

Museum Space – Model-driven Web-based Platform for Digitalisation and Preservation of Cultural Heritage

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Abstract. Museum Space is an end-to-end Museum Management Software Suite developed to help Galleries, Libraries, Archives, and Museums (GLAM) make the World's Cultural Treasure accessible to and meaningful for all. Museum Space utilizes Sirma Enterprise Platform (SEP), a comprehensive open-source platform with a service-oriented model-driven architecture (SOA, MDA) for high performance and reliability in the cloud. SEP incorporates open source components and semantic technologies which are used to implement enterprise content management (ECM) applications covering document and collaboration management, business process management, semantic search, optical character recognition (OCR), image annotation, managing email correspondence, security and permission management, integrations with legacy systems, etc. The semantic technology allows representing highly interlinked data and application of data scheme updates without increasing implementation and maintenance complexity.

Keywords: museum, GLAM, model-driven application, open-source, semantic

1 Introduction

The idea for the development of Museum Space (<https://museumspace.com/>), solution for full museum management, including collections, exhibitions, loans, acquisitions, conservation activities started from Conservation Space – a web-based, open-source, digital document management system, developed specifically for conservators by Sirma.

More than 8 years ago, in 2010, in a workshop organized by The Andrew W. Mellon Foundation (<https://mellon.org>), was identified a need of a system for the conservation community. A group of 26 conservators and IT professionals participating in the workshop, came up with functional requirements for ConservationSpace (<http://conspace.wixsite.com/conservationspace/copy-of-overview-1>) - a well-designed open-source software system that would facilitate the work of conservation professionals by supporting customizable templates to make report writing easy, providing ability to upload and store documents in all popular formats, powerful search tools to find documents, configurable to address all types of cultural objects, image annotation, etc. The request for proposals was released in October 2012 and our company Sirma

Solutions, a member of Sirma Group Holding, was selected as the developer in February 2013.

After we achieved the functional scope of ConservationSpace, and deployed it as a cloud multi-tenant application ready to be used by partner museums (Courtauld Institute of Art, The Denver Art Museum, Indianapolis Museum of Art, Statens Museum for Kunst, Yale University, and the National Gallery of Art, Washington), we upgraded the solution with two more modules – Exhibition Space (with exhibition management functionalities) and Collection Space (with collection and curation management functionalities)

2 Sirma Enterprise Platform - the Basis for Museum Space

2.1 SEP Architecture overview

Sirma Enterprise Platform (SEP) is a combination between semantic technologies, modelling tools and methods, as well as utilization of leading open-source servers and components. It is designed applying service-oriented architecture (SOA) for high performance and reliability. Applications built with the platform solve various business problems and comprise of specific models and customizations on top of a rich functional foundation. More information about the architecture and technologies used can be found on the in Sirma Enterprise Platform web site (<https://www.sirmaplatform.com/>)

2.2 SEP Functional overview

SEP establishes a solid functional foundation for enterprise data integration, content creation and organization, collaboration, knowledge management and business processes. The platform incorporates the following basic functionalities:

- **Content management** - Ability to upload, store and preview any kind of existing electronic document formats – MS Office, PDF, txt, scanned documents, images, audio and video files, OCR of scanned documents, version control (preview historical versions, compare versions), full text search in document content, records management, etc. Ability to create and edit documents directly in system, that can combine static text with dynamic content like a result of a real-time reports and content from other business objects and images.
- **Image management** - Integration with Mirador tool, an open-source, web-based tool for image annotation, deep zoom and image manipulations (brightness, contrast, flip, rotate, adjust saturation, support grayscale, image comparison and image overlay).
- **Manage business objects** – Ability to create business objects based on organization-specific semantic domain model, create libraries of business

objects, link documents and other business objects, manage behaviour based on state transitions.

