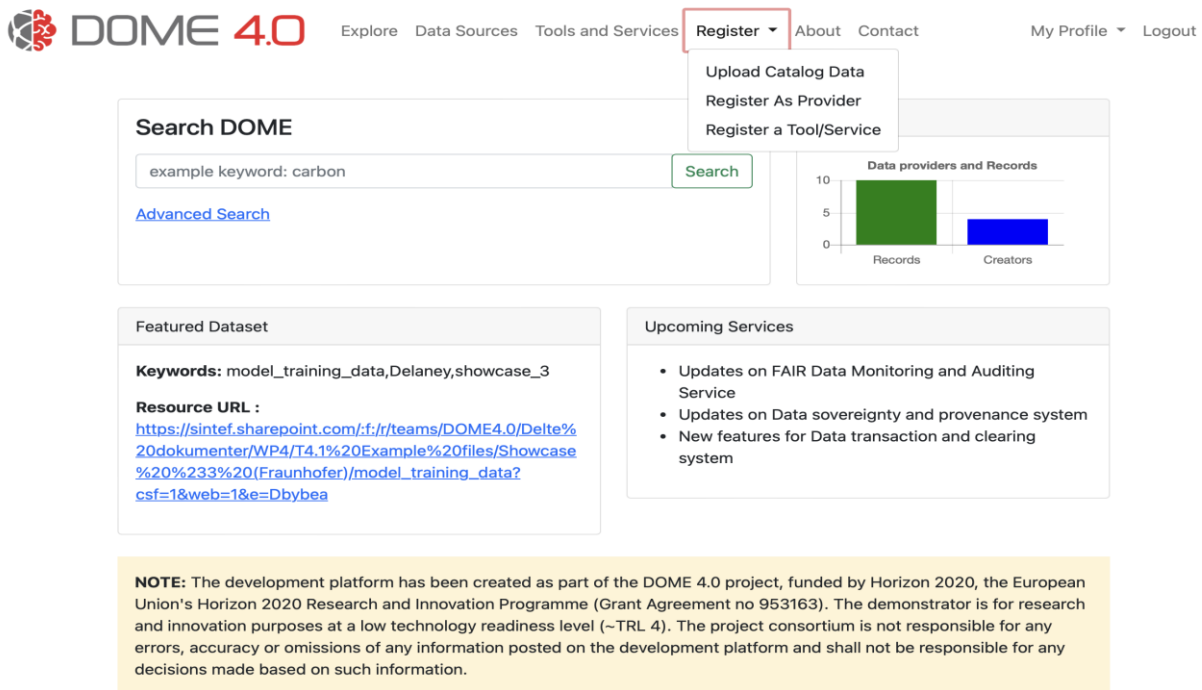
<https://dome-stage1nq.the-marketplace.eu/api/discover/results/fde/b73b5-65f0-4f5b-86a3-02ff9e8e540d>

Figure 6: Example of the "more details" results page. This page is currently technical in nature displaying a raw JSON data structure. More human friendly representation is part of the work in progress.

4. On-Boarding Data Provider/Owner

Onboarding a data provider or owner (here we do not distinguish between the specifics of the difference between the provider and owner) is done in two ways and in multiple steps in DOME 4.0. The initial step of course is that an owner should be registered as a user of the DOME platform, and this step is the same as the onboarding of an end user in the previous chapters.

There are 3 distinct ways to onboard a data provider or owner. The first consists of **uploading a data catalogue** of the datasets. This is useful for cases whereby the data is not yet available in electronic form or is under some sort of proprietary licence. The second **“Register as a provider”** approach covers the case where the provider supports existing open standards that are implemented in DOME 4.0 (meaning The Data Set based Ontology and DOME 4.0 API). The third way consists of **developing and deploying a specific connector** for the platform that allows users to directly perform search on the third-party data using specific, often non standardised, API and data formats of the connected platforms.



