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| <b>Authors</b>                   | URBAN, Cristiano, VICINANZA, Martina, SPONZA, Massimo                                             |
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## DOI metadata generator

**Issue/Rev. No.:** 1.0

**Date:** May 15, 2026

**Authors:** Cristiano Urban<sup>a</sup>, Martina Vicinanza<sup>b</sup>, Massimo Sponza<sup>a</sup>

**Affiliations:** <sup>a</sup>INAF - Istituto Nazionale di Astrofisica - Osservatorio Astronomico di Trieste, <sup>b</sup>INAF - Istituto Nazionale di Astrofisica - Osservatorio Astronomico di Roma

**Approved by:** Riccardo Smareglia

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## 1 Introduction

This document describes the installation, configuration and usage of a simple web interface developed at IA2 and made available to the INAF community. The goal was to provide the user with a simple and intuitive interface for requesting a DOI registration and to minimize the manual operations required for registering a DOI from the administrator side. Section 2 briefly describes the software features, while section 3 illustrates the software installation procedure. Section 4 describes the application user flow. Section 5 provides a more detailed description of the application user interface. Section 6 shows an example of a resource description in XML format useful for registering a DOI.

## 2 Main features

This software was written using PHP for the backend and plain HTML and Javascript with Bootstrap[1] for the frontend.

The DOI metadata generator service provides the following features:

- Automatic generation of an XML resource for DOI[2] registration
- Automatic ORCID[3] validation through web API
- User input validation
- LDAP<sup>1</sup> authentication
- Checksum calculation for uploaded files
- Email notification system for both users and admins.

## 3 Installation instructions

This section describes step by step the installation procedure.  
The reference OS is a Rocky Linux 9.

First of all install the EPEL repository:

```
dnf install epel-release
```

Install PHP 8.3.9:

```
dnf install https://rpms.remirepo.net/enterprise/remi-release-9.rpm
dnf module switch-to php:remi-8.3
dnf module install php:remi-8.3
dnf install php php-mcrypt php-cli php-gd php-curl php-mysql php-ldap php-zip php-fileinfo php
➔ -xml php-intl php-mbstring php-fpm
```

Test PHP installation:

```
php --version
php --modules
```

Install, start the Apache web server and enable it at boot:

```
dnf install httpd
systemctl start httpd.service
systemctl enable httpd
```

Open internal firewall ports 80 and 443:

---

<sup>1</sup>Lightweight Directory Access Protocol: <https://datatracker.ietf.org/doc/html/rfc4511>



## DOI metadata generator

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```
firewall-cmd --permanent --zone=public --add-service=http
firewall-cmd --permanent --zone=public --add-service=https
firewall-cmd --reload
```

Install, start and enable Postfix (in our case, a relayhost must be added in `/etc/postfix/main.cf`):

```
dnf install postfix
systemctl enable postfix
systemctl start postfix
```

Perform a test from command line by sending an email to your email address:

```
dnf install s-nail
echo "Hello world" | s-nail -s "This is a test" RECIPIENT_EMAIL_ADDRESS
```

Enable Apache to connect to external resources (only required if SELinux is active in enforcing mode):

```
setsebool -P httpd_can_network_connect 1
```

Enable Apache to send emails using PHP (only required if SELinux is active in enforcing mode):

```
setsebool -P httpd_can_sendmail 1
```

Enable PHP debug by setting the following parameters in `/etc/php.ini` (it should be disabled in production):

```
- display_errors = On
- display_startup_errors = On
```

Limit the upload file size by setting the following parameters in `/etc/php.ini`:

```
- upload_max_filesize = 100M
- post_max_size = 110M
```

Install `mod_ssl` and `mod_ldap` modules for Apache:

```
dnf install mod_ssl mod_ldap
```

Create temporary self-signed certificates to enable HTTPS:

```
openssl req -x509 -nodes -days 365 -newkey rsa:2048 -keyout /etc/ssl/certs/doi.ict.inaf.it.key
➔ -out /etc/ssl/certs/doi.ict.inaf.it.crt
```

Create the virtual host configuration file:

```
cat > /etc/httpd/conf.d/doi.conf <<'EOF'
<VirtualHost *:80>
ServerName doi.ict.inaf.it
Redirect / https://doi.ict.inaf.it
</VirtualHost>

<VirtualHost _default_:443>
ServerName doi.ict.inaf.it
DocumentRoot /var/www/vhosts/doi

