ZEEROmed Store

User Manual

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Mark	CE **CE mark** under the Medical Device Regulaton EU 2017/745
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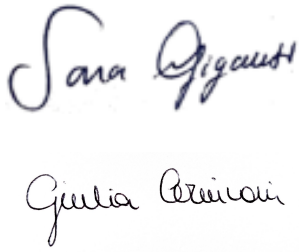
Written/modified by:	Sara Giganti Giulia Cernivani	23/04/2025	
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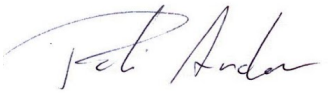
Approved by:	Andrea Poli	23/04/2025	

Modifications from previous system version	
Modifications	**Chapter**
Sections 1.3 and 1.4 update	Introduction

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1 Introduction

O3IMS.Store is a PACS system (Picture Archiving and Communication System) that manages all the types of data and signals that can be handled through the DICOM standard. The product is intended for the storage and management of biomedical images, especially those relate to radiological specialties. Hereafter, it is referred to as the "product" or "system".

1.1 Manufacturer Essential Data

NAME: O3 Enterprise srl

HEAD OFFICE: AREA Science Park, Padriciano 99, 34149, Trieste, ITALY

OPERATIONAL CENTRE: AREA Science Park, Padriciano 99, 34149, Trieste, ITALY

LOCAL UNIT: Via Caprin 18, 34170, Gorizia, ITALY

VAT NUMBER: 01137150320

1.2 Medical Device description and specifications

Device name	**ZEEROmed Store**
Intended purpose	Software application which aims to provide support for archiving and distributing images and clinical data. The product is intended for storing, managing and transmitting images and clinical data.

General description of the device	ZEEROmed Store is a Medical Device Software (MDSW) that provides a web interface easy to use. It's a PACS (picture archiving and communication system) without the possibility to visualize the image, which can be achieve in combination with another third party software. The system does not apply any filter to the images, if configured it can perform a lossless compression. The eventual alteration of the images is eventually delegated to other connected systems. The system does not show any warnings or alarms originating from other medical equipment and does not mean to control or influence usage of medical devices, nor change their normal use. The device is not intended for supporting vital functions, nor for influencing devices which support vital functions.
Intended patient population	There is not a specific intended population designated to be treated with this MDSW because of its intended purpose (archiving patients images and clinical data). All patient populations can indirectly benefit from this MDSW if needed.
Intended user	Administrator systems and technicians
Medical condition	There is no clinical condition that is to be diagnosed, prevented, monitored, treated, alleviated, compensated for, replaced, modified or controlled by this medical device because ZEEROmed Store is used for archiving and distributing images and clinical data. It is not used directly to diagnose a medical condition, but it's used in combination with other software and devices to do so.
Indication for use	Usage of the device and changes to its configuration are to be allowed just to qualified personnel trained on the system, through the use of suitable protection means, such as usage of appropriate usernames and passwords. Users lacking the appropriate training could not be able to correctly understand the information provided by the system, to change its parameters and/or enforce appropriate security measures.
Contraindication	There are NO contraindications
Warning	There are NO warnings
Side effects	There are NO side effects
Lifetime	ZEEROmed Store is considered obsolete if it hasn't received any system updates for three years

Table 1: Medical Device description and specifications

1.3 Information on incidents

The user shall inform the competent authorities of:

- any malfunction or deterioration in the characteristics or performance of a device made available on the market, including use-error due to ergonomic features, as well as any inadequacy in the information supplied by the manufacturer and any undesirable side-effect
- any incident that directly or indirectly led, might have led or might lead to any of the following:
    - the death of a patient, user or other person,
    - the temporary or permanent serious deterioration of a patient's, user's or other person's state of health,
    - a serious public health threat;
- any adverse event that led to any of the following:
    - death,
    - serious deterioration in the health of the subject, that resulted in any of the following:
        - life-threatening illness or injury,
        - permanent impairment of a body structure or a body function,
        - hospitalisation or prolongation of patient hospitalisation,
        - medical or surgical intervention to prevent life-threatening illness or injury or permanent impairment to a body structure or a body function,
        - chronic disease,
    - foetal distress, foetal death or a congenital physical or mental impairment or birth defect.

Such incidents or adverse events must be reported to O3 Enterprise s.r.l., as the manufacturer of the MD, at the following email addresses:

- qualita@o3enterprise.com;
- claims@o3enterprise.com.

1.4 Minimal and recommended technical requirements

1.4.1 Minimal server requirements

1.4.1.1 Operating system

The application can run on any 64-bit Linux OS compatible with Docker Engine.

The recommended Linux operating systems are:

- Ubuntu 20.04 LTS or 22.04 LTS
- RHEL-based OS

1.4.1.2 Minimal HW requirements

Hardware sizing might slightly vary based on the modalities used by customers and on concurrent users.

Concurrent users	CPU cores*	RAM
10	6 cores	12 GB
20	10 cores	20 GB
50	18 cores	36 GB
50+	+1 core per 10 concurrent users	+4 GB per 10 concurrent users

Table 2: Minimal HW requirements

* Equivalent of 7th generation Intel i5 2.4 GHz CPU core.

⚠**Note**: to ensure optimal performance, digital pathology projects require 1.5 CPU cores per concurrent user

The hardware requirements above refer to a load of fewer than 150 exams per day (each containing 200 images). If the load is higher, more resources must be provided for the system.

The storage is used for software and temporary data cache. At least 50 GB of storage size is recommended.

Since the network bandwidth directly affects opening speed, we recommend at least 100 Mbit/s.

1.4.2 Client requirements

Desktop web HTML5	
CPU	Intel i3 4 core CPU or better
RAM	8+ GB of RAM, 256+ MB of video memory
Storage space	10+ GB
Network bandwidth	100+ Mbit/s
Web browsers	Google Chrome 112+**, Microsoft Edge 112+, Mozilla Firefox 112+, Safari 16+

Table 3: Minimal client requirements

** To achieve the best performance, it is recommended to use **Google Chrome**.

1.5 The device

The product is a software application that enables doctors, professionals and technicians to store and distribute clinical images and data.

The system communicates through standard protocols such as DICOM, HL7, and WADO, and it is also compliant with the Integrating the Healthcare Enterprise (IHE) initiative.

It consists of modules that can be configured by system administrators in order to achieve an effective and efficient integration with other Hospital Information Systems, to which the device can be connected.

2 Login

Steps to log in:

1. Go to the following address: *https://pacs.<customer_name>.zeeromed.cloud/o3-ipm-web*;
2. Enter *Username* and *Password*;
3. Click on the "*Login*" button.

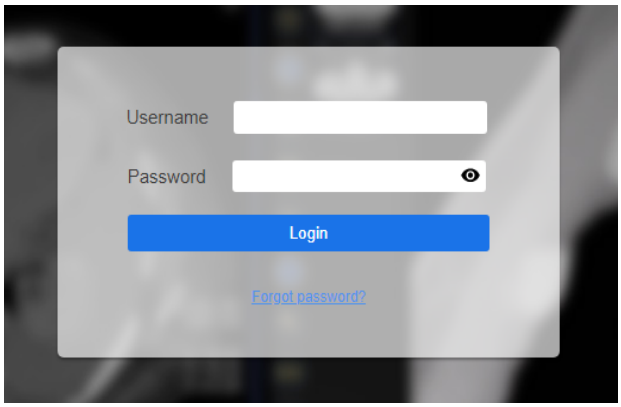


Image 4: Username and password

2.1 Password recovery

Steps to recovery the password:

1. Click on the "*Forget password*" button;
2. Insert the email address in the pop-up window:

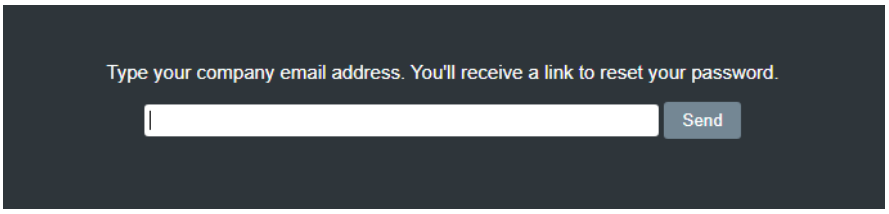


Image 5: Forgot password pop-up

3. Check the email and follow the steps provided to reset the password. The new password must comply with the criteria define in paragraph **2.3 Password formulation criteria**.

2.2 Edit password

After the first login, change the temporary password provided by O3 Enterprise by clicking the "Edit" icon in the User Management section.

The new password must comply with the criteria defined in paragraph **2.3 Password formulation criteria**.

2.3 Password formulation criteria

For password creation, it is recommended to consider the following criteria:

- Minimum length of 6 characters;
- Maximum length of 100 characters;
- At least 1 uppercase letter;
- At least 1 lowercase letter;
- At least 1 numeric character;
- At least 1 non-alphanumeric character (such as ^ $ * . [ ] { } ? " ! @ # % & / \ , > < ' : ; | _ ~ `).

Note: Password formulation criteria are configurable, so they can be different according to the type of project.

3 Dashboard

Once logged in, the following "*Image Management*" screen is displayed:

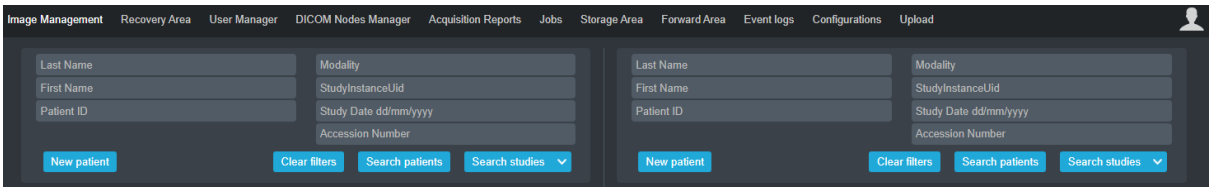


Image 6: "Image management" screen

In the top left corner, there is a menu that contains various clickable sections that can be configured by the user:

1. Image management;
2. Recovery Area;
3. User Manager;
4. DICOM Nodes Manager;
5. Acquisition Reports;
6. Jobs;
7. Storage Area;
8. Forward Area;
9. Event logs;
10. Configurations;
11. Upload.

The following chapters will delve into each section in more details.

4 Image Management

In the Image management section it is possible to:

- Search for a patient using the filters: Last name, First name, Patient ID; modality, StudyInstanceUid, Study date, Accession Number;
- Add a new patient;
- Reset the filters;
- Search for a patient;
- Search for a study.

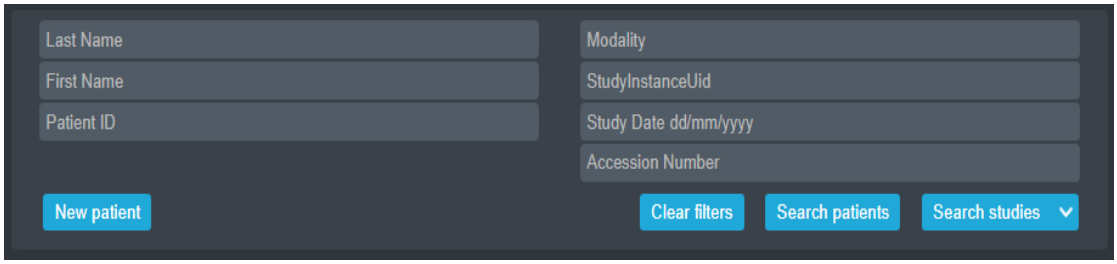


Image 7: Image management panel

The "*Study Date*" filter allows the user to manually insert the date (dd/mm/yyyy) or navigate through the displayed calendar pop-up.

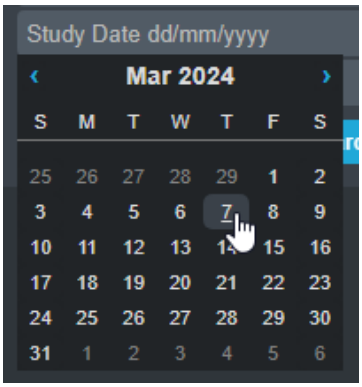


Image 8: Pop-upof the "Study Date" filter

4.1 New patient

For adding a new patient, user has to click on the "*New patient*" bottom and to fill out the provided form.

Finally, user has to click on the "*Save*" button.

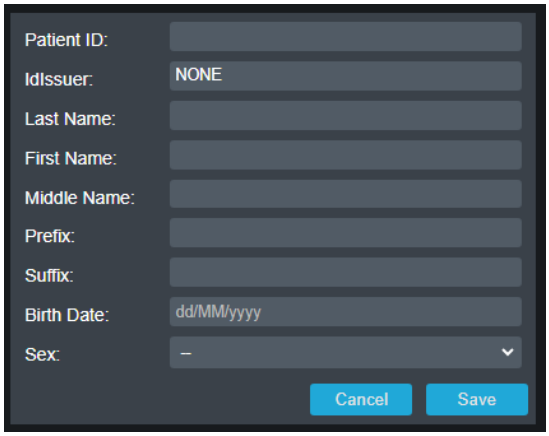


Image 9: "New patient" panel

4.2 Patient search

By clicking the "*Patient Search*" button, a list of patients (in alphabetical order), who have undergone the examination, is displayed:

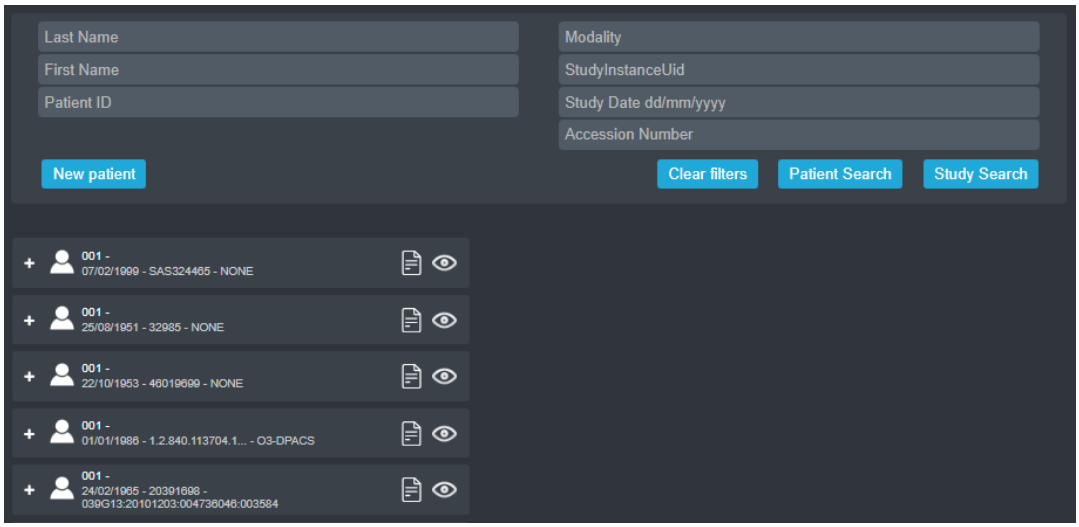


Image 10: "Patient Search" panel

The following table describes the functionalities of each icon in the patient list.