The screenshot shows the DOME 4.0 web application interface. The navigation bar includes the DOME 4.0 logo, 'Explore', 'Data Sources', 'Tools and Services', 'Register' (highlighted with a red box), 'About', 'Contact', 'My Profile', and 'Logout'. The 'Register' dropdown menu is open, showing three options: 'Upload Catalog Data', 'Register As Provider', and 'Register a Tool/Service'. The main content area features a search bar with the text 'example keyword: carbon' and a 'Search' button. Below the search bar is a link for 'Advanced Search'. To the right of the search bar is a bar chart titled 'Data providers and Records' showing 10 records and 5 creators. Below the search bar are two sections: 'Featured Dataset' and 'Upcoming Services'. The 'Featured Dataset' section includes keywords 'model_training_data, Delaney, showcase_3' and a resource URL. The 'Upcoming Services' section lists three updates: 'Updates on FAIR Data Monitoring and Auditing Service', 'Updates on Data sovereignty and provenance system', and 'New features for Data transaction and clearing system'. A yellow note at the bottom states: 'NOTE: The development platform has been created as part of the DOME 4.0 project, funded by Horizon 2020, the European Union's Horizon 2020 Research and Innovation Programme (Grant Agreement no 953163). The demonstrator is for research and innovation purposes at a low technology readiness level (~TRL 4). The project consortium is not responsible for any errors, accuracy or omissions of any information posted on the development platform and shall not be responsible for any decisions made based on such information.'

Figure 7: Use the Register submenu item to add a new catalog data, register as provider or register a tool or service.

4.1 Onboarding a Data Set Catalogue

By far the simplest and most straightforward onboarding of data is the use of the simple data set catalogue. Here, as shown in the Figure 8, the user merely needs to enter the title of the data or the resource name, the data set name or name for the resources, the creator, publisher, issue date and the data URL which may be an external homepage of any sort. The key here are the keywords which would convey the information about the specific data stored within the data set and it is used solely for the purpose of matching the data set with the search keywords of the user.

This addresses a scenario where the data is not yet available publicly or accessible through an electronic form or accessible through a public website endpoint and so the only aspects that we can add are simply the high-level meta data describing the data set. The information about the data-set content can only be provided through keywords.

In the current version of the DOME 4.0 platform, we only support syntactic keywords on the front end. However, the infrastructure for supporting the semantic keywords through the DOME 4.0 data set ontology (cf. DOME 4.0 Deliverable 3.1) is already in place in the back end and will be connected to the front end later. This will result in adding another input field in the front end which is for the semantic keywords which can only be chosen from supported ontologies.

Another particular use of this scenario is when the data is provided but, for instance, through a non-standard API which requires a specific connector to be developed. Here, while the connector is being developed the data provider or owner can use the data catalogue approach to make a number of datasets FAIR quickly and efficiently by providing the information about them using the DOME 4.0 data set ontology.

Register Data

NOTE: The development platform has been created as part of the DOME 4.0 project, funded by Horizon 2020, the European Union's Horizon 2020 Research and Innovation Programme (Grant Agreement no 953163). The demonstrator is for research and innovation purposes at a low technology readiness level (~TRL 4). The project consortium is not responsible for any errors, accuracy or omissions of any information posted on the development platform and shall not be responsible for any decisions made based on such information.

Keywords*

Title of Data (Resource Name)*

Dataset Name (Name for a set of Resources)*

Data Creator*

Data Publisher*

Issue Date*


Data URL*

Register

Figure 8: Registering a data catalogue for a specific data set. Note that semantic information can be included only using the keywords.

4.2 On boarding a Data Platform

Onboarding a data platform can be very straightforward if this data platform supports one of the widely available data standards that are built into DOME 4.0. For example, if a platform supports the OPTIMADE API, then adding the platform is as simple as filling the data provider form as shown in the Figure 8 below. This does not only add the platform, but it automatically makes any search on the DOME 4.0 platform execute in real time in that connected platform as well, and hence provides results directly from that platform to the end user. This is one of the unique propositions on features of the DOME 4.0 platform. Figure 9 shows an example of adding the Materials Project platform. Consequently, the information about the platform can be found under “Data Resources” as shown in Figure 10.

 Explore Data Sources Tools and Services Register ▾ About Contact My Profile ▾ Logout

Register a Data Provider

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Platform Name*

Platform Description

Platform Type*

Interactive app provider
 Data on demand provider
 Data provider

Conforms to Standard

Ids api specification
 Optimade api specification

Query URL*

API Documentation URL

Home Page URL

Offers data free of charge*

True
 False

Product Type*

Topic*

Figure 9: Example of registering the materials project platform provided it supports standard connectors on DOME 4.0.

Materials Project

Harnessing the power of supercomputing and state-of-the-art methods, the Materials Project provides open web-based access to computed information on known and predicted materials as well as powerful analysis tools to inspire and design novel materials.