SSLEngine on
SSLCertificateFile /etc/ssl/certs/doi.ict.inaf.it/doi.ict.inaf.t.crt
SSLCertificateKeyFile /etc/ssl/certs/doi.ict.inaf.it/doi.ict.inaf.it.key

SSLProtocol all -SSLv2 -SSLv3
SSLCipherSuite ECDHE-ECDSA-CHACHA20-POLY1305:ECDHE-RSA-CHACHA20-POLY1305:ECDHE-ECDSA-
➔ AES128-GCM-SHA256:ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES256-GCM-SHA384:ECDHE-RSA-
➔ AES256-GCM-SHA384:DHE-RSA-AES128-GCM-SHA256:DHE-RSA-AES256-GCM-SHA384:ECDHE-ECDSA-AES128
➔ -SHA256:ECDHE-RSA-AES128-SHA256:ECDHE-ECDSA-AES128-SHA:ECDHE-RSA-AES256-SHA384:ECDHE-RSA
➔ -AES128-SHA:ECDHE-ECDSA-AES256-SHA384:ECDHE-ECDSA-AES256-SHA:ECDHE-RSA-AES256-SHA:DHE-
➔ RSA-AES128-SHA256:DHE-RSA-AES128-SHA:DHE-RSA-AES256-SHA256:DHE-RSA-AES256-SHA:ECDHE-
➔ ECDSA-DES-CBC3-SHA:ECDHE-RSA-DES-CBC3-SHA:EDH-RSA-DES-CBC3-SHA:AES128-GCM-SHA256:AES256-
➔ GCM-SHA384:AES128-SHA256:AES256-SHA256:AES128-SHA:AES256-SHA:DES-CBC3-SHA:!DSS

SSLHonorCipherOrder on

<IfModule mod_headers.c>
Header always set Strict-Transport-Security "max-age=15552000; includeSubDomains"
</IfModule>
```

|                                                                                   |                        |                                                                                                                                              |                |     |      |              |      |         |
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```
CustomLog logs/doi/access.log combined
ErrorLog logs/doi/error.log
LogLevel error
ServerSignature Off
```

```
<Directory "/var/www/vhosts/doi">
Options Indexes FollowSymLinks
AllowOverride None
Require all granted
</Directory>

</VirtualHost>
EOF
```

Create a folder for storing uploads:

```
mkdir -p /var/www/vhosts/doi/uploads
```

Install git:

```
dnf install git
```

Clone the doi-metadata-generator repository<sup>[4]</sup>, copy all the content of the www folder in /var/www/vhosts/doi and set the right permissions:

```
git clone https://www.ict.inaf.it/gitlab/ia2/doi-metadata-generator.git
cd doi-metadata-generator
cp -r www /var/www/vhosts/doi/
chown -R apache:apache /var/www/vhosts/doi
```

Restart Apache:

```
systemctl restart httpd
```

Install Certbot with also the corresponding Apache plugin:

```
dnf install certbot python3-certbot-apache
```

Start the ACME<sup>2</sup> challenge to get the SSL certificate (this will change the Apache configuration transparently):

```
certbot --apache -d doi.ict.inaf.it
```

Configure automatic renew of certificate by adding the following content into the crontab file:

```
MAILTO="A COMMA-SEPARATED LIST OF EMAIL ADDRESSES"
0 */12 * * * /usr/bin/certbot -q renew --apache
```

## 4 User flow

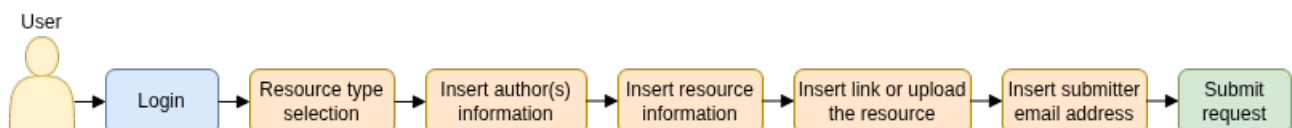


Figure 1: DOI metadata generator user flow.

The user lands on the login screen and performs a login using the INAF credentials.

<sup>2</sup>Automatic Certificate Management Environment: <https://datatracker.ietf.org/doc/html/rfc8555>

|                                                                                   |                        |                                                                                                                                              |                |     |      |              |      |         |
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After logging in, the user is redirected to the index page of the application. The first step the user has to do is to select the type of resource for which he/she wishes to request a DOI.