Icon	Name	Functionality
	Edit	Allows the user to modify patient data
	Open examination	Allows the user to display the examination associated with that specific patient through the integration with a viewing software
	Expand patient	Allows the user to expand the patient tree, showing all the associated studies

4.3 Study search

By clicking the "*Study Search*" button, a list of studies stores is displayed.

The drop-down menu of the button allows the user to filter the results by "*Orders only*" and "*Off worklist only*", as described in the paragraph **4.3.1 "Search studies" filter**.

In the list of archived studies, locally available studies are identified by the folder icon while those available on the *Google Cloud Bucket* with a cloud-shaped icon.

Image 11: Search study panel

The search can be conducted simultaneously on both panels, as the scrolling of each results tree is independent.

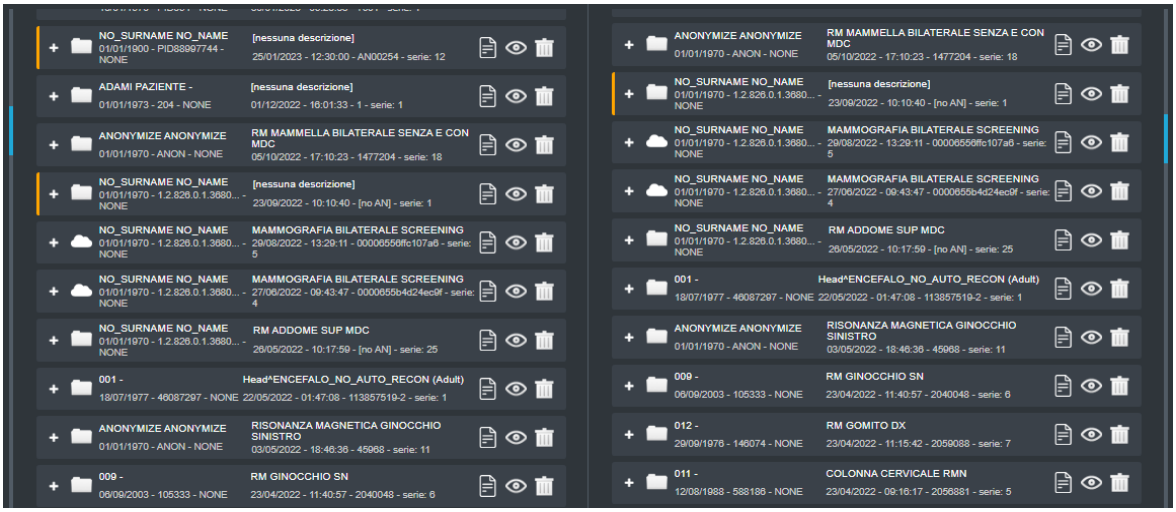


Image 12: Searching for the study using both panels

The following table describes the functionalities of each icon in the study list.

Icon	Name	Functionality
	Edit	Allows the user to edit the study data
	Open examination	Enables the user to display the examination through the integration with a viewing software.
	Delete	Deprecates the selected examination. Clicking on this button opens a pop-up for entering the deprecation description

Icon	Name	Functionality
	Multiple deselection	This button is available only when multiple series belonging to the same study are selected simultaneously. By clicking the button, the series are deselected. The same behavior can be achieved by pressing the ESC key on the keyboard.
	Expand study	Clicking on this button opens the study tree, displaying all associated series. In turn, series can also be expanded or deprecated.

4.3.1 "Search studies" filter

The "*Search studies*" button in the "*Image management*" panel features a dropdown menu to automatically filter the "Orders only" and the "Off worklist only".

"**Orders only**" comprises all orders that have not received images yet.

"**Off worklist only**" refers to studies without a corresponding order and therefore need reconciliation.

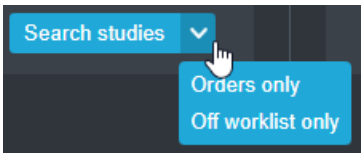


Image 13: "Search studies" and dropdown menu

Having two independent search panels can facilitate order reconciliation, allowing the user to filter for "Orders only" in one panel and "Off worklist only" in the other.

4.4 Editing a study

By clicking on the "*Edit study*" button , the following pop-up becomes available.

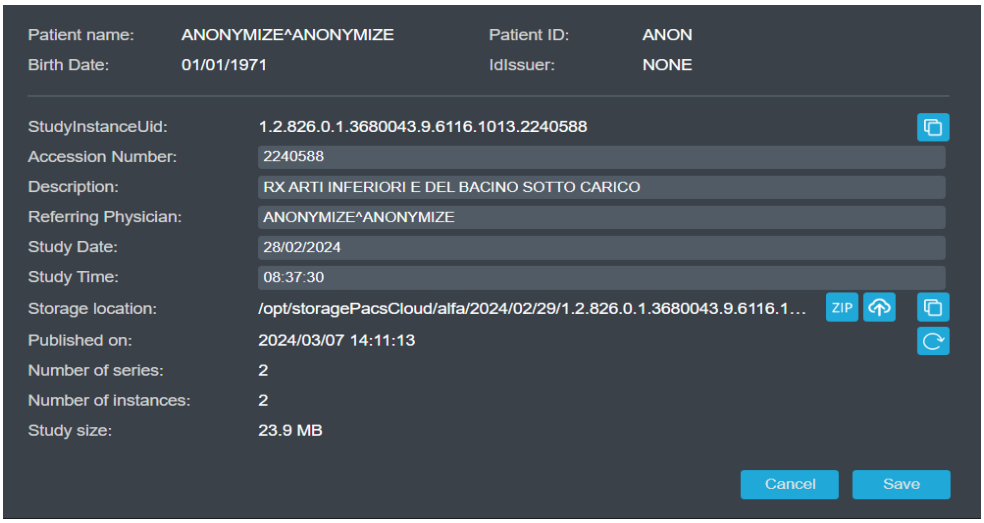


Image 14: Edit study pop-up

In the popup user can check some patient general information, update key details such as the *Accession Number*, *Study Description* and *Study Data*, download the compressed study archive in *.zip* format ZIP or upload it into one of the available *Google Cloud Bucket* .

The "*Republish study*" icon allows the user to republish the study.

4.5 Editing a series

A similar popup is displayed when choosing to edit the series' information, by clicking on the "*Edit*" icon next to the series row.

The popup displays series information related to: StudyInstanceUid, UID Serie, modality, station name, body part, number of instances, series description, AE title, series size and storage location.

However, in this popup it is possible to only edit the *Description* of the selected series.

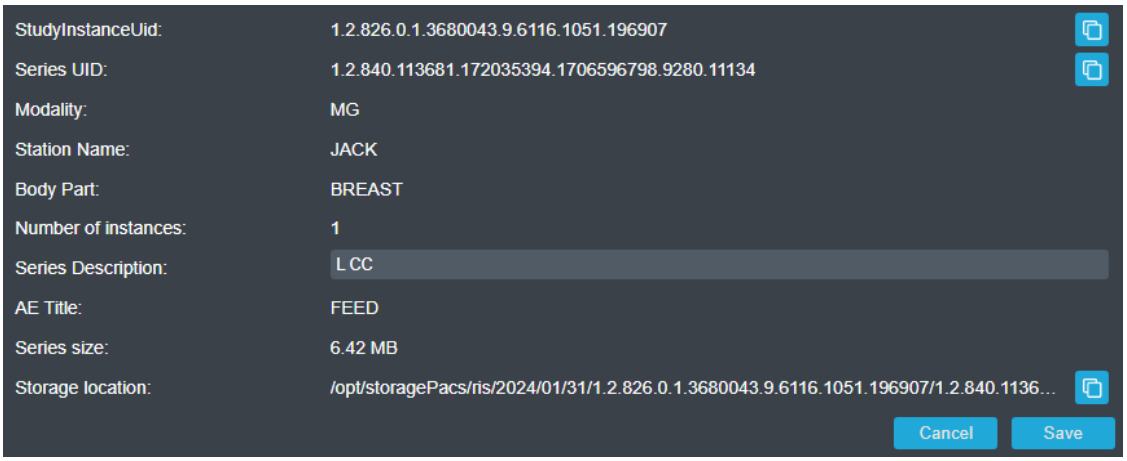


Image 15: Edit series pop-up

4.6 Instances pop-up

To display the popup with the series information, open the instance using the "Expand study" icon and click on the "Edit" icon in the instance row.

The instance popup provides information related to StudyUID, SeriesUID, InstanceUID, SOP class, Transfer syntax, file dimension and storage location.

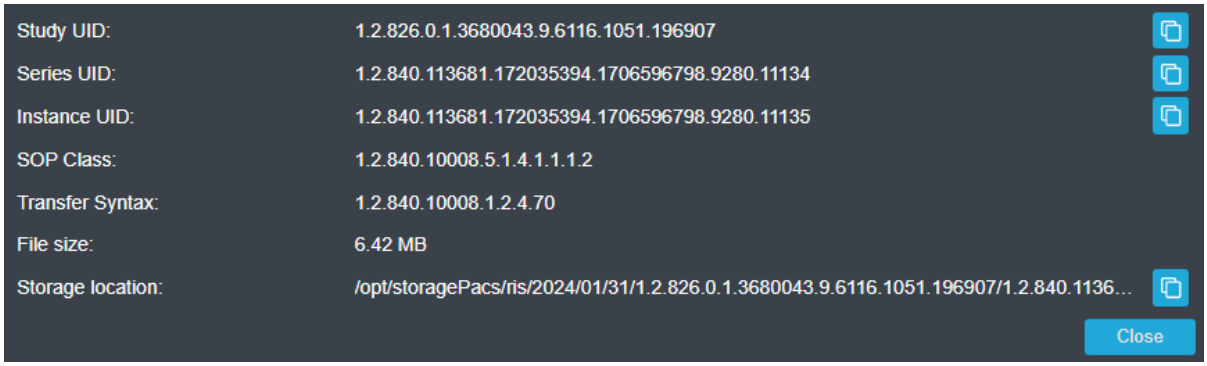


Image 16: Pop-up with the series information

4.7 Objects interaction

The ZEEROmed Store allows a wide range of operation between studies, series or instances.
All actions involve the **physical dragging of the selected element by using the mouse**.

These operations can be briefly summarized in the following list:

1. A study can be moved under another patient. In this case the patient's metadata is updated so that the study belongs to the chosen patient;

2. A study can be dragged over another study; in this case an operational choice pop-up becomes available, asking the user if he wants to perform:

    - ***Swap*** of the series (= moving all the series from the original study to the destination study and, vice versa, all the series of the destination study under the original one);

    - ***Move all series*** (= assigning all the series from the original study to the destination study).

3. A study **can not** be moved under a series or an instances;

4. One or multiple series can be moved under a patient or a study, updating all its metadata;

5. One or multiple series **can not** be moved under another series or instance;

6. An instance can be moved under a patient, study or series;

7. An instance **can not** be moved under another instance.

In case it is necessary to create new elements (e.g. when moving an instance under a study, some information regarding the belonging series in the destination study may lacking), information from the original study are used.

4.7.1 Reconciliation

The reconciliation procedure allows 4 different actions:

1. Exchange of a study with another;
2. Association of a study with a different patient;
3. Association of a series with a different study or patient;
4. Association of a instance with a different series, study or patient;
5. Reconciliation of a study by moving all the series to another study.