Platform Type
DATA_PROVIDER

Free Platform
true

Domain
ENGINEERING_AND_TECHNOLOGY
NATURAL_SCIENCES

Offers
EXPERIMENTAL_DATA
MATERIAL_PROPERTY

Home Page
<https://next-gen.materialsproject.org>

Conforms to standard
OPTIMADE_API_SPECIFICATION

API Documentation

Query URL ⓘ
<https://dome-staging.the-marketplace.eu/api/discover/results/aaca08db-84ff-4cfe-9625-95cd868b2e2f>

Figure 10: Once a platform is registered (on boarded) it is available under Data Sources and all queries are directed to the platform as well.

4.3 Onboarding Custom Platforms with Specific Connector

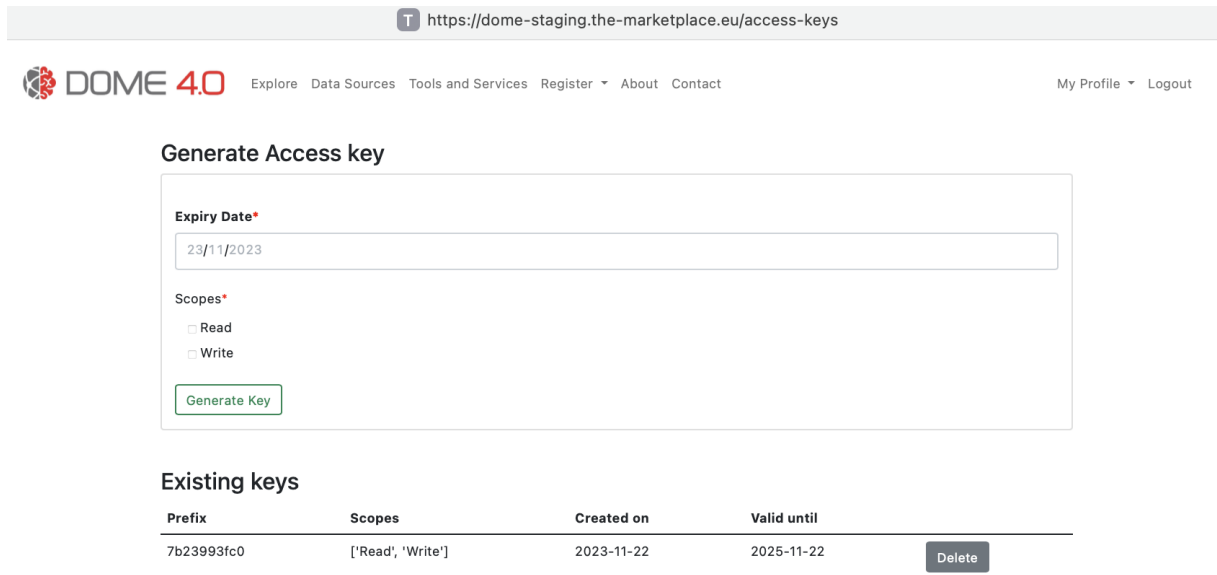
There is an increasingly large number of emerging data platforms. Many of which provide their own data and search standards that are specific to the kind of data and community they serve. For example, it is reasonable to assume that experimental data consisting of small number of process steps would have different requirements than high-throughput computational data that may have numerous large data files. It is also not realistic to assume that all platforms will support the same API and search standards, hence DOME 4.0 provides the concept of the unified Connector (see DOME 4.0 Deliverable D3.5). In this section we focus on the development of an on-boarding tool that allows rapid development of connectors.

Data Connectors are enablers of semantic data exchange on the DOME 4.0 platform. A Data Connector is an orchestrated container service providing semantic API interfaces to the DOME 4.0 front-end, backend and the third-party platform backends. To facilitate the development, a reference connector is developed in Task 3.5 and D3.5. Here, as part of the onboarding, a specific Onboarding tool is developed by SINTEF based on the initial connector developed by UCL. As the connector requires development of code, this tool is developer oriented albeit does not require deep programming knowledge and is intended for those with basic knowledge to be able to build a connector. It is mainly targeting platform owners which would be the majority of the users of this approach.


The tool is based on a software “cookie cutter” design principle, namely it is designed as a templating library for creating boilerplate for projects in any programming language. It alleviates most of the programming tasks needed and allows developers to focus on a small part of the code that is typically specific and limited in scope for each platform in the ecosystem. The cookie cutter code is essentially a pre-designed standardised blueprint for creating specific type of software components for connecting third party platforms in the DOME 4.0 ecosystem. The main specific aspects are parsing the data from the third-party platform and translating API from DOME 4.0 to the platform and back in such a way that DOME 4.0 can access the relevant metadata and data. The cookie cutter is part of the reference connector repository developed by SINTEF and found here: <https://github.com/DOME-4-0/reference-connector>. A step-by-step guide is available on the repository and is shown in the Appendix 1.