Once the resource type has been selected, the user must enter the information for one or more authors. Next, the resource fields must be filled in, including the resource location (URL or manual upload, depending on the resource type previously chosen). Not all fields are mandatory.

The submitter is then asked for a valid email address.

Once the form is filled out, the request can be sent. User input validation is performed mostly by the frontend and partially by the backend.

When the request is sent, the user data is processed by the backend, an XML file containing the resource description is generated and a notification email is sent to both the user and the service administrators, with also the generated XML file attached.

An administrator can now use the XML file to register the DOI to the DataCite[5] catalogue.

## 5 The web interface

This section will show an overview of the DOI metadata generator web interface.

### 5.1 Login screen

After pointing the browser to <https://doi.ict.inaf.it> the login screen appears. Authentication relies on the INAF LDAP server, so only people possessing an INAF account can login.

A session lasts one hour, after which it is automatically destroyed and a new login operation must be performed.

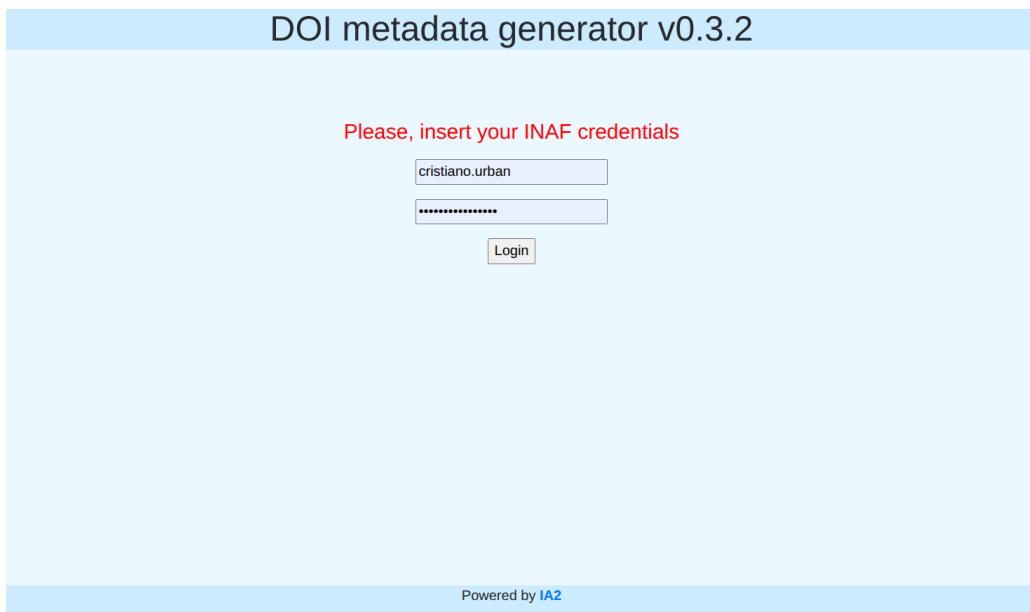


Figure 2: DOI metadata generator login screen.

## 5.2 Index page

After login, the user is redirected to the index page (figure 3). Visible fields include both common fields to all the resource types and specific fields of the selected resource type. This details will become more clear in the following sections.

### DOI metadata generator v0.3.2

[Click here](#) for more information about interface usage  
**Contacts and support: [doi.ict@inaf.it](mailto:doi.ict@inaf.it)**

**Resource type**

Dataset ▾

The type of resource

**Current authors: 1**

Add author
Remove author

**Surname**

Insert author surname

Author surname

**Name**

Insert author name

Author name

**ORCID**

Insert author ORCID

Author [ORCID](#) (e.g. "0000-0002-1825-0097")

**Affiliation type**

INAF ▾

Author affiliation type

**INAF affiliation**

Select... ▾

Author affiliation (INAF)

**Title**

Insert title

The title of your resource

**Created on**

gg/mm/aaaa

When the resource was created

**Available from**

gg/mm/aaaa

When the resource was made available

**Modified on**

gg/mm/aaaa

Date of resource last modification

**File format**

.tar.gz ▾

The file format of your resource (e.g. "tar.gz")

**File size**

0

File size and unit (e.g. "127.89 GB" with max 2 decimal digits)

**Unit**

MB ▾

**Version**

Insert version

Version of your resource (e.g. "2.2.8")

**Publisher**

Select... ▾

The institution responsible for publication

**Language**

English ▾

The publication language

**Abstract**

Insert your abstract here...