- **Tasks and Business process management** - Integrated BPMN 2.0 based Camunda workflow automation platform, ability for automated execution of custom workflows, configured based on organization needs, support of single, pool and multi-instance tasks, log time on tasks, assign tasks in the context of documents and business objects, send notifications on new tasks.
- **Dashboards** - Provide personalized view of the system through custom dashboards, provide personal dashboards, as centralized high-level view of key information associated with the user.
- **Integrated e-mail** – Integrated Zimbra mail server and client, allowing support of email addresses for different business objects, thus providing unified space for communication and collaboration by sending email messages and addressing to internal and external recipients from the business object itself.
- **Contextual comments** - Ability to comment and create discussions on every document and business object, search and filter comments, send e-mail notifications when user is addressed in a comment.
- **Search** – Keyword search in the content of any document and business object, advanced search queries, providing ability to combine different business object criteria with AND and OR operands, saved searches.
- **Business reports** – provide ability to create custom static and dynamic business reports, support table view format of the reports, export to MS Excel, MS Word and PDF.
- **User management and access control** – manage user login credentials, manage personal profile, support role-based system for access control, support system audit log, single sign-on.
- **System configurations** – template management, vocabulary management, organization/ tenant specific configurations – default language, time zone, date format, etc.

3 Museum Space

Museum Space is a web-based, open-source museum management solution, built on top of SEP for the needs of Galleries, Libraries, Archives and Museums (GLAM). As the solution is model-driven, it allows rapid application development (RAD) and could easily be customized for any institution based on its specific requirements – data model, cultural objects tombstone data, business objects(e.g. loans, exhibitions, acquisitions, movements, etc.), types of documents and document templates, business workflows.

3.1 Features and capabilities

The museum management functionality is organized in 3 integrated modules – Collection Space, Exhibition Space, Conservation space:

- **Collection Space** - The module maintains an electronic dossier for every cultural object, that includes the scientific passport of cultural value and all documents related to acquisition and restoration, certificates, scientific publications, surveys, condition assessments, photos, audio and video files, etc. The module facilitates the movements and inventory of cultural objects by keeping register of all the buildings and premises of the museum, with history information for all the movements and relocations.
- **Exhibition Space** enables collaboration between people from different departments during their daily activities for preparing an exhibition - planning, documentation, sending requests for outgoing loans to other museums and private collectors, tracking requests for movements from one premises to another, etc. All materials, prepared for the purpose of an exhibition are stored in one place in a digital format - printed texts, drawings, diagrams, posters, diagrams, etc.
- **Conservation Space** is designed especially for the needs of conservation experts and conservation departments at galleries and museums. The main advantages of the module are related to the opportunities for creating documents, based on templates specific to the institution, running automated workflows for restoration and of cultural objects, storage of key data about the current and previous condition of cultural objects, annotation and manipulation of available images, image overlay and image comparison.

3.2 Models

The application is built based on specific models which manage specific aspects of the application. The data model is managed using ontology models and controlled vocabularies. The behaviour model covers the availability of actions, state transitions, validation, rules and conditions as well as business processes. The view model covers the representation of the data by allowing the users to manage templates by using different rich text editors and widgets. Examples of models are given below. The models are easily configurable to meet specific need of particular organization.