5. On-Boarding of CLI applications and agents

DOME 4.0 provides its own open standard REST API to allow third party applications (and platforms for that matter) to use the services. In particular, DOME 4.0 allows command line interface (CLI) applications and other platforms to access DOME 4.0 through an API. The first step is to obtain an API key using the ‘User Profile → Access Key’ menu item as shown in Figure 11. Once a user obtains an access key they can visit the API documentation page on the DOME 4.0 web site. An example of the use of the API to search for the keyword ‘carbon’ is shown in Figure 12.



https://dome-staging.the-marketplace.eu/access-keys


[Explore](#) [Data Sources](#) [Tools and Services](#) [Register](#) [About](#) [Contact](#)
[My Profile](#) [Logout](#)

Generate Access key

Expiry Date*

23/11/2023

Scopes*

Read

Write

[Generate Key](#)

Existing keys

Prefix	Scopes	Created on	Valid until	
7b23993fc0	['Read', 'Write']	2023-11-22	2025-11-22	Delete

Figure 11: Onboarding an API CLI application on DOME 4.0 requires an API access key.

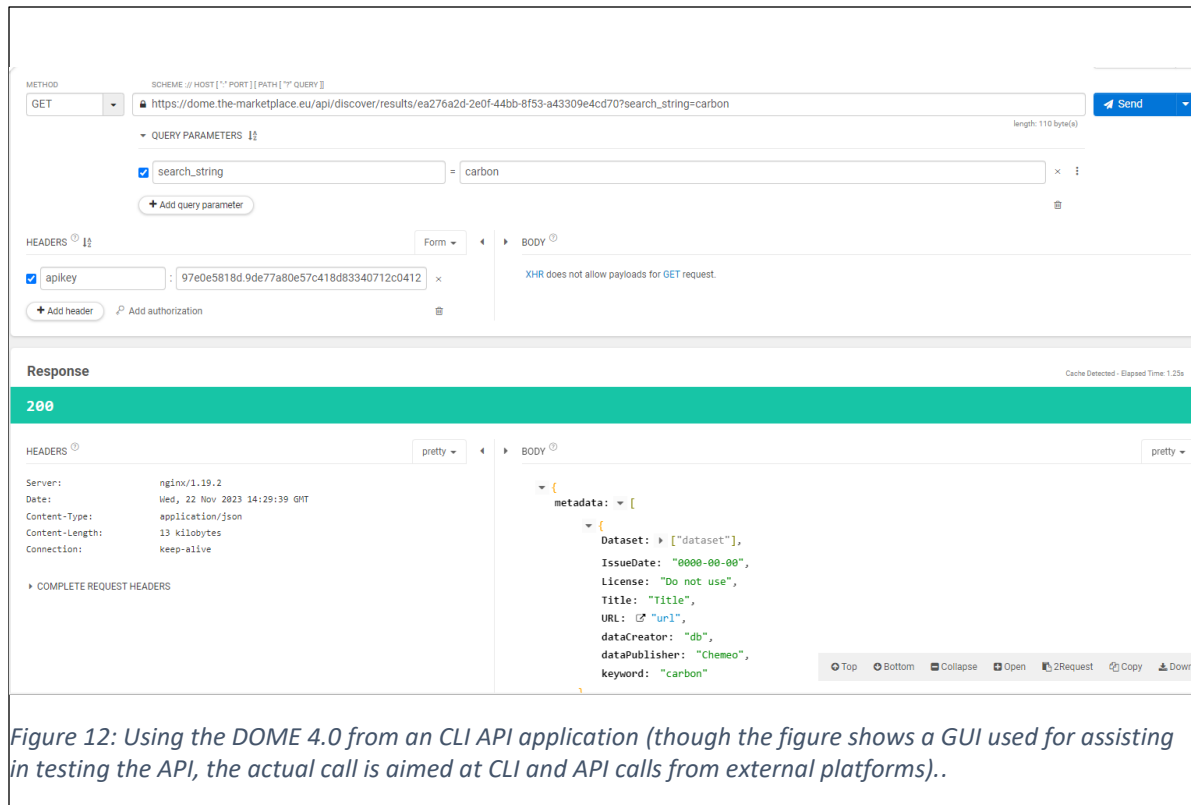


Figure 12: Using the DOME 4.0 from an CLI API application (though the figure shows a GUI used for assisting in testing the API, the actual call is aimed at CLI and API calls from external platforms)..