A short (plain) text illustrating the resource content

**Associated papers**

Insert associated papers here (if any)...

Field to insert associated papers, if any

**License type**

GPLv3 ▾

The license of your resource

**Location**

File upload (local) ▾

The location of your resource

**Upload your file (max size: 100 MB)**

Scegli file

A file containing all your data (e.g. "mydata.tar.gz")

**Email address (you will receive a notification)**

Insert your email here...

We will never share your email with anyone else

Submit

Powered by [IA2](#)

Figure 3: DOI metadata generator index page: the default selected resource type is a Dataset.

|                                                                                   |                        |                                                                                                                                              |                |     |      |              |      |         |
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### 5.2.1 Resource type

A drop-down list to select one of the four available resource types:

- Dataset
- Movie
- Software
- astroEDU[6]

By default a Dataset resource type is set.

**Dataset** and **Movie** basically present the same layout and fields. The only difference between the two is represented by the values assumed by the file format drop-down list (see 5.2.5). While a dataset can be packed in multiple formats (e.g. .tar.gz, .zip. etc...), a movie has a predefined file format set to `application/octet-stream`. **Software** layout is similar to the previous ones, except for the file information fields which are not present. Instead, there is a drop-down list to select the programming language.

As for **astroEDU**, which is an open-access platform for peer-reviewed science education activities, the file information fields (see 5.2.5) and the license type drop-down list (see 5.2.12) are not present.

### 5.2.2 Author(s)

By default there must be at least one author. Each author is represented by a row containing the following fields:

- Surname
- Name
- ORCID
- Affiliation (INAF or external).

All these fields are mandatory but the ORCID.

### 5.2.3 Title

This field represents the title of the resource and is mandatory.

### 5.2.4 Dates

There are three date fields representing respectively:

- the resource creation date (**Created on**)
- the availability date (**Available from**)
- the last modification date (**Modified on**).

All of these fields are mandatory. Moreover, the following conditions must be met:

- **Created on** date must be older than or equal to **Available from** date
- **Available from** date must be older than or equal to **Modified on** date.

### 5.2.5 File information fields

File information fields are shown only for **Dataset** and **Movie** resource types.

- File format: a drop-down list to select the file format (default is .tar.gz)
- File size: a field to insert the numeric file size, default is 0 (this field is mandatory)
- Unit: a drop-down list to select the unit associated to the file size, default is MB

### 5.2.6 Version

Represents the version of the resource (e.g. 2.2.8). This field is mandatory.

### 5.2.7 Publisher

A drop-down list representing the institution responsible for the publication (e.g. O.A. Roma). For astroEDU resource type the value is automatically set to **astroEDU**. This field is mandatory.

### 5.2.8 Language

A drop-down list for selecting the resource publication language. The choice is between **English** (default) and **Italian**.

### 5.2.9 Programming language

A drop-down list that allows users to choose from a wide range of programming languages. Default value is not set. If the desired programming language is not present in the list, it is still possible to enter it manually. This item is shown only if the **Software** resource type is selected and is not mandatory.

### 5.2.10 Abstract

A mandatory text box for inserting an abstract.

### 5.2.11 Associated papers

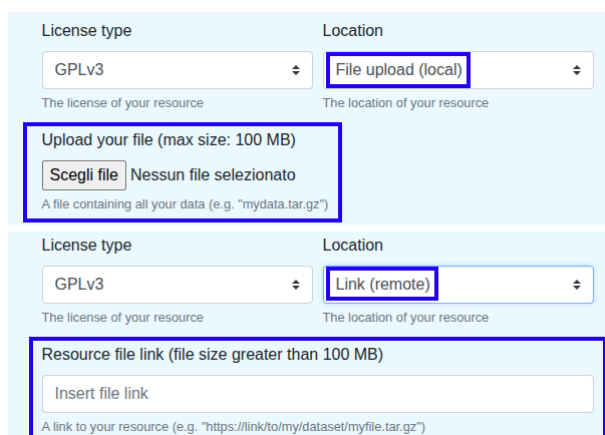
A text box that allows users to enter, one per row, any paper related to the resource. This field is not mandatory and is visible only for **Dataset**, **Movie** and **Software** resource types.