Museum Space ontology model

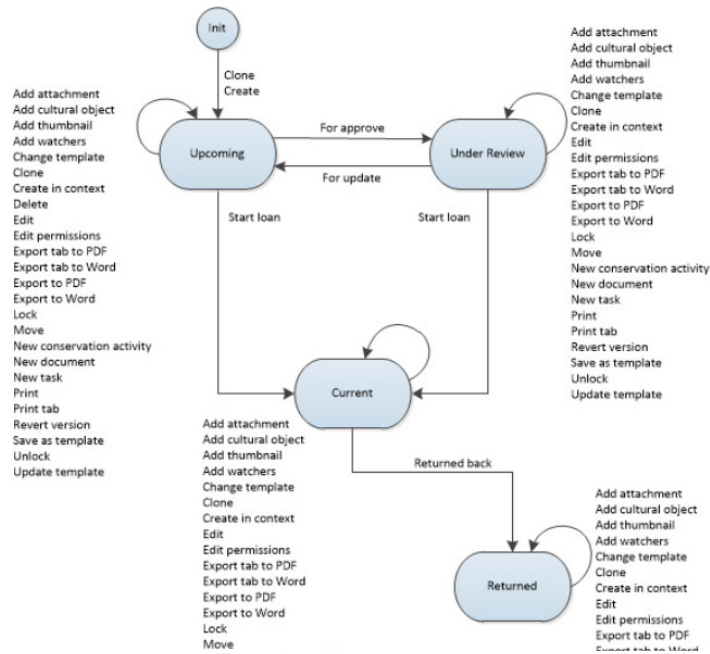


Fig 3 Example of description of actions for class Loan

Business process modelling

Business processes are modelled in BPMN 2.0 using Camunda Modelling tool. The BPMN 2.0 file is then deployed on Camunda Workflow Platform which is integrated in SEP.

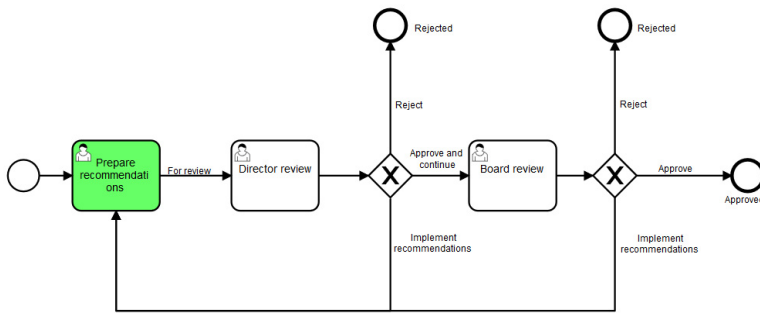


Fig 4 Example modelling the template for business object view page

3.3 Screens

Cultural object's dashboard

Cultural object's dashboard shows all information related to the cultural object including metadata, gallery view of related images, related documents, related activities such (e.g. conservation activities, movements, loans, etc.) and other. The dashboard is split in tabs so that different aspects of the cultural object to be displayed in more details separately. Comments, discussions can be easy added.

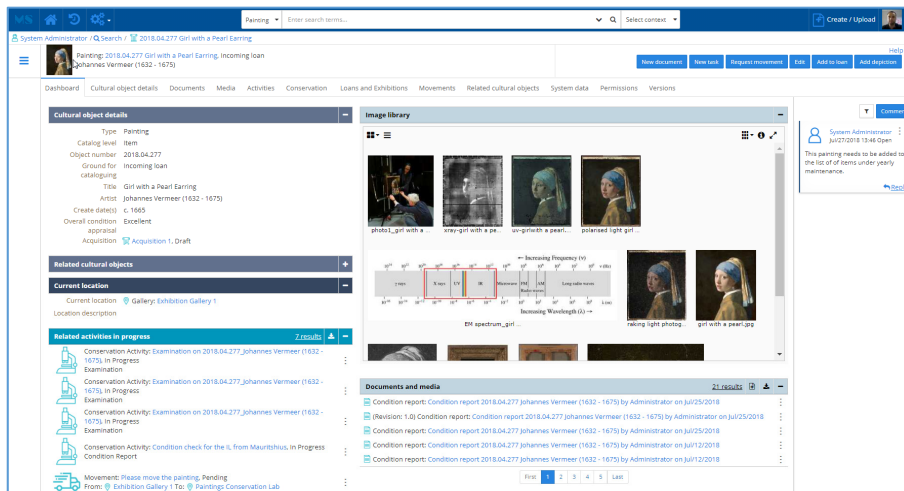


Fig 5 Cultural objects dashboard

Metadata fields

A comprehensive set of metadata fields is available. Customs metadata fields can be added via configuration.