In order to perform the reconciliation, simply drag on the screen the chosen element to the selected destination element:

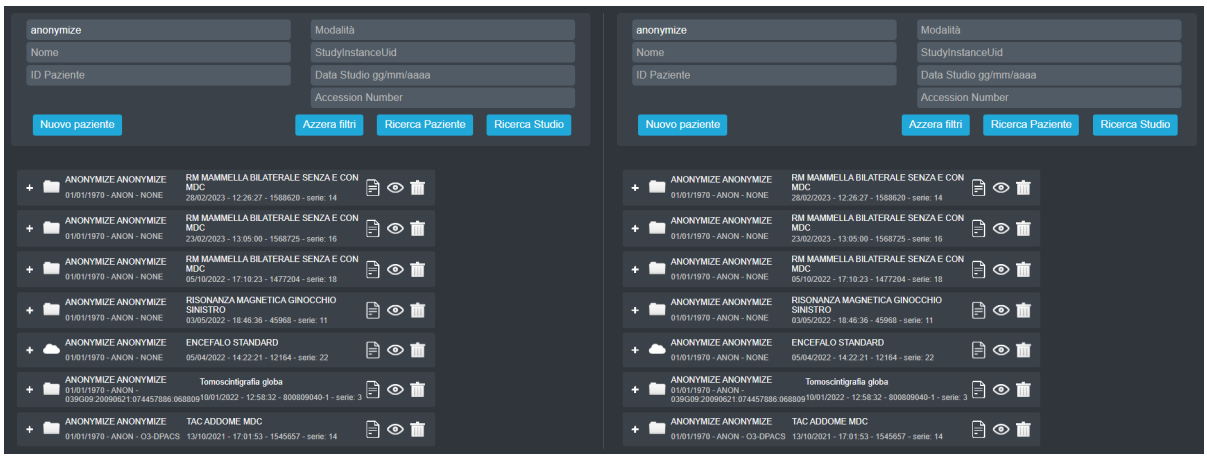


Image 17: Reconciliation screen

Step to perform reconciliation:

- Hold down the left button of the mouse, drag the selected element and release the button once the destination element is reached;

  If the operation is not allowed, the destination will turn red:

  If it is allowed, the destination will turn green:

- Confirm the operation by clicking "*Ok*" in the pop-up:

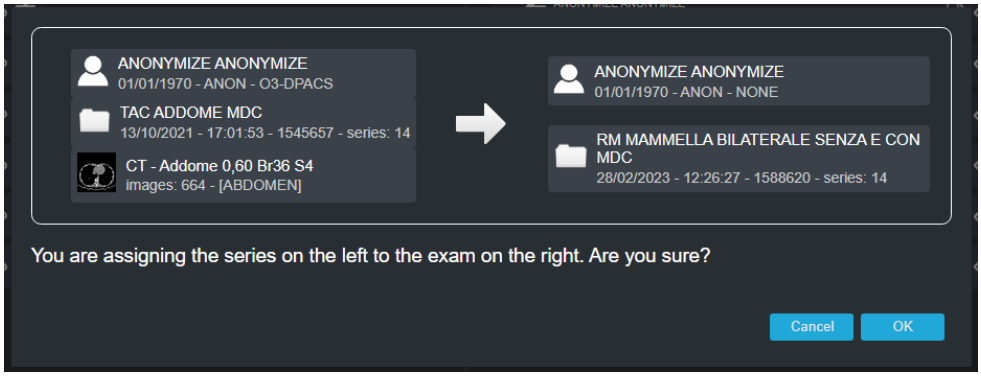


Image 18: Pop-up to confirm the reconciliation

If a study is dragged over another study, the following pop-up becomes available:

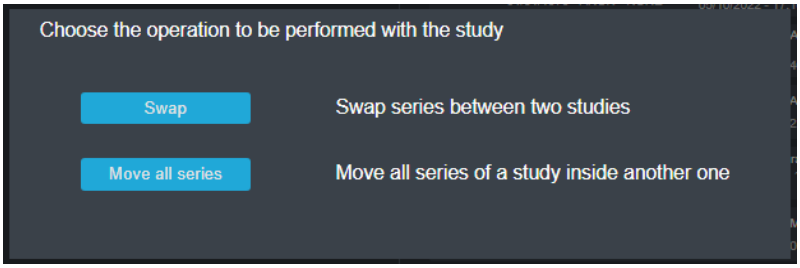


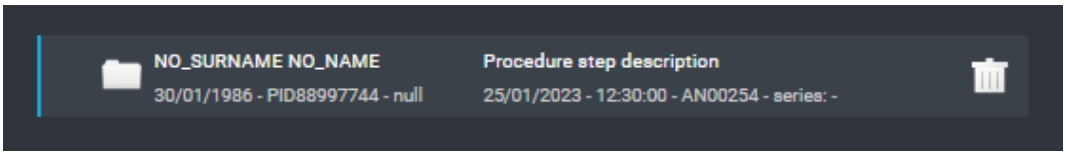
Image 19: Study reconciliation screen

At this point, it is necessary to select the desired operation; then, the confirmation pop-up will appear.

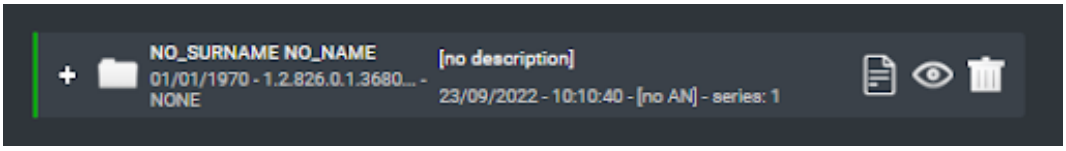
4.7.2 Reconciliation with orders

In the image management section, some colors can be associated to the studies:

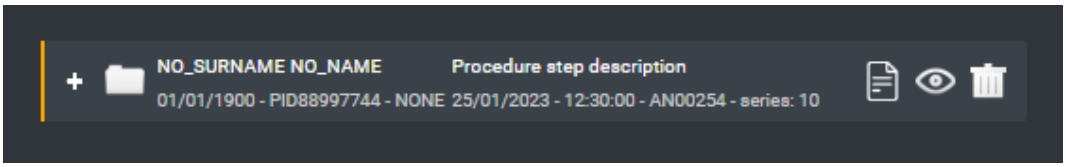
1. Blue: indicates that the element is an order and the images are not yet available on the ZEEROmed Store.
   It is possible to manually reconcile an order with an existing study by dragging it over the study; if the data matches, the color will turn green, otherwise it will be yellow.



2. Green: indicates that the exam is associated with an order and their data matches.



3. Yellow: indicates that the exam is associated with an order but their data does not matches.



If there is no color associated with the exam, the exam is not yet associated to an order.

4.8 Patient Merge

The ZEEROmed Store interface allows users to merge patients directly by dragging and dropping patient items. The recap widget will inform the user that all studies from patient A will be associated with patient B and will request confirmation.

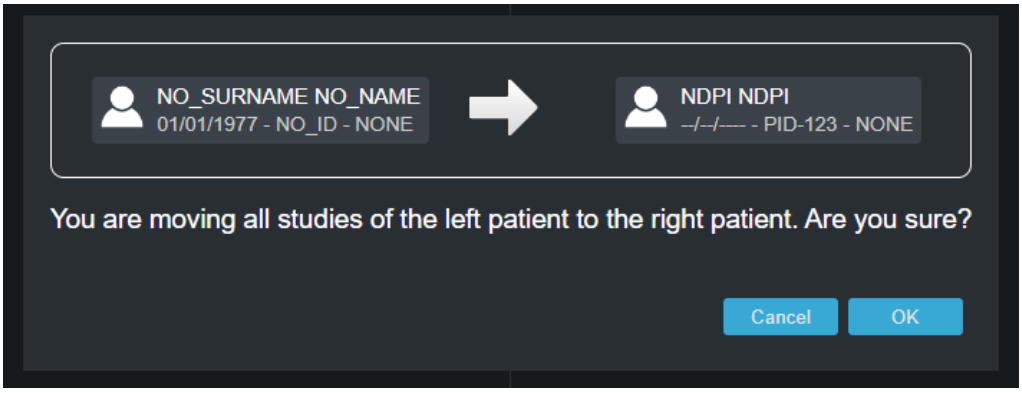


Image 20: Patient merging widget preview

To prevent modifications to incomplete studies, a warning in the widget preview will alert the user about the study's status, requiring confirmation.

NOTE: the check is performed only for the studies of the left-side patient.

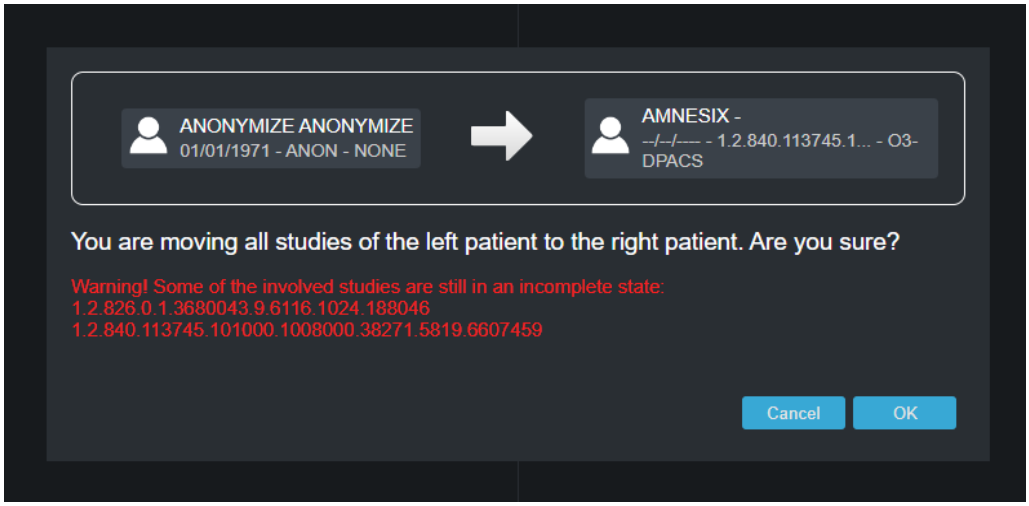


Image 21: Warning in the widget preview for a modification of an incomplete study

5 Recovery area

5.1 Deprecations list

In the "*Recovery area*" the user can view all the information regarding deprecations that have occured on the current ZEEROmed Store. The "*Deprecations list*" table displays the subject of the deprecation ("*STUDY*" o "*SERIES*"), some general information related to the deprecation (the reason, the author, the data of deprecation, and whether it has been recovered or not), and other information related to the subject of the deprecation (study date, patient name, mode and number of deprecated instances).

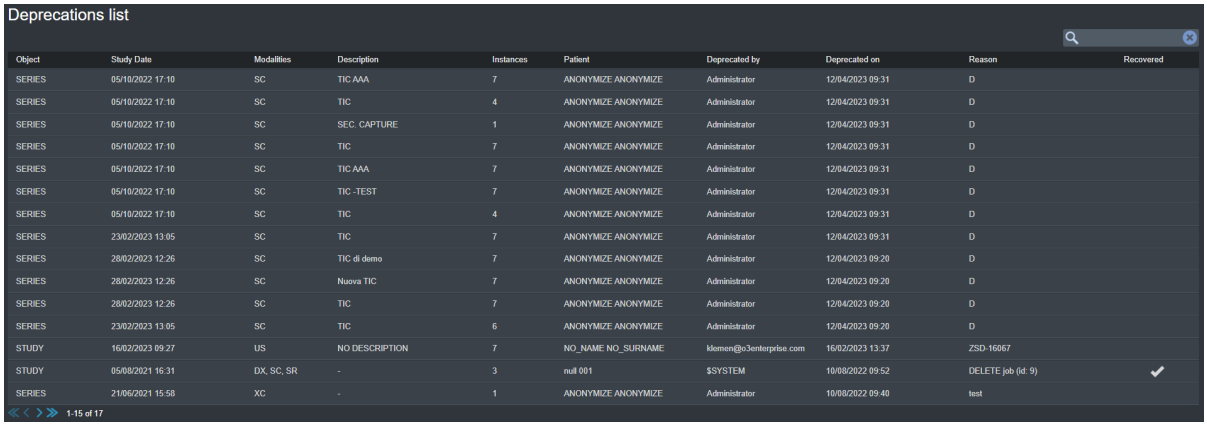


Image 22: Deprecation list

5.2 Deprecation overview and study/series recovery

The user can display additional information related to the study/series and to the deprecation, by clicking on the row of the selected subject.

Furthermore, it is possible to restore the study or the series by clicking on the "*Recovery*" button at the bottom left. In case the recovery is successful, the recovery icon is activated at the end of the deprecation row.

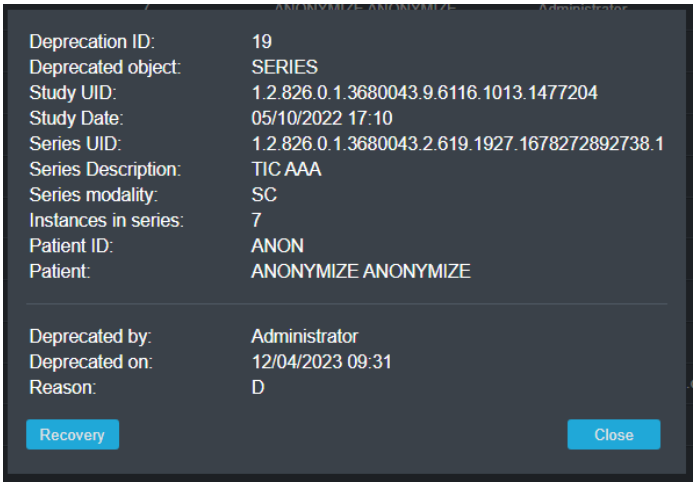


Image 23: Deprecation overview

6 User Manager

In this section the user can control the list of users configured in the ZEEROmed Store, add new users, edit and create new roles, or update the existing ones through the permissions overview.

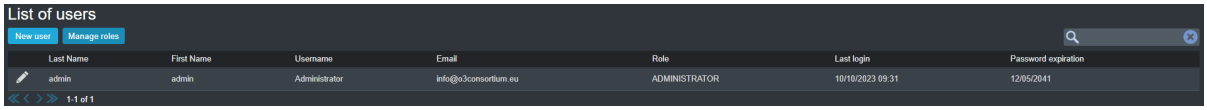


Image 24: List of configured users

6.1 Users

In the screen, the list of users is presented; some minimal information are present for each user, such as name and surname, username, email, role, timestamp of the last login and date when the password will expire. Furthermore, it is possible to filter the results using the search box at the top left.

6.1.1 New user

By clicking on the "*New user*" button, it is possible to add a new user.

The "*Role*" combo box is pre-filled with the roles currently available; therefore, for a better user experience, it is recommended to firstly create the desired role (see paragraph **6.2 Roles**) and then connect it to the selected user.

All the input fields present in the following picture are mandatory.

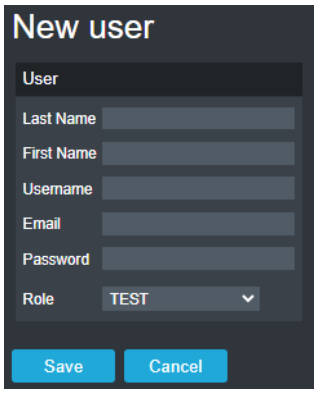


Image 25: "New user" configuration panel

Alternatively, by using the "*Edit*" button at the beginning of the row and marked with the pencil icon , it is possible to update the information of the selected user.