6. FAIR Onboarding

This means that the data must be supplied in a format that we can process. The FAIR service will check if a link published in DOME has a metadata payload that is FAIR, giving it a score (F-UJI). Best way to be FAIR by design is to use a common RDF serialization like JSON-LD, at the least, using properly ontologized (DCAT for datasets) contents. The F-UJI tool takes the link to the dataset and does a series of checks and returns a JSON with the results of the assessment, including a score. Low scores usually are caused by a bad serialization or lack of proper identifiers in the metadata. This stops F-UJI from reaching further stages. as the metadata cannot be parsed or certain IRIs accessed, if remote. Also, a good recommendation would be to use the DOME Ecosystem Ontology as the best level of support for FAIR data. Thus, in order of fitness, Ontologized JSON, any RDF, RDF with DCAT, RDF with the DOME Ecosystem Ontology.

7. Conclusions / Next steps

A set of tools and educational resources which are available on the DOME 4.0 web platform has been provided and pointed to in this deliverable to explain the various onboarding methods for all types of users and platforms, covering both data providers, owners, and consumers.

In tandem with the planned first release of DOME 4.0 official beta release in M40, the onboarding will be further refined and embedded into the code base of the platform to help rapid seamless onboarding and enable wider use of DOME 4.0

8. Lessons learnt

The Onboarding is very much related to the functionality and design of the platform; hence it was essential to first build the basis of the platform, have a running prototype and then develop the onboarding.

While proved to be very practical, in the next step the updates to the onboarding will be done through the code base of the platform and not as separate documentation.

9. Deviations from Annex 1

None.

10. Acknowledgement

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Project partners:

#	Type	Partner	Partner full name
1	SME	CMCL	Computational Modelling Cambridge Limited
2	Research	FHG	Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung E.V.
3	Research	INTRA	Intrasoft International SA
4	University	UNIBO	Alma Mater Studiorum – Università di Bologna
5	University	EPFL	Ecole Polytechnique Federale de Lausanne
6	Research	UKRI	United Kingdom Research and Innovation
7	Large Industry	SISW	Siemens Industry Software NV
8	Large Industry	BOSCH	Robert Bosch GmbH
9	SME	UNR	Uniresearch B.V.
10	Research	SINTEF	SINTEF AS
11	SME	CNT	Cambridge Nanomaterials Technology LTD
12	University	UCL	University College London



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Annex 1

11. Reference-Connector-Template

This is a template for a wrapper that will allow third-party connectors to provide data on the DOME 4.0 platform.

The template has been created using cookiecutter.

11.1 Generate your project from the template

First, install cookie-cutter according to the documentation.

Then run the following command to generate your project:

```
cookiecutter gh:DOME-4-0/reference-connector
```

Now type in the required inputs to customize your repository.

Alternatively, you can pre-define the inputs in a JSON file and pass it to the cookiecutter command using the `--config-file` option. The list of input keys and default values can be found in `cookiecutter.json`. An overview is also provided in the following table:

Input key	Description	Default value
project_name	A human-readable name of the project.	My DOME 4.0 connector
project_slug	The official package name to be used when installing the package via a package manager (e.g., pip or conda). This will be the root directory name and should also be the repository name on an online git repository (like GitHub or GitLab).	my-dome40-connector
package_name	The Python importable root module. This will be the root module repository name, under which the source code will be placed.	my_dome40_connector

Important: A project slug value may *not* include white space.

Important: A package name value

Input key	Description	Default value
	may <i>not</i> include white space. A package name value may <i>only</i> be made up of the character set: a-z, A-Z, _, 0-9, and may <i>not</i> start with a number.	
author	The author of the package. This can also be your organization name.	Firstname Lastname
organization	Your organization.	DOME 4.0
email	The author's email address.	firstname.lastname@DOME.org
version	Important: Must follow semantic versioning. For more information see semver.org .	0.0.1
year	The current year.	2023
use_git	Whether or not the generated repository should be initialized using git.	True
username	A public source code platform username, e.g., for GitHub, GitLab, BitBucket	GitHub_GitLab_BitBucket_etc_Username
scm_url	The intended or existing URL to the repository's source code.	https://github.com/FirstnameLastname/my-dome40-connector

Once the project is created , use the step by step guide under the folder Documents to create a connector and onboard the provider to the platform.