The screenshot shows a web interface for a cultural object. At the top, there is a navigation bar with a search box and a 'Painting' dropdown. Below this, the breadcrumb trail reads: 'System Administrator / Reports - Cultural Objects / 2018.05.332 Roses / Q Search / 2018.04.181 Portrait of Louise de Keroualle, Duchess of Portsmouth'. The main header area includes a small image of the painting, the title 'Painting: 2018.04.181 Portrait of Louise de Keroualle, Duchess of Portsmouth, Museum collection Peter Lely (English, 1618 - 1680)', and a set of action buttons: 'New document', 'New task', 'Request movement', 'Edit', 'Add to loan', and 'Add depiction'. A secondary navigation bar contains tabs for 'Dashboard', 'Cultural object details', 'Documents', 'Media', 'Activities', 'Conservation', 'Loans and Exhibitions', 'Movements', and 'Related cultural objects'. Below the tabs, there are sub-sections for 'System data', 'Permissions', and 'Versions'. The main content area is titled 'Cultural object details' and contains the following fields:

- Type: Painting
- Catalog level: Item
- Object number: 2018.04.181
- Ground for cataloguing: Museum collection
- Status: Current
- Title: Portrait of Louise de Keroualle, Duchess of Portsmouth
- Artist: Peter Lely (English, 1618 - 1680)
- Description: Louise de Keroualle, the duchess of Portsmouth, sits in front of a window open to a lush landscape. Her loosely draped blue silk dress reveals the creamy skin of her chest and neck. In a pose both sensual and elegant, with her head slightly turned, Louise de Keroualle looks down at the viewer as she plays with a thick, lush strand of her abundant hair. Her features—almond-shaped eyes, gently arched eyebrows, a straight nose, and full red lips—epitomized ideal beauty of the late 1600s. Louise de Keroualle, who worked as a spy for Louis XIV, came to England from France as a Maid of Honour to the sister of King Charles II in 1670. Soon afterward, she became Charles's favorite mistress, and in 1673 he created for her the position of Duchess of Portsmouth. She used her influence to strengthen the friendship between Charles II and Louis XIV.
- Create date(s): about 1671-1674
- Materials and technique: canvas
- Inscription:
- Physical dimensions: 125.1 x 101.6 cm (49 1/4 x 40 in.)
- Credit line:
- Provenance: by 1769 - 1819 George Harry Grey, fifth earl of Stamford and first earl of Warrington, 1737 - 1819, probably by inheritance to his son, George Harry Grey, 1819. Source: 1769 Dunham Massey inventory, 1819 - 1845 Probably George Harry Grey, sixth earl of Stamford and second earl of Warrington, 1765 - 1845, probably by inheritance to his grandson, George Harry Grey, 1845 - 1883 George Harry Grey, seventh earl of Stamford and third earl of Warrington, 1827 - 1883, probably by inheritance (life interest only) to his second wife, Katherine Cocks, 1883 - 1905 Probably Katherine Cocks, countess of Stamford, died 1905, probably by inheritance to her grandniece, Catherine Sarah Grey, 1905 - 1909 - Probably Lady Catherine Sarah (Payne) Grey, died 1923, probably by inheritance to her son, John Foley Grey, - 1928 Sir John Foley Grey, eighth Bart., 1893 - 1938 [sold, Grey sale, Christie's, London, June 15, 1928, lot 48, to Coinagli,] 1928 Coinagli, sold to L. Gow, July 1928; transaction cancelled and painting re-
- Owner:
- Bibliography: Catalogue of the Art Treasures of the United Kingdom, Collected at Manchester in 1857, exh. cat. (n.p.: n.p., 1857), p. 122, no. 198, Christie, Manson & Woods, London, Catalogue of Choice Pictures by Old Masters: The Property of Sir John Foley Grey, Bart. [...], June 15, 1928, p. 9, lot 48; Sotheby's, London, Catalogue of Important Old Master Paintings [...], December 7, 1960, p. 4, lot 9; Sotheby's, New York, Important Old Master Paintings, December 2, 1976, under lot 148, Millar, Oliver, Sir Peter Lely, 1618-80, exh. cat. (London: National Portrait Gallery, 1978), pp. 65-66, no. 49, ill. Rogers, Malcolm, "Some Beauties of Sir Peter Lely," Connoisseur 200, no. 804 (February 1979), p. 112, cover ill. Stewart, J. Douglas, Review of Sir Peter Lely, 1618-80, London, National Portrait Gallery, The Burlington Magazine 121, no. 911 (February 1979), pp. 130, 132, fig. 39; Benko, Eva, "Sur un Portrait de Femme par Godfrey Kneller," Bulletin du Musée des Beaux-Arts, no. 55, (1980), pp. 57-64, figs. 35 (detail).
- Overall condition appraisal: Good
- Acquisition:

Fig 6 Cultural object's metadata fields

Acquisition workflow

Formal processes may require automated workflows, for example review of acquisitions. Workflows ease the process of going through process, providing tasks assignments according to the predefined flow, visualization of the workflow and its status, reports etc.

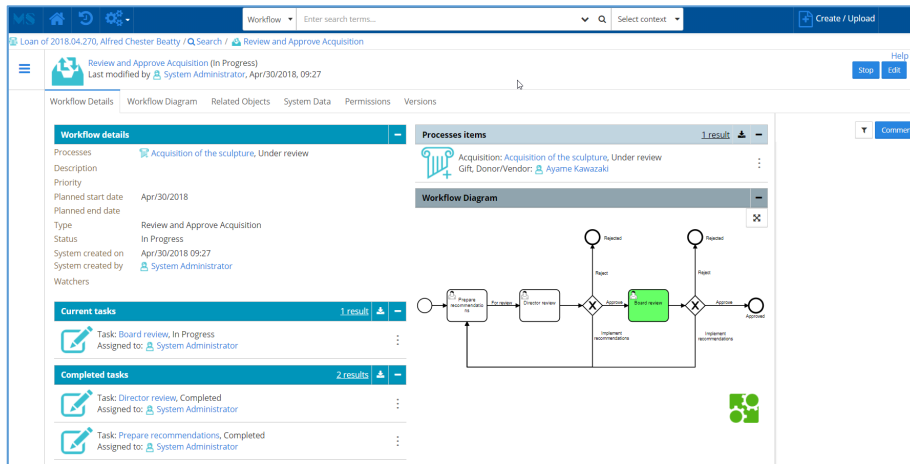


Fig 7 Acquisitions workflow

Creating documents online

System allows users to create documents online. Predifined documents templates are available and users can define their own. The online created documents can combine text, dynamically extracted information, preview of images, reports results etc. Document templates can be used.

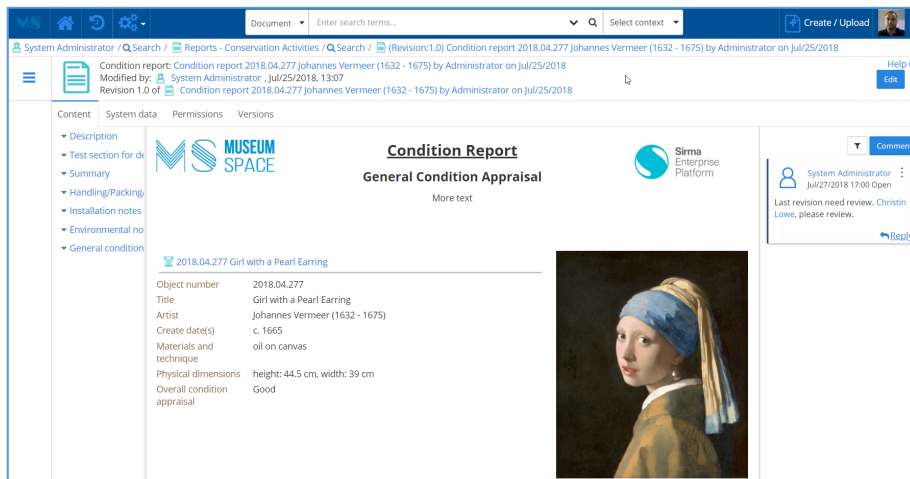


Fig 8 Condition Report - an online created document

Images

MusemuSpace provides a functionality to preview, annotate and edit images. Images can be directly previewed, manipulated or annotated on object's dashboards and in documents.