6.2 Roles

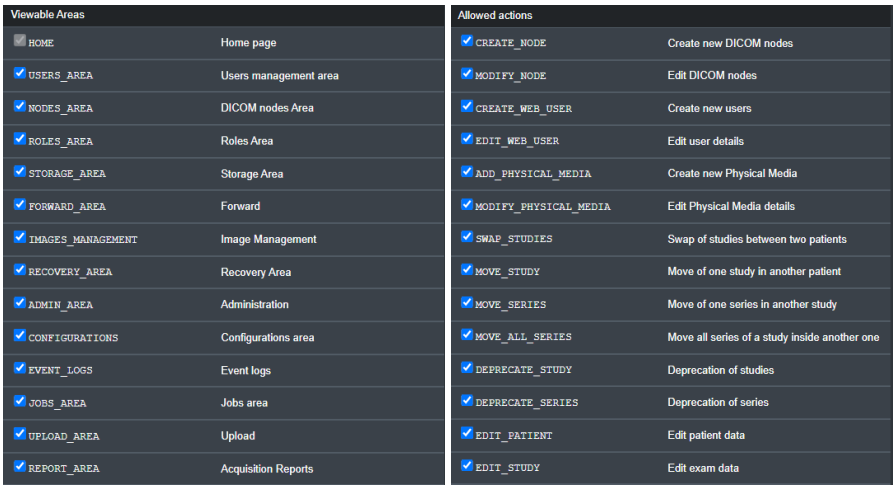
To create or modify a role click the "*Manage roles*" button.

6.2.1 Changing role permissions

To view and edit the permissions associated with a role, click on the "*Load*" button.

For each role it is possible to define:

- "*Viewable Areas*"- a list of pages that users with the selected role can access;
- "*Allowed actions*"- a set of actions that can be performed on the enabled pages.



Viewable Areas	
HOME	Home page
USERS_AREA	Users management area
NODES_AREA	DICOM nodes Area
ROLES_AREA	Roles Area
STORAGE_AREA	Storage Area
FORWARD_AREA	Forward
IMAGES_MANAGEMENT	Image Management
RECOVERY_AREA	Recovery Area
ADMIN_AREA	Administration
CONFIGURATIONS	Configurations area
EVENT_LOGS	Event logs
JOBS_AREA	Jobs area
UPLOAD_AREA	Upload
REPORT_AREA	Acquisition Reports

Allowed actions	
CREATE_NODE	Create new DICOM nodes
MODIFY_NODE	Edit DICOM nodes
CREATE_WEB_USER	Create new users
EDIT_WEB_USER	Edit user details
ADD_PHYSICAL_MEDIA	Create new Physical Media
MODIFY_PHYSICAL_MEDIA	Edit Physical Media details
SWAP_STUDIES	Swap of studies between two patients
MOVE_STUDY	Move of one study in another patient
MOVE_SERIES	Move of one series in another study
MOVE_ALL_SERIES	Move all series of a study inside another one
DEPRECATE_STUDY	Deprecation of studies
DEPRECATE_SERIES	Deprecation of series
EDIT_PATIENT	Edit patient data
EDIT_STUDY	Edit exam data

Image 26: "Viewable areas" and "Allowed actions" panel

To save the current configuration, click the "*Save*" button at the bottom of the page; to the contrary, to cancel the operation, click the "*Cancel*" button.

6.2.2 Creating a new role

To create a new role, click the "*New role*" button and fill in the "*Role name*" field.

6.3 Considerations on roles and users

As the user may have noticed, on the role configuration page, there is a check-box labeled "*Privileged roles*" that makes the current role *privileged* and the user a *super-user*. This check-box can only be checked by other super-users.

It is important to remember that, during the users creation, there must be at least one privileged role and a user associated with it. In any case, the ZEEROmed Store automatically prevents the modification of this check-box if the aforementioned requirements are not met.

6.4 User panel

In the top right corner of all the pages, by clicking on the button marked with the profile icon , the "*User panel*" is available. In the "User panel" it is possible to check the date and time of the last profile access, change the password, display the label with the

information about the ZEEROmed Store license and log out.
If the user is configured as a *super-user*, the "*Go to Admin tenant*" button is available for global system configurations.

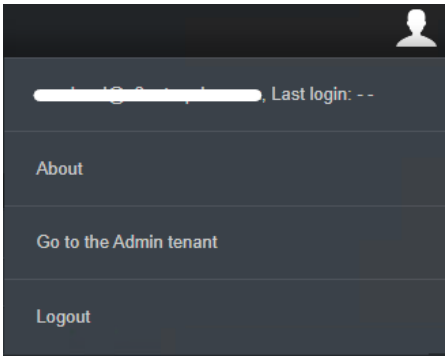


Image 27: User panel (super-user)

7 DICOM Nodes Manager

7.1 DICOM nodes list

On the "*DICOM Nodes Manager*" page the user can access a complete list of all the DICOM nodes currently configured in the system. The "*Dicom nodes list*" table shows for each node its *AE Title*, the possible *Station Name*, the type of the node (*FEED* o *OTHER*), the file system folder where the files will be saved and whether the compression and the anonymization are enabled or not.
Furthermore, it is possible to filter the results in the table using the search box in the top right corner.

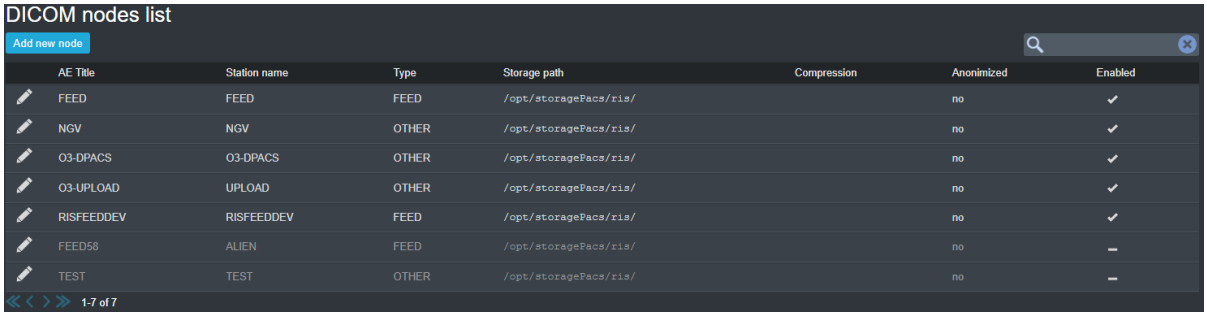


Image 28: DICOM nodes list

7.2 Adding or editing a DICOM node

User can add a new node by clicking on the "*Add new node*" button at the top left; this action will open a node configuration pop-up.

All fields marked with an asterisk (*) are mandatory (*AE Title*, *Host*, *Port* e *Station name*). The "*Storage path*" combo box is automatically populated using the current configured Storage Areas: it is advisable to firstly create a *physical support* and, subsequently, the node associated with it. For more information on how to create a physical support, user should refer to chapter **7 DICOM Nodes Manager**.

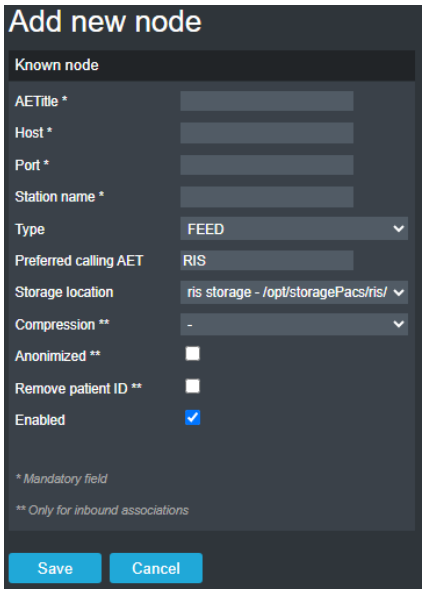


Image 29: Add new DICOM node

Using the "*Edit*" button, marked with a pencil icon and located next to the AE Title , user can modify the current configurations of the selected node; the same node configuration pop-up is displayed but pre-populated with the configurations that should be modified.

7.3 Add unknow DICOM nodes

ZEEROmed Store is configured to reject requests from unknown nodes but to save their references in the "DICOM node List" with the "*Disabled*" flag. To enable the node, refer to paragraph **7.3.1 Enabling a disabled unknown node**

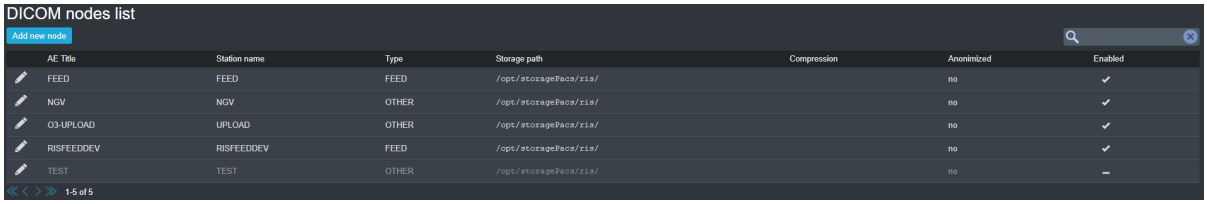


Image 30: Adding an unknown node to the "DICOM node list"

Requests can be:

- DICOM C-Store request;
- DICOM C-Find request;

- DICOM C-Move request;
- DICOM C-Echo request.

7.3.1 Enabling a disabled unknown node

To activate a disabled unknown node, the user needs to open the "*Modify node*" panel through the "Edit" icon and check the "*Enabled*" field.

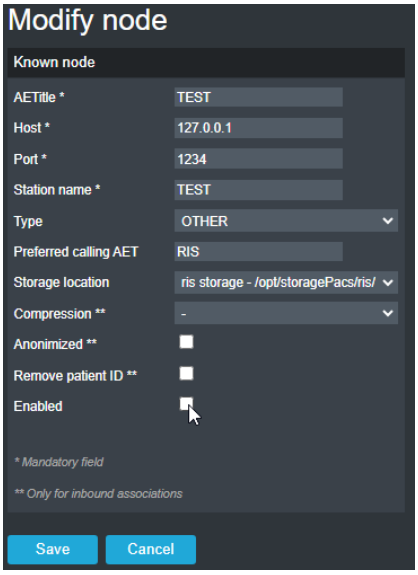


Image 31: Enabling a disabled unknown node

8 Jobs

On the "*Jobs*" page, user can define the queue of tasks that have to be executed at a specific time point in the future. Currently, the following seven jobs are available:

- Delete;
- Deprecate;
- Image availability;
- Relocate;
- Export;
- Forward series;
- Forward non DICOM slides;
- Delete empty.

Furthermore, the user can specify when these tasks should be executed by setting the *trigger* to one of the following options: "*Daily*", "*Manual*", "*Scheduled*" and "*Periodic*".

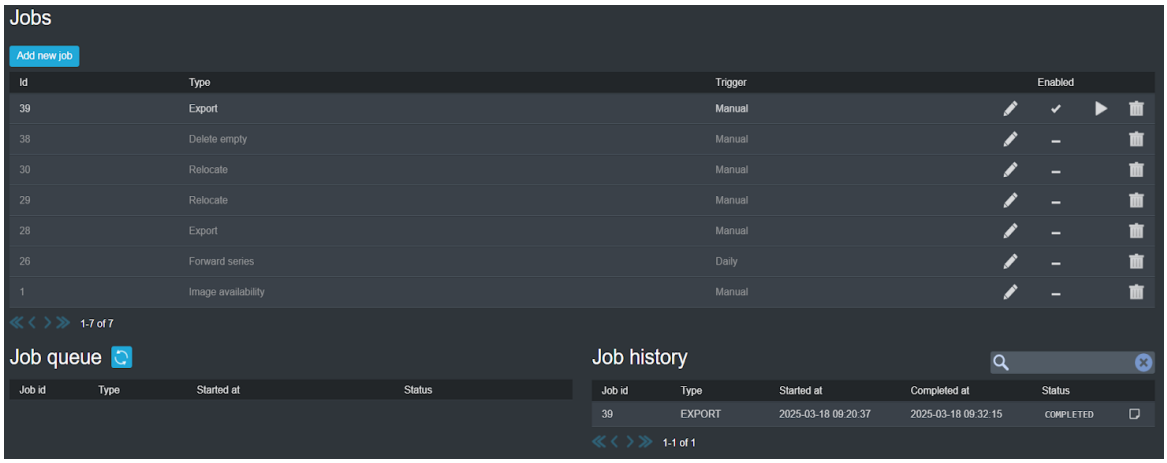


Image 32: Jobs section

8.1 Queueing rules

The production and management of the queue follow specific rules to avoid conflicts during task execution. The most important rules include:

- If a job has already been added to the execution queue or if it has been executed at least once (for recurring job), it cannot be modified;
- The system strives to execute jobs at the time define by the user, taking into account the current system resources and the compatibility with other concurrently running jobs.

8.2 Types of jobs

8.2.1 *Delete*

This task is used to **permanently** delete studies or series previously marked as "*deprecated*", both from the file system and the database.

> ⚠ **Warning**: once the object has been successfully processed by the task, it can not be recover in any way

Configuration options for this job are:

- **Deprecation age**: number of days that have been passed since the element was deprecated;
- **Deprecated by**: name of user who performed the deprecation. This is particularly useful when combined with the *Deprecation job*, which deprecates all the elements using the alias "$SYSTEM".