### 5.2.12 License type

This is a drop-down list to select the license under which the resource is released. Default value is GPLv3. This field is visible for all the resource types but astroEDU.

### 5.2.13 Location

A drop-down list representing the location of the resource. As shown in the figure 4, the location can be local (a file must be uploaded) or remote (a valid link must be provided). The local option sets a limit of 100 MB for the upload operation. This item is shown for all the resource types but astroEDU.



The figure displays two panels illustrating resource location options. Both panels have a 'License type' dropdown menu set to 'GPLv3'.

**Top Panel (File upload (local)):**

- Location:** File upload (local)
- Upload your file (max size: 100 MB):** A section containing a 'Scegli file' button and the text 'Nessun file selezionato'.
- Text:** A file containing all your data (e.g. "mydata.tar.gz")

**Bottom Panel (Link (remote)):**

- Location:** Link (remote)
- Resource file link (file size greater than 100 MB):** A section containing a text input field with the placeholder 'Insert file link'.
- Text:** A link to your resource (e.g. "https://link.to/my/dataset/myfile.tar.gz")

Figure 4: Resource location: local (file upload) and remote (link).

### 5.2.14 Website link

Represents a link (a URL) to the website that hosts the resource. This field is visible only for the **astroEDU** resource type and is mandatory.

### 5.2.15 Email address

A valid email address for the request submitter. This is used by the backend to send a confirmation email to the user after submitting the DOI request. This field is mandatory.

## 5.3 ORCID validation

The ORCID validation involves both the frontend and the backend. On the client side a pattern validation ensures that the ORCID inserted by the user is a valid ORCID. Once this is verified, if the ORCID is valid, an AJAX<sup>3</sup> request is sent to a backend endpoint that communicates with the ORCID Web APIs to obtain more information about the ORCID state and finally send it back to the frontend.

According to the information retrieved by the backend, there are three possible cases:

- the ORCID is valid, exists and is active
- the ORCID is valid, exists but is locked or deactivated
- the ORCID is valid, but it does not exist.

In the figure 5 the ORCID of the first author is valid, exists and is active. The second one is valid but it does not exist and the third one is invalid.

Surname
Name
ORCID
Cristiano Urban ✓

Urban
Cristiano
0000-0001-8417-0346

Author surname
Author name
Author ORCID (e.g. "0000-0002-1825-0097")

Surname
Name
ORCID
This ORCID does not exist ✗

Urban
Cristiano
0000-0001-8417-0347

Author surname
Author name
Author ORCID (e.g. "0000-0002-1825-0097")

Surname
Name
ORCID
Invalid ORCID format ✗

Urban
Cristiano
0000-0001-8417-0347?

Author surname
Author name
Author ORCID (e.g. "0000-0002-1825-0097")

Figure 5: ORCID validation.

<sup>3</sup>Asynchronous JavaScript and XML

5.4 Adding and removing authors

Resource type

Dataset

The type of resource

Current authors: 1

Add author

Remove author

Add a new author section

| Surname        | Name        | ORCID                                     | Affiliation type        | INAF affiliation          |
|----------------|-------------|-------------------------------------------|-------------------------|---------------------------|
| Urban          | Cristiano   | 0000-0001-8417-0346                       | INAF                    | O.A. Trieste              |
| Author surname | Author name | Author ORCID (e.g. "0000-0002-1825-0097") | Author affiliation type | Author affiliation (INAF) |

Resource type

Dataset

The type of resource

Current authors: 2

Add author

Remove author

| Surname        | Name        | ORCID                                     | Affiliation type        | INAF affiliation          |
|----------------|-------------|-------------------------------------------|-------------------------|---------------------------|
| Urban          | Cristiano   | 0000-0001-8417-0346                       | INAF                    | O.A. Trieste              |
| Vicinanza      | Martina     | 0000-0002-2179-2268                       | INAF                    | O.A. Roma                 |
| Author surname | Author name | Author ORCID (e.g. "0000-0002-1825-0097") | Author affiliation type | Author affiliation (INAF) |

Figure 6: Adding a new author

It is possible to add more authors by clicking on the **Add author** green button. Once this button is clicked, a new row containing the fields for a new author appears, the author counter (Current authors) is incremented by one, and the red **Remove author** button is enabled (figure 6). Clicking this button removes the last row containing the author’s fields and decreases the author counter.