Images can be visualised in different views – image view, book view, gallery view and scroll view.

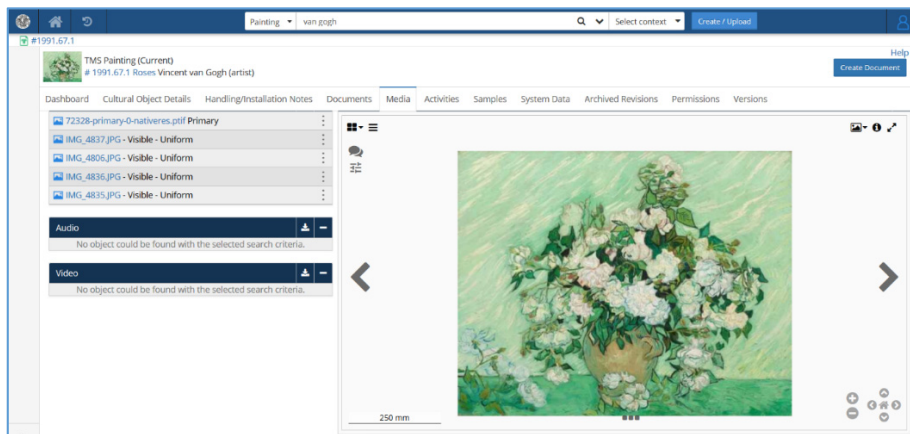


Fig 9 Preview of an image related to a cultural object

Deep zoom on multi-resolution images is available.



Fig 10 Deep zoom of a multi-resolution image

Image annotations can be placed on a selected area of the image using variety of options for selection shape, collar, comment formatting and more. Comments on annotated images can be easily seen at any time when pointing at the annotated area.

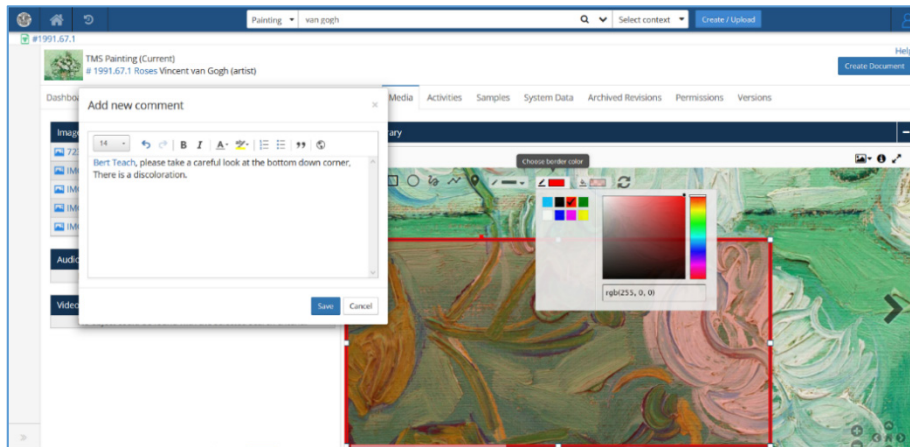


Fig 11 Image annotation

Image overlay allows different photographs (x-ray and a regular photo) to be put on over the other as separate layers. Changing opacity of each layer reveals mappings between the images.