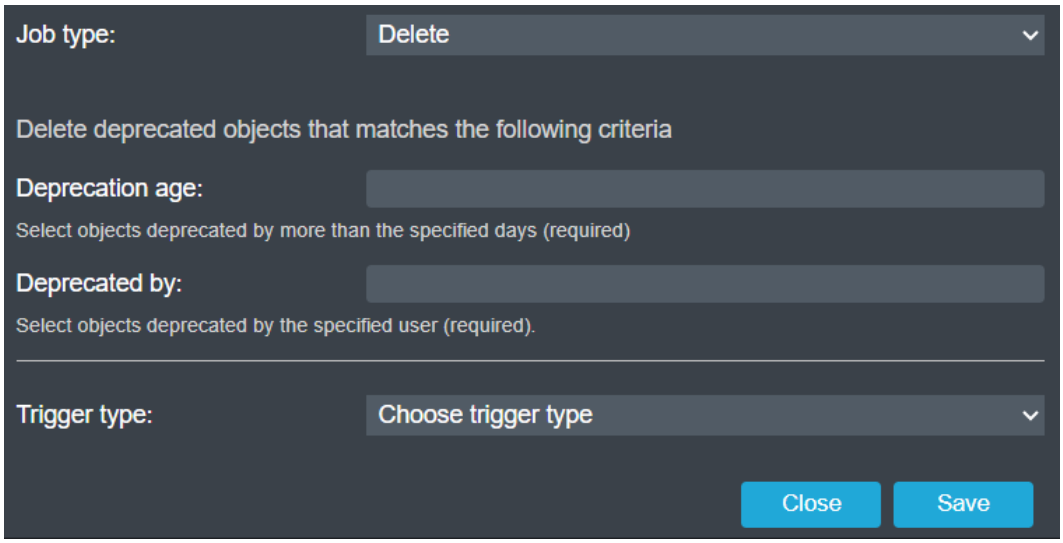


Image 33: "Delete" panel

8.2.2 Deprecate

The "*Deprecate*" job is used to automatically deprecate all elements that match the filters specified in its configuration. User can specify:

- **Study age**: number of days during which the study should not have been modified;
- **AE Title**: filter to select studies only from a specific AE;
- **Modality**: filter to select studies that contain specific modalities;
- **Station name**: filter to select studies only from a specific station.

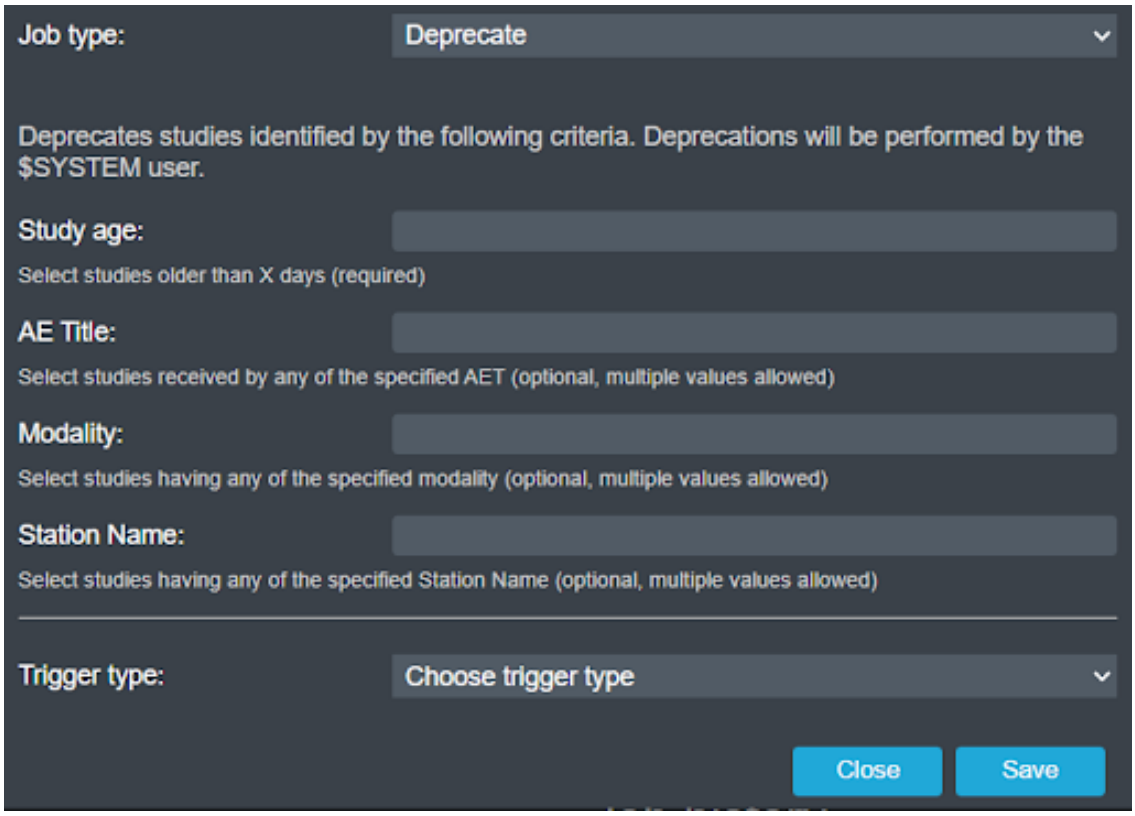


Image 34: "Deprecate" panel

8.2.3 Image Availability

This task is used for publishing image availability to the configured endpoint; additionally, it is possible to specify the "*Machine learning endopoint*" used for *AI* services. The configurations are:

- **Source Id**: name by which the ZEEROmed Store presents itself to the third-party service during publication;
- **Endpoint**: url to notify the image availability;
- **Machine learning endpoint**: url of the artificial intelligence services to notify the image availability
- **Authentication header**: optional authentication header for the previously specified endpoint;

- **Study cooldown seconds**: time, in seconds, after which a study can be considered publishable. It can be simply calculated as `current time - study's last modification time > seconds for the study's cooldown`.

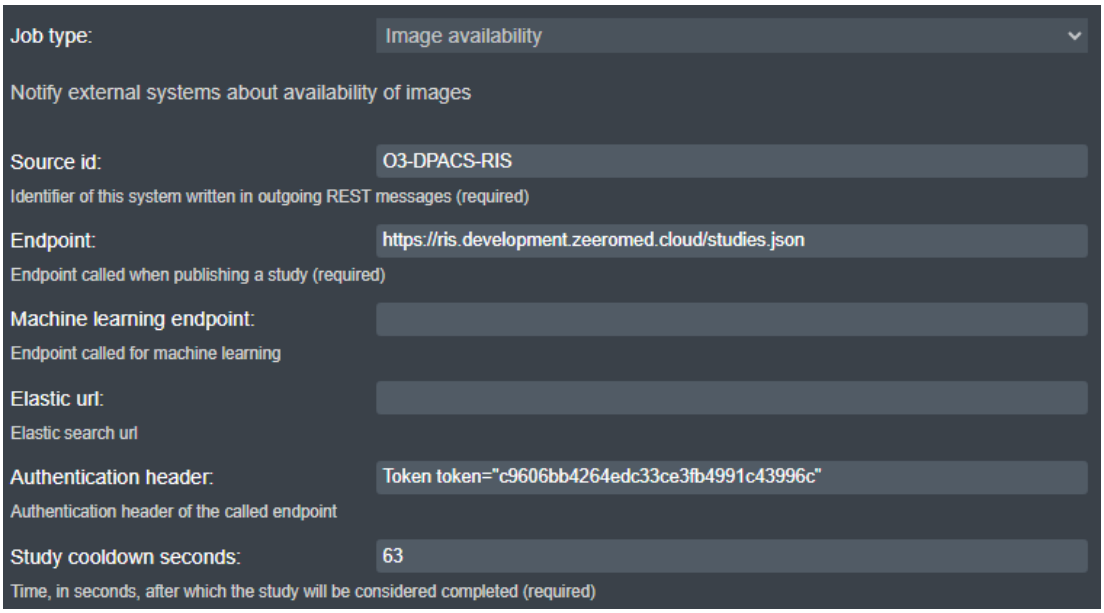


Image 35: "Image availability" panel

8.2.4 Relocate

This job is used to automatically move studies from their source storage to another (even if its type is different). Due to the fact that the ZEEROmed Store supports *Google Clouds Buckets*, it is possible to move a study from a bucket to a local storage, from a local storage to a bucket and from a local storage to another file system folder. The available configurations are:

- **Storage type**: type of destination storage; it can be "*Disk*" or "*Bucket*". Depending on its value, a different text box becomes available ("*New storage location*" for Disk, "*Destination bucket*" for Bucket);
- **New storage location**: absolute path in the file system in which studies should be moved;
- **Destination bucket**: name of the bucket in which studies should be moved. Only current configured buckets are present;
- **Study age**: number of days during which the study should not have been modified.

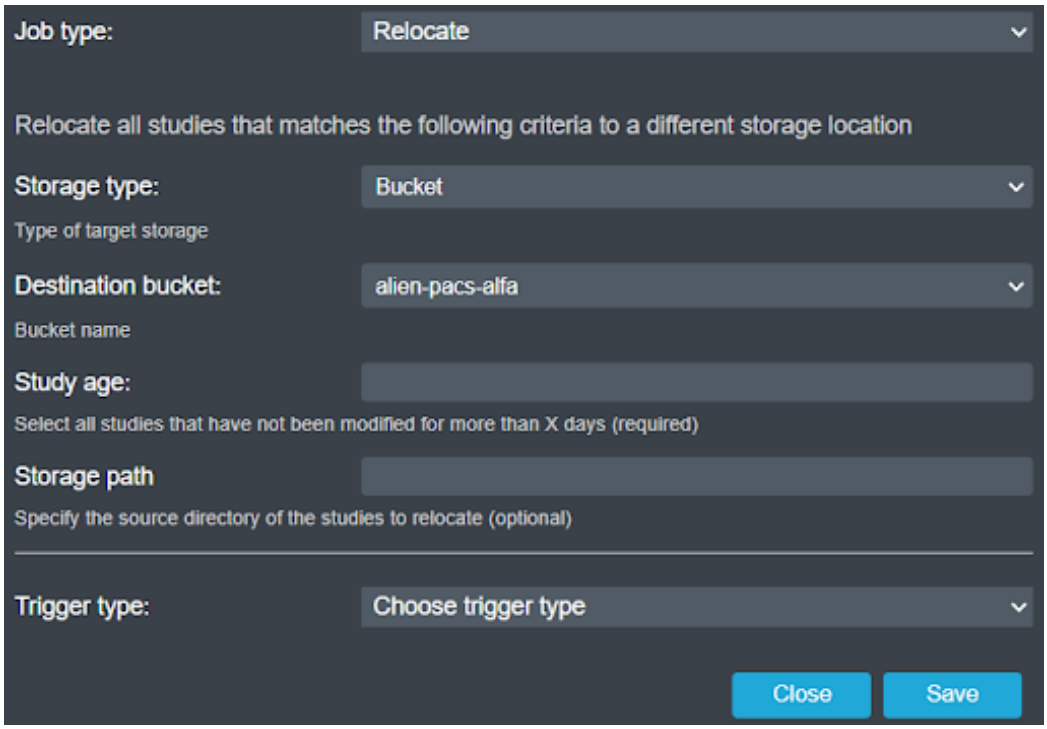


Image 36: "Relocate" panel

8.2.5 Export

This job exports all the studies that meet the specified filters, updating all metadata to ensure that they are completely synchronized. This task can be very useful in the case of a *transfer back*. Its configurations include:

- **Storage type**: type of destination storage; it can be "*Disk*" or "*Bucket*". Depending on its value, a different text box becomes available ("*Disk folder*" for Disk, "*Bucket name*" and "*Bucket folder*" for Bucket);
- **Disk folder**: absolute file system path where the selected elements should be exported;
- **Bucket name**: name of the destination bucket. Only the currently configured buckets are present;
- **Bucket folder**: name of the folder within the selected bucket where the studies should be exported;

- **Studies older than**: filter used to select all studies not modified since the specified date;
- **AE Title**: filter used to select studies only from a specific AE title;
- **Modality**: filter used to select studies containing images with the specified modalities;
- **Station Name**: filter used to select studies only from a specific *station*.

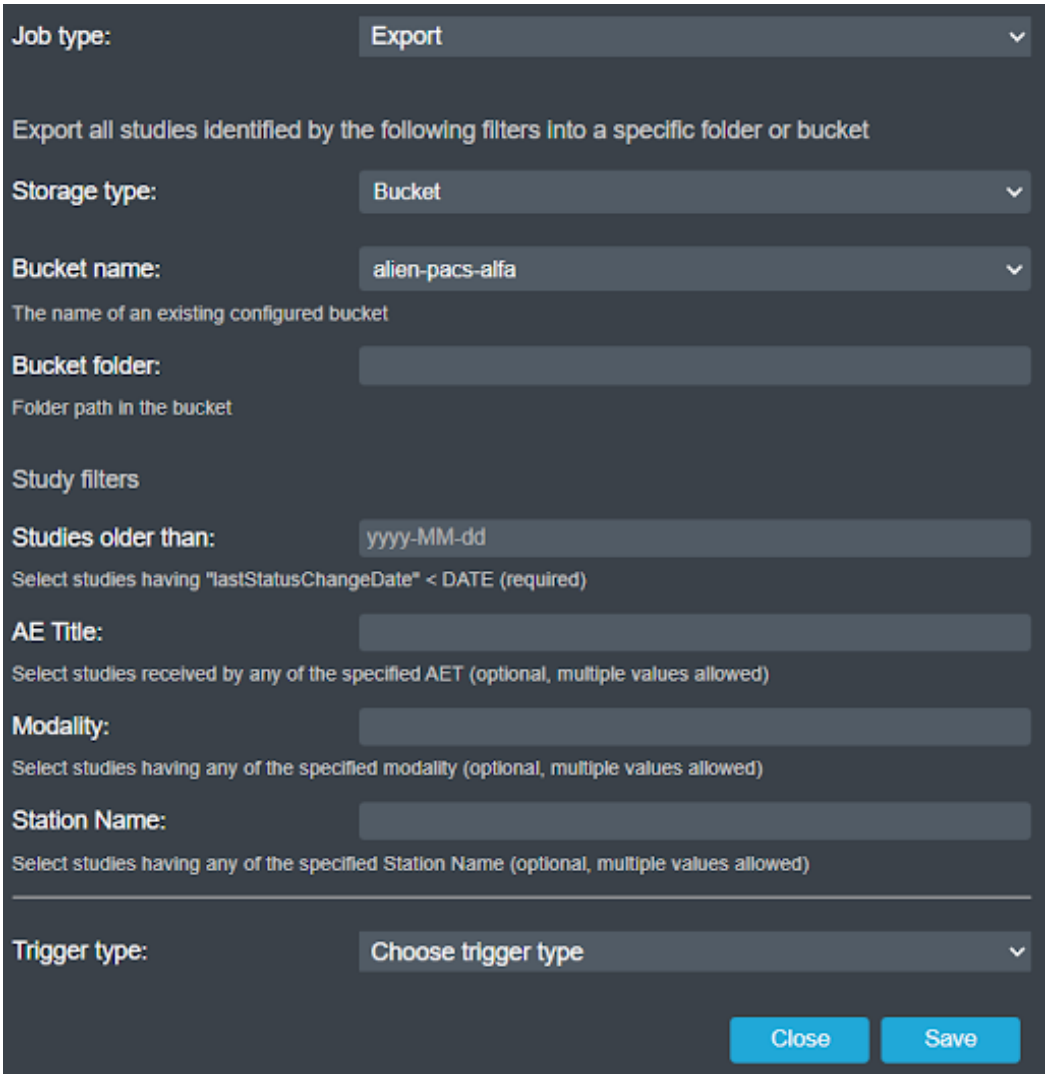


Image 37: "Export" panel

8.2.6 Forward series

The "*Forward series*" job can be used to automatically forward all the series that meet specific criteria to other nodes previously configured in the system. In this task it is possible to define the forwarding rules to filter the relevant series effectively. Due to the need of supporting a high level of complexity in the rule definition, unlike other job types, it is not possible to define more than one task of this type. In addition, user can not associate a "*Manual*" or "*Scheduled*" trigger, as they are not relevant to this specific case. The configurations include:

- **Max attempts**: integer number indicating how many times ZEEROmed Store should retry the forwarding of specific series (in case of a previous failure). The next attempt occurs in the next queue processing round;
- **Rule**: by clicking the "*New Rule*" button, a box containing the forwarding rules becomes available; it is possible to add an undefined number of rules. User can remove a rule by clicking on the "*Delete rule*" button, located at the bottom right of the box. Each rule consists of:
    - **Source node**: indicates the source node of the series. If the user does not want to specify the source node, he can use the "*any source*" entry;
    - **Studies received after***: date and time, in the `dd/MM/yyyy HH:mm` format, after which studies should be considered for forwarding;
    - **Cooldown (seconds)***: time, in seconds, after which the series can be considered completed (and therefore eligible for forwarding);
    - **Destination node***: node, previously configured in the ZEEROmed Store, to which the filtered series should be forwarded;
    - **Modalities**: modality that a series should have to be forwarded; this field is optional.

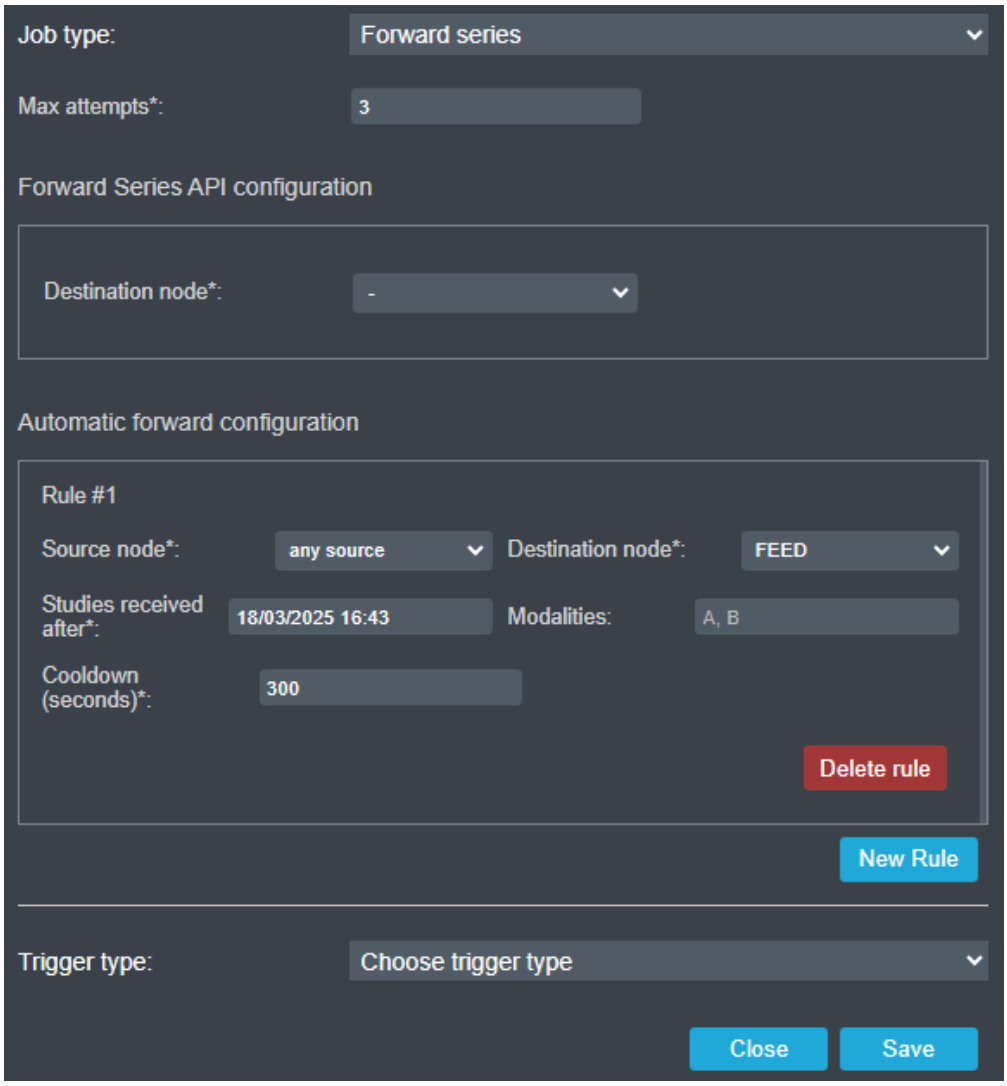


Image 38: "Forward series" panel

8.2.7 Forward non dicom slides

The "*Forward non DICOM slides*" job can be used to automatically forward all non DICOM pathology slides that meet specific criteria to a previously configured endpoint. In this task it is possible to define the forwarding rules to filter the relevant slides effectively. Due to the need of supporting a high level of complexity in the rule definition, unlike other job types, it is not possible to define more than one task of this type. In addition, user can not associate a "*Manual*" or "*Scheduled*" trigger, as they are not relevant to this specific case. The configurations include:

- **Max attempts**: integer number indicating how many times ZEEROmed Store should retry the forwarding of specific non dicom slides (in case of a previous failure). The next attempt occurs in the next queue processing round;
- **Rule**: by clicking the "*New Rule*" button, a box containing the forwarding rules becomes available; it is possible to add an undefined number of rules. User can remove a rule by clicking on the "*Delete rule*" button, located at the bottom right of the box. Each rule consists of:
    - **Source node***: indicates the source node of the slides. If the user does not want to specify the source node, he can use the "*any source*" entry;
    - **Studies received after***: date and time, in the `dd/MM/yyyy HH:mm` format, after which studies should be considered for forwarding;
    - **Cooldown (seconds)***: time, in seconds, after which the slides can be considered completed (and therefore eligible for forwarding);
    - **Destination endpoint***: endpoint, previously configured in the ZEEROmed Store, to which the filtered slides should be forwarded;
    - **Destination API Key**: API Key, previously configured in the ZEEROmed Store, to which the filtered slides should be forwarded;
    - **Modalities**: modality that a slide should have to be forwarded; this field is optional

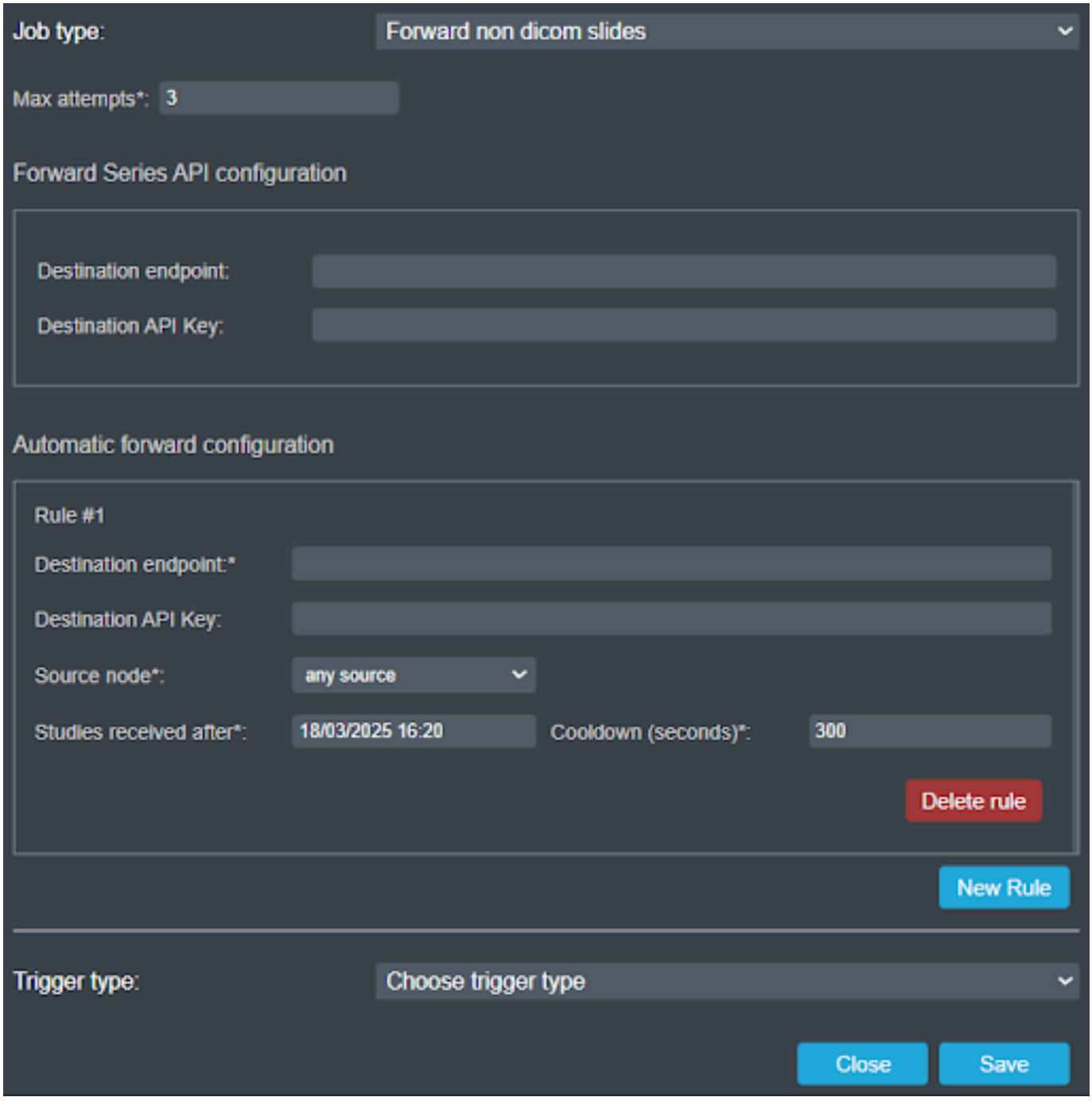


Image 39: "Forward non DICOM series" panel

8.2.8 Delete empty

The "*Delete empty*" job removes all studies and patients that do not have any child attached and therefore are considered "*empty*" by the system.

A study is "empty" if it does not contain any series.

A patient is "empty" if does not have associated study.

The "*Study Age*" field enables the filtering of studies, removing only those older than the specified time (dd) by the user.

In the event of exceptions or issues during the job execution, operations are canceled to prevent the loss of information.

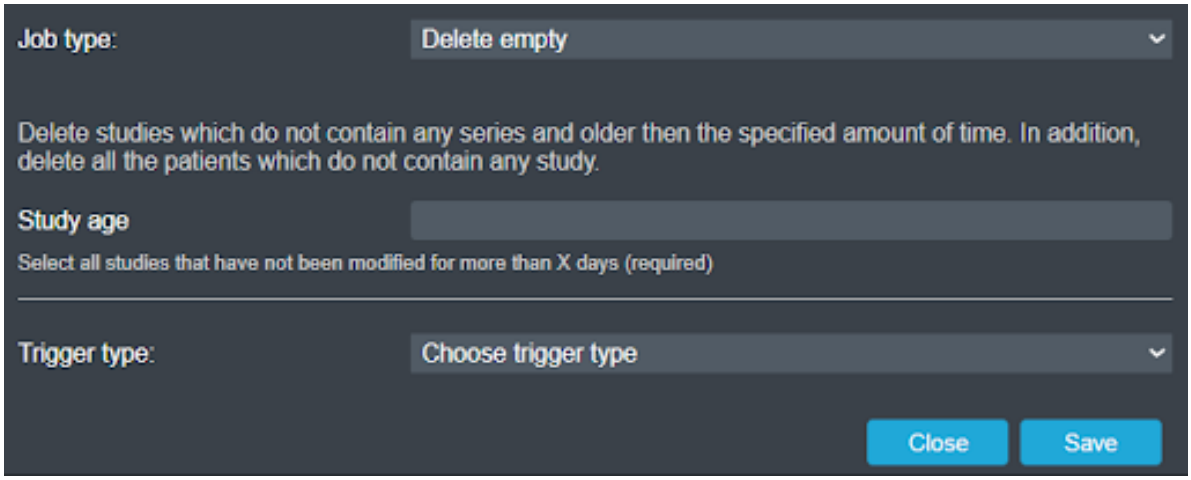


Image 40: "Delete empty" panel

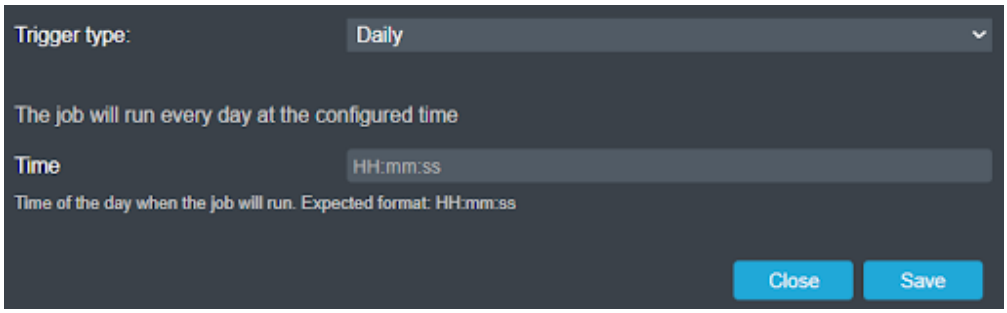
Warning: the system only deletes entries in the database, without performing any operations on the file system. Therefore, some empty folders may not be deleted.