Although only INAF users can access the web application, it is still possible to add authors whose affiliation is external to INAF (figure 7).

Resource type

Dataset

The type of resource

Current authors: 3

Add author

Remove author

| Surname        | Name        | ORCID                                     | Affiliation type        | INAF affiliation                   |
|----------------|-------------|-------------------------------------------|-------------------------|------------------------------------|
| Urban          | Cristiano   | 0000-0001-8417-0346                       | INAF                    | O.A. Trieste                       |
| Vicinanza      | Martina     | 0000-0002-2179-2268                       | INAF                    | O.A. Roma                          |
| John           | Smith       | Insert author ORCID                       | Other institution       | California Institute of Technology |
| Author surname | Author name | Author ORCID (e.g. "0000-0002-1825-0097") | Author affiliation type | Author affiliation (external)      |

Figure 7: Adding authors with external affiliation.

Bear in mind that surname, name and affiliation (INAF or external) are mandatory fields.

|                                                                                   |                        |                                                                                                                                               |                |     |      |              |      |          |
|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----|------|--------------|------|----------|
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## 5.5 Email notifications

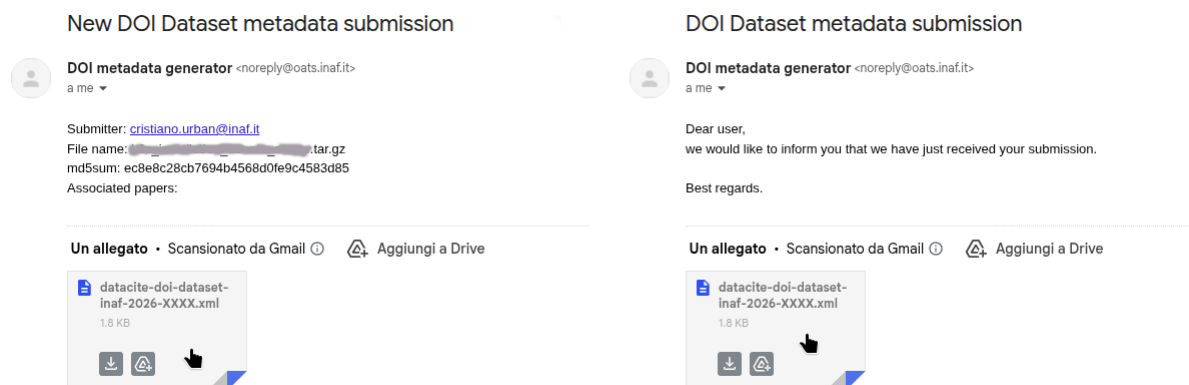


Figure 8: Administrator notification (on the left) and user notification (on the right).

Once all fields have been filled out and the DOI registration request has been submitted, two notification emails are sent: one to the user to confirm receipt of the request and one to the administrators to notify them of the arrival of a new registration request (figure 8).

In both cases, a copy of the resource description in XML format is attached to the message.

The notification received by the administrators provides additional details, such as the name of the uploaded file (or the link to the resource), the checksum, and any associated papers.

## 5.6 FAQ and support

On the top of the web page is reported an email address for support with also a link which opens a modal window displaying some frequently asked questions (figure 9).

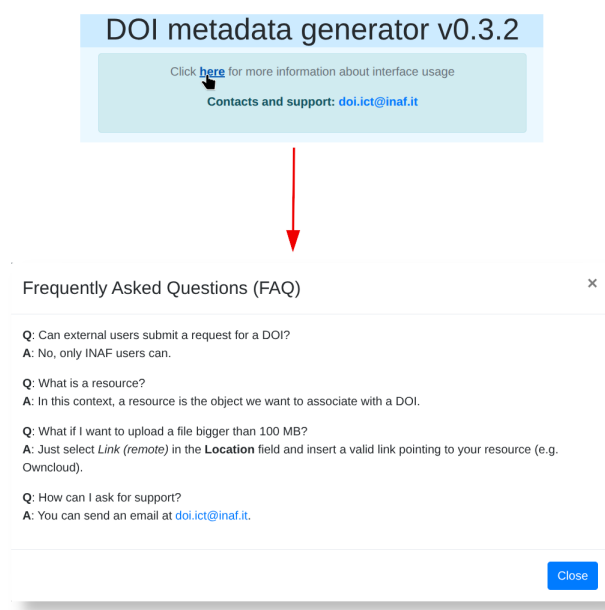


Figure 9: The FAQ modal window.