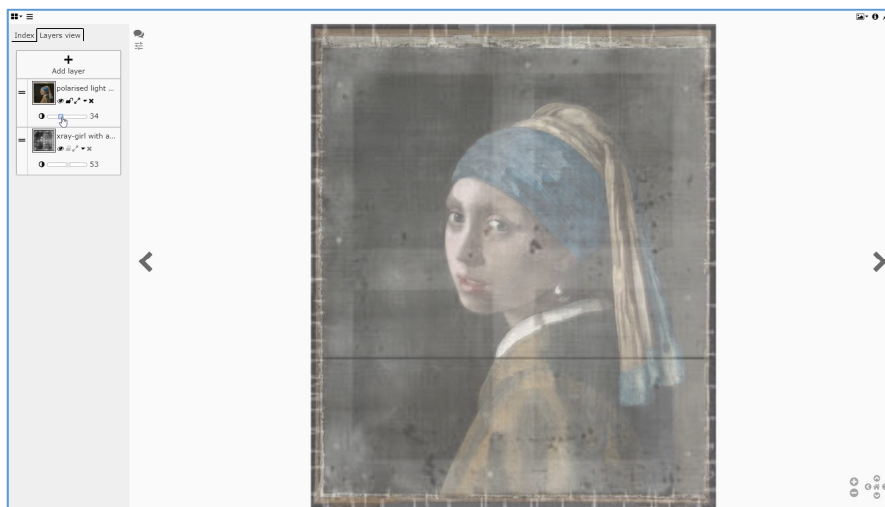


Fig 12 Image overlay

Searching

MuseumSpace provides comprehensive and easy to use search functionality, based on semantic technology. It allows users to search using combination between texts, metadata and object relations.

Advanced search allows using of all metadata and relations of the objects together with full text search.

The screenshot displays the MuseumSpace advanced search interface. At the top, there is a navigation bar with icons for home, search, and user profile, along with a search bar containing 'Enter search terms...' and a 'Select context' dropdown. Below the navigation bar, the user is identified as 'System Administrator' and the current location is '2018.07.386 The Bay of Naples'. The search results show '1 - 7 of 7 items are found for type Painting'. The search criteria are defined as follows:

- Keywords: Contains Enter search terms...
- Materials an...: Contains oil
- Overall condi...: In Bad

The search results list the following paintings:

- Painting: 2018.04.175 David Meeting Abigail, Museum collection
Workshop of Peter Paul Rubens (Flemish, 1577 - 1640)
- Painting: 2018.04.142 Cimon and Pero: "Roman Charity", Museum collection
Jean-Baptiste Greuze (French, 1725 - 1805)
- Painting: 2018.04.141 Family Group in an Interior, Museum collection
Attributed to Quiringh Gerritsz. van Brekelenkam (Dutch, after 1622 - about 1669)
- Painting: 2018.04.136 Classical Landscape with Figures and Sculpture, Museum collection
Pierre-Henri de Valenciennes (French, 1750 - 1819)

Fig 13 Advanced search for objects

Reporting

The MuseumSpace provides a comprehensive set of reporting options. The reports show up-to date information visualized as tables or different charts. Report results can be included in any document or on dashboards.

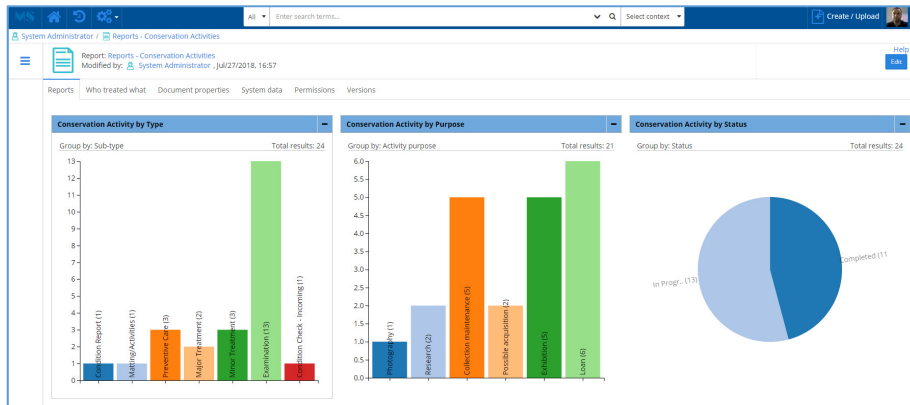


Fig 14 Reports as charts

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