8.3 Triggers types

8.3.1 Daily

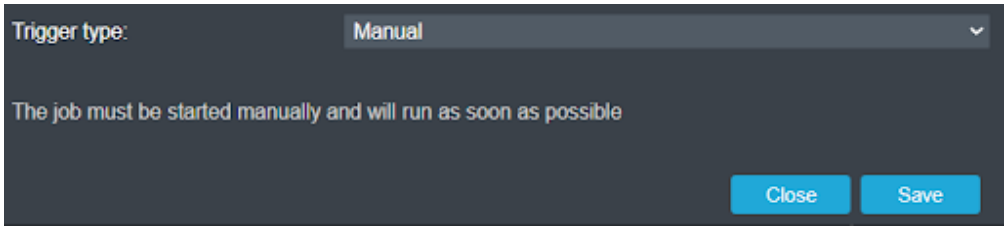
This trigger allows the user to queue the associated job at a specific time of the day. It is important to note that the specified time will be the moment in which the task is **queued** (with a error margin of approximately 10 seconds) and not when it is executed. The job, considering the queueing rule discussed in **8.1 Queueing rules**, will be executed as soon as the queueing conditions allow it. Its configuretions include:

- **Time**: time, expressed in `HH:mm:ss` format, when the associated task is queued.



8.3.2 Manual

This trigger allows the user to manually queue a job, executing it as soon as possible, based on the current queue conditions. If a task has this type of trigger, the "*Play*" action appears on its row. This trigger does not have any specific configuration.

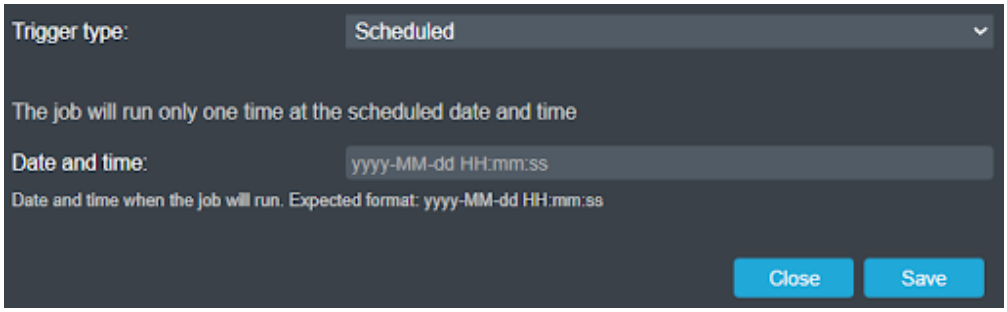


8.3.3 Scheduled

This trigger can be used to execute a job only once, at the specified date and time. Similar to the "*Daily trigger*" the timestamp represents the moment when the job is queued, not

when it is executed. Its configurations include:

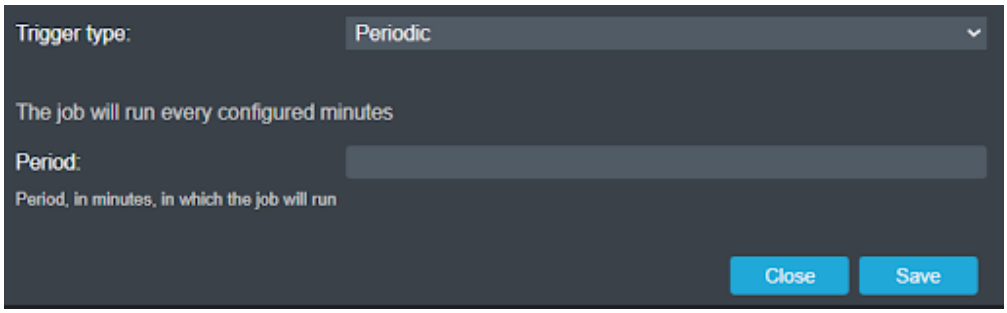
- **Date and time**: timestamp, expressed in `yyyy-MM-dd HH:mm:ss` format, when the associated job is queued.



8.3.4 Periodic

This trigger is used to queue the associated job at regular intervals, allowing the user to specify the time range. Its configurations are:

- **Period**: time, expressed in minutes, that has to elapse between each executions.



8.4 Jobs page

8.4.1 Summary Table for "Jobs"

On the "*Jobs*" page, user can add new jobs (of any types and with any triggers), check the current configuration of each existing job, modify, enable or disable, manual queuing (only if the type of the associated trigger is "*Manual*") and delete jobs.

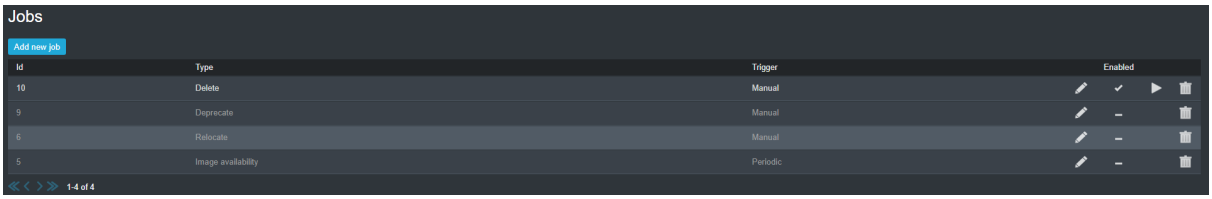


Image 41: Jobs

8.4.2 Job queue

The "*Job queue*" table, located below the "*Job*" table, allows the user to monitor the current status of the queue. Each row contains the Job id, the type, the execution timestamp ("*Started at*") and the status (which can be either "*ENQUEUED*", if it is simply queued, or "*PROCESSING*", if it is running).

If the status is "*ENQUEUED*", it is possible to remove it from the queue by using the "*Remove from queue*" button marked with the "X" and located at the end of the row .

The table is automatically updated every 10 seconds, but the user can manually refresh the status by clicking on the "*Refresh job queue*" button, next to the section title .

Image 42: Job queue

8.4.3 Job history

The last section of the Job page is the "*Job history*" table. This table displays the status of the completed jobs along with the additional data related to the execution time. User can filter the results present in the table using the searching box located at the top right. Similar to the "*Job queue*" table, this table is automatically updated every 10 seconds.

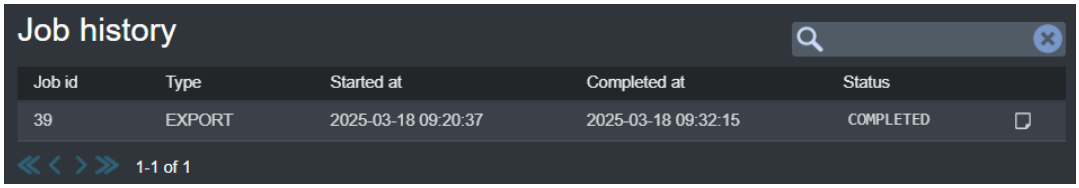


Image 43: Job history

At the end of each row, the "*Show logs*" button will open a pop-up containing some logs related to the current execution. If the execution ends with at least one error, the button will display a warning icon and all the error logs will be highlighted in red.

For practical purposes, all executions and logs older than three days are deleted and no longer accessible in any way.

9 Acquisition Reports

This section provides the acquisition times of studies from a specific station within a given timeframe, along with their average value.

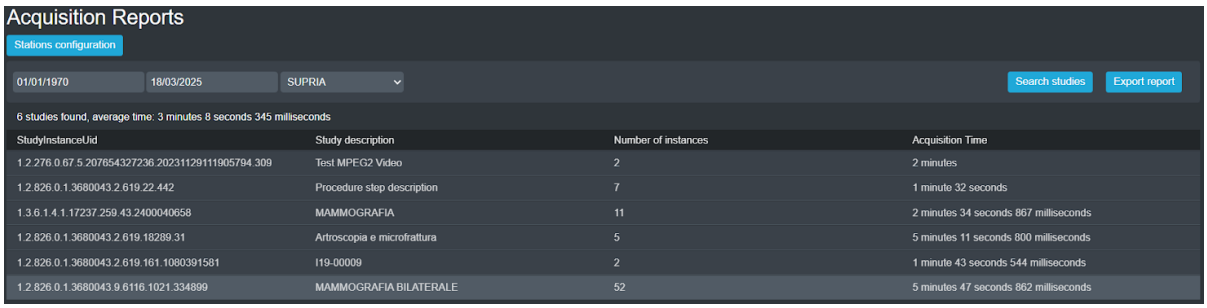


Image 44: Studies acquisition time

To perform the analysis:

1. Enter the "*Acquisition begin date*" and "*Acquisition end date*" using the calendar pop-up;
2. Select the pre-configured station (see **9.1 Station configuration and Acquisition Tag**);
3. Click the "*Search studies*" button.

The results can be exported as a .CSV file, by clicking the "*Export report*" button.

9.1 Station configuration and Acquisition Tag

To configure a station:

1. Click the "*Stations configuration*" button;
2. Fill in the "*Station name*" and "*Acquisition tags*" fields.

The "**Acquisition tag**" refers to the DICOM tag that specifies which time period to consider; available options include:

- Acquisition date and acquisition time;
- Creation date and time;
- Content date and time.

3. Click the "*Create*" icon (represented by a plus sign);
4. Click the "*Save*" button.

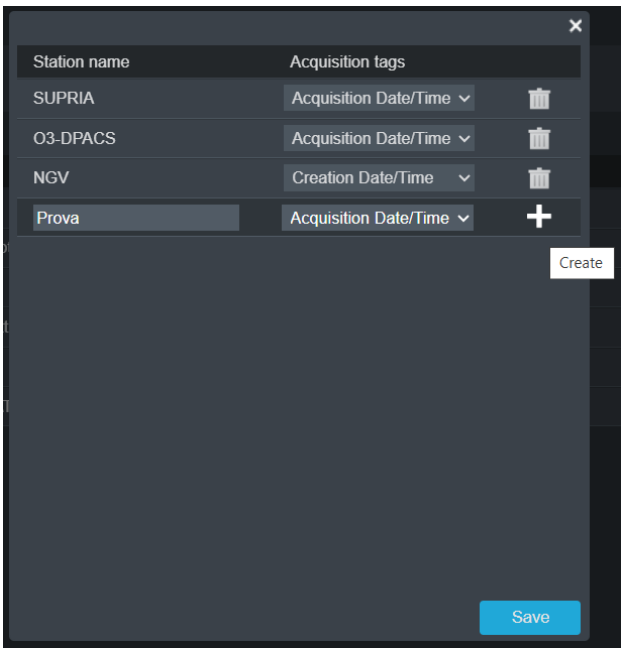


Image 45: Station configuration

10 Storage Area

10.1 Physical Media List

On the "*Storage Area*" page, user can check the presence of any storage areas, add new ones and modify the existing ones. It is also possible to filter the list of *physical supports* using the search box on the top right corner. The summary table of storage area provides to the user the name of the storage area, its file system path, its availability and an optional description.

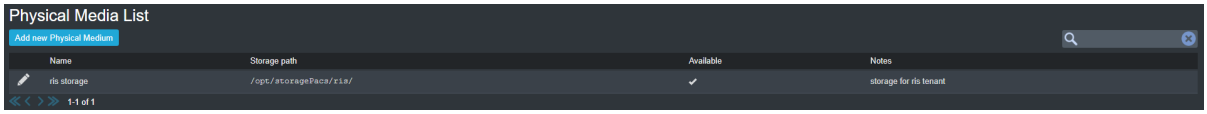


Image 46: Physical media lists

10.2 Adding and modifying a storage area

By clicking the "*Add new Physical Medium*" button, a pop-up for creating the storage area becomes available; in this pop-up the user can configure its setting. In case of changes to an existing storage area, the same pop-up is shown but pre-filled with the previous setting.

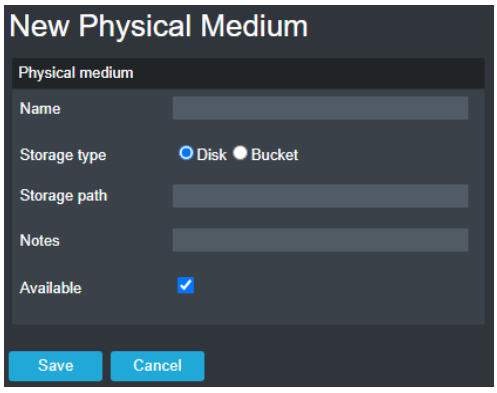


Image 47: New physical medium pop-up

11 Forward area

In this section, the user can check the current status of the following forwarding queues:

- **Series forwarding queue** – obtained through the "*Forward series*" job (see **8.2.6 Forward series**);
- **Non DICOM slides forwarding queue** – obtained through the "*Forward non DICOM slide*" job (see **8.2.7 Forward non dicom slides**).

For each queue, the table provides information regarding:

- Study Instance UID;
- Series Instance UID;
- Destination node/destination endpoint;
- Queuing timestamp;
- Date and time of the last update;
- Number of attempts made (if applicable);
- Current forwarding status, which can be:
    - SENDING: series/slides is in the sending process;
    - ERROR: one or more series/slides instances can not be forwarded;
    - PAUSED: one or more series/slides instances can not be forwarded and the previously configured maximum number of attempts in the tasks has been reached;
    - DONE: the forwarding process of the entire series/slides has been completed without errors.