|                                                                                   |                        |                                                                                                                                               |                |     |      |              |      |          |
|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----|------|--------------|------|----------|
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| Issue/Rev. No.                                                                    | 1.0                    |                                                                                                                                               |                |     |      |              |      |          |
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## 6 An example of resource description

The listing below shows the structure of an XML file containing a resource description. Various information is provided. For example, the resource is of the Software type, the programming language is Python, three authors are listed, the publisher is the Astronomical Observatory of Rome, the software is licensed under MIT, etc...

Before registering the DOI, the administrator must replace the string XXXXX within the <identifier> attribute with a sequential number based on the numbers used to register previous DOIs.

```
<?xml version="1.0" encoding="UTF-8"?>
<resource xmlns="http://datacite.org/schema/kernel-4" xmlns:xsi="http://www.w3.org/2001/
  ↳ XMLSchema-instance" xsi:schemaLocation="http://datacite.org/schema/kernel-4 http://
  ↳ schema.datacite.org/meta/kernel-4.1/metadata.xsd">
  <identifier identifierType="DOI">10.20371/INAF/SW/2026_XXXXX</identifier>
  <creators>
    <creator>
      <creatorName>Urban, Cristiano</creatorName>
      <givenName>Cristiano</givenName>
      <familyName>Urban</familyName>
      <nameIdentifier schemeURI="http://orcid.org/" nameIdentifierScheme="ORCID"
        ↳ ">0000-0001-8417-0346</nameIdentifier>
      <affiliation>INAF-O.A. Trieste</affiliation>
    </creator>
    <creator>
      <creatorName>Vicinanza, Martina</creatorName>
      <givenName>Martina</givenName>
      <familyName>Vicinanza</familyName>
      <nameIdentifier schemeURI="http://orcid.org/" nameIdentifierScheme="ORCID"
        ↳ ">0000-0002-2179-2268</nameIdentifier>
      <affiliation>INAF-O.A. Roma</affiliation>
    </creator>
    <creator>
      <creatorName>Sponza, Massimo</creatorName>
      <givenName>Massimo</givenName>
      <familyName>Sponza</familyName>
      <nameIdentifier schemeURI="http://orcid.org/" nameIdentifierScheme="ORCID"
        ↳ ">0000-0002-3357-4890</nameIdentifier>
      <affiliation>INAF-O.A. Trieste</affiliation>
    </creator>
  </creators>
  <titles>
    <title xml:lang="en"/>
  </titles>
  <publisher>O.A. Roma</publisher>
  <publicationYear>2026</publicationYear>
  <resourceType resourceTypeGeneral="Software">Software</resourceType>
  <dates>
    <date dateType="Created">2026-04-28</date>
    <date dateType="Available">2026-04-28</date>
    <date dateType="Updated">2026-04-28</date>
  </dates>
  <language>en</language>
  <formats>
    <format>application/Python</format>
  </formats>
  <version>1.0</version>
  <rightsList>
    <rights rightsURI="https://opensource.org/licenses/MIT">MIT License</rights>
  </rightsList>
  <descriptions>
    <description xml:lang="en" descriptionType="Abstract">Just another Python software.</
      ↳ description>
  </descriptions>
</resource>
```

|                                                                                   |                        |                                                                                                                                               |                |     |      |              |      |          |
|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----|------|--------------|------|----------|
|  | DOI metadata generator | <table><tr><td>Issue/Rev. No.</td><td>1.0</td></tr><tr><td>Date</td><td>May 15, 2026</td></tr><tr><td>Page</td><td>14 of 15</td></tr></table> | Issue/Rev. No. | 1.0 | Date | May 15, 2026 | Page | 14 of 15 |
| Issue/Rev. No.                                                                    | 1.0                    |                                                                                                                                               |                |     |      |              |      |          |
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## 7 Conclusion

Developing an application that allows the generation of a DOI description from a clear and intuitive interface, greatly simplifies user interaction and drastically reduces the manual workload for those responsible for DOI registration. Regarding future developments, it is necessary to first evaluate any new requirements, including integration with other existing software.

|                                                                                   |                        |                                                                                                                                               |                |     |      |              |      |          |
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