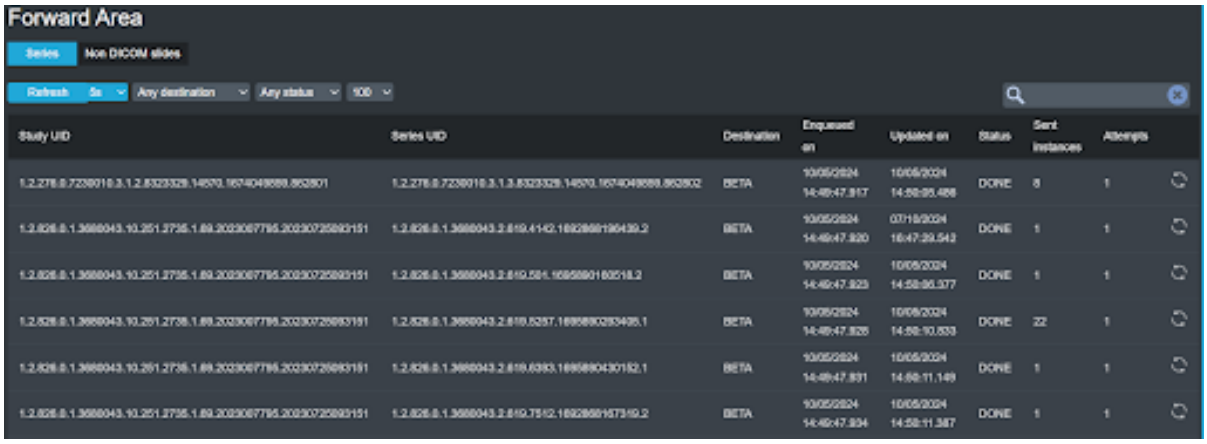


Image 48: Series forwarding

To filter the results, use the "*Destination*" and "*Status*" filters or the search bar on the top right.

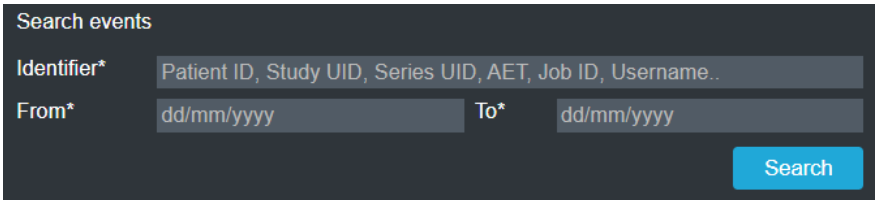
Users can choose the number of rows to be displayed (e.g. 100, 500 or 1000).

The "*Refresh*" button updates the table's content; it is also possible to configure the automatic table updates (every 5, 10 and 20 seconds) using the dropdown menu.

12 Event Logs

In the Event logs section user can analyze all operations performed on items stored on the ZEEROmed Store.

Upon selected the "*Event logs*" icon from the dashboard, the following panel is displayed, allowing user to filter by "Identifier" (which can be *Patient ID*, *Study UID*, *Series UID*, *AET*, *Job ID*, *Username*) and date range.



In particular, ZEEROmed Store stores the following operations or events performed on items:

- Patient: creation, update;
- Study: creation, reconciliation, update, movement, deprecation, recovery, deletion, relocation;
- Series: creation, reassignment, update, deprecation, recovery, deletion;
- Instance: movement;
- Node: creation, update;
- Job: creation, update, deletion;
- Webapp login events.

Results are limited to 1000 rows and each event contains the event type, the timestamp and all the partecipants.

The following examples pertain to patient's creation and node's operations research:

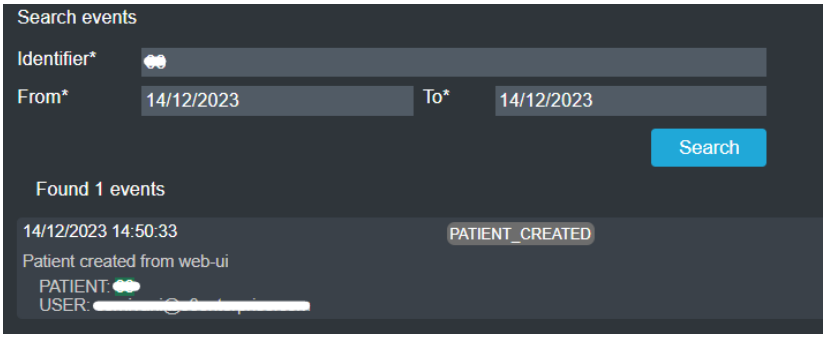


Image 49: Patient creation

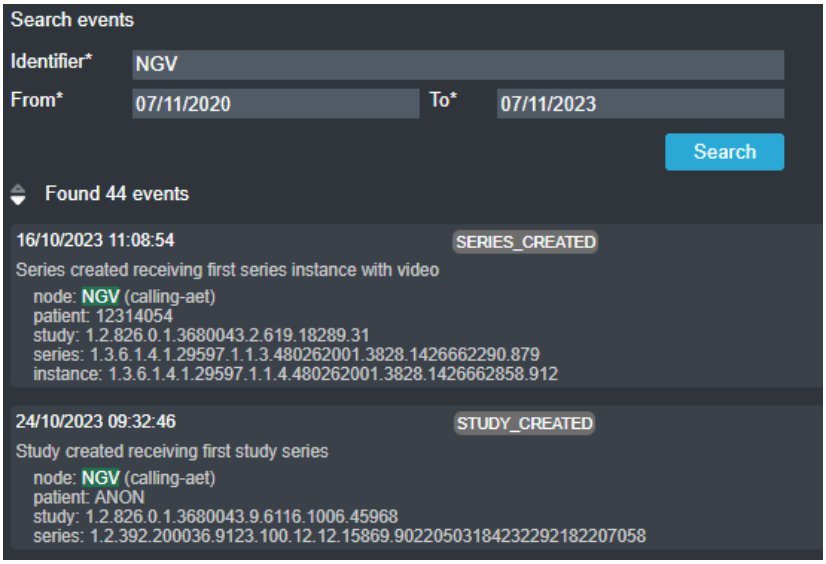


Image 50: Operations related to a node

13 Configurations

In the configuration page, user can check and update some ZEEROmed Store operation settings.

The page has three main sections: “*Settings*”, “*Buckets*” and “*API Keys*”.

NOTE: this section is only accessible to system administrators.

13.1 Settings - Tenant configuration

The *Settings* page includes the following subsections, which can be expanded by clickling the 'plus' icon:

- Settings: general system settings;
- Viewer: configurations for the image diagnostic viewer;
- Users' password constraints: settings for password restrictions;
- Email settings: configuration of the email server.

When updating a configuration, the user has to click on the “*Save*” button.

To revert to the last saved configuration, click the “*Reset*” button.

13.2 Buckets table

Through the *Buckets* table the user can view, edit or delete the currently configured *Google Cloud* or *AWS S3* buckets.

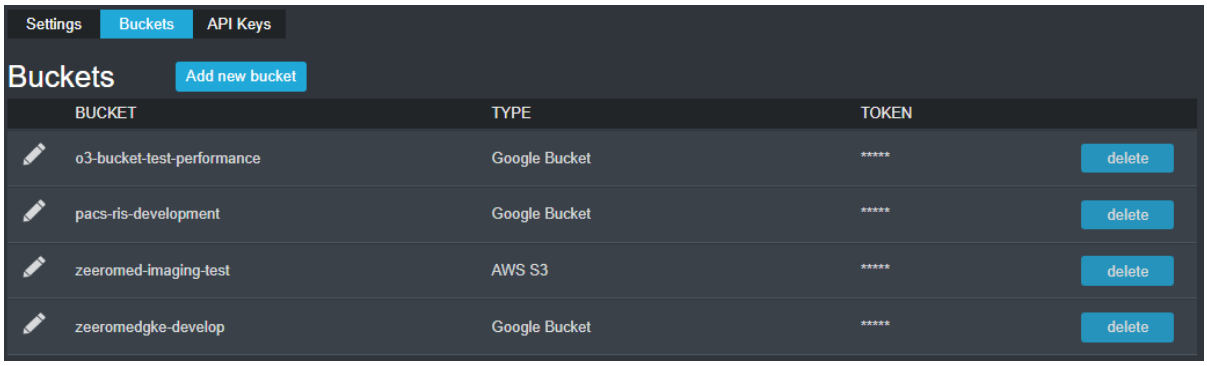


Image 51: Buckets panel

To add new buckets, click on the "*Add new bucket*" button and fill in the bucket configuration pop-up. In this phase the token is displayed.

> ⚠**Warning**: for security reason, the token can no longer be viewed

To update the bucket, click the "*Edit*" button .

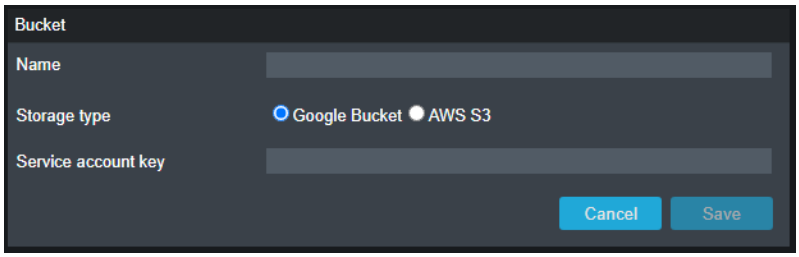


Image 52: Bucket configuration pop-up

To delete the bucket and its configuration, click the "*Cancel*" button.

NOTE: no files will be deleted but only the bucket's references.

13.3 API Keys

Through the *API Keys* table the user can view, enable or delete the configured API keys.

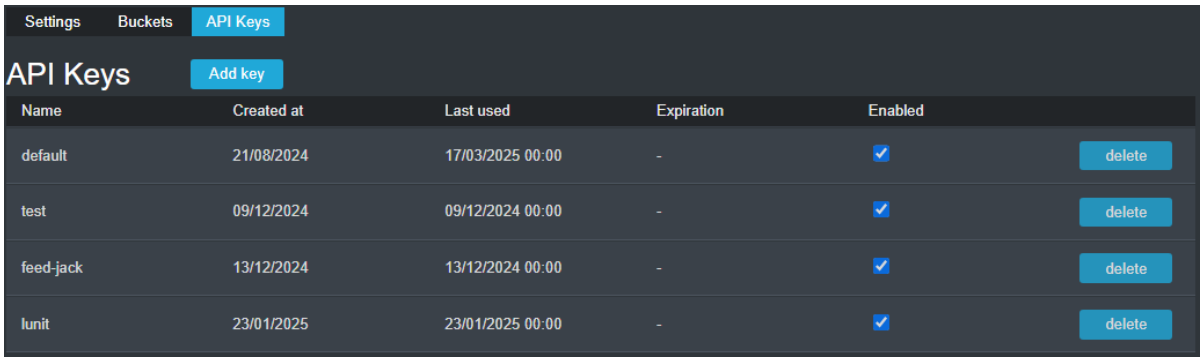


Image 53: API Key panel

To add new API keys, the user has to click on the "*Add key*" button and fill in the API key configuration pop-up.

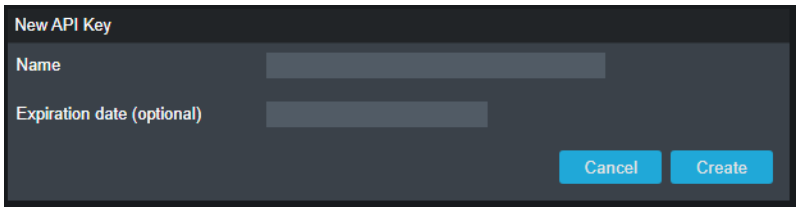


Image 54: API Key configuration pop-up

14 Upload

This section allows users to drag, upload and store DICOM files, zip files and folders.

Using a combo-box, the user can select the calling AE Title.

The upload process provides the following outputs: total uploaded files, stored files, error files, ignored files, stored study UIDs or optional error messages.

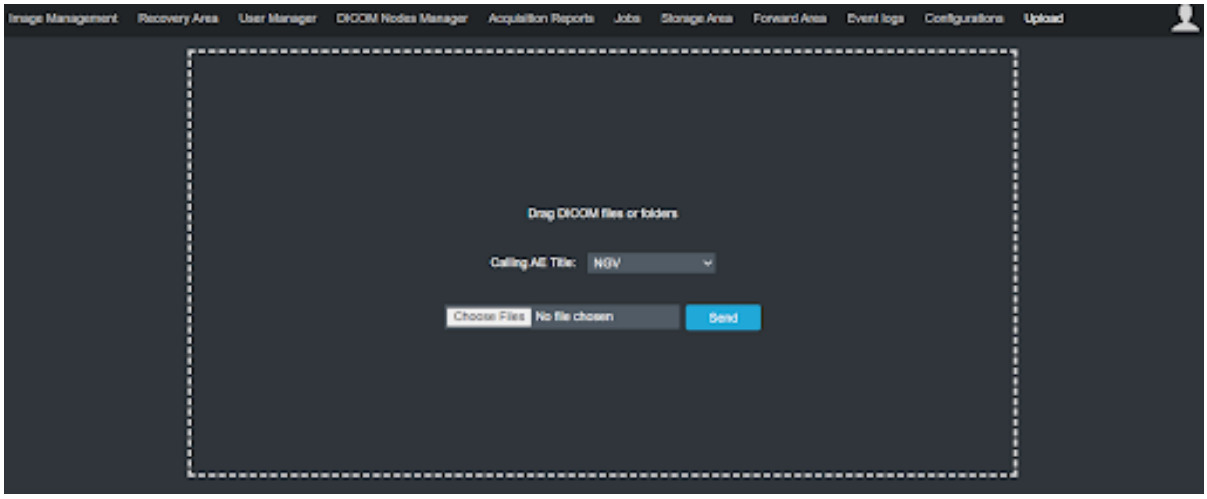


Image 55: Upload panel