

A Design of a Framework for Organising Virtual Museum over the Web

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Abstract

This paper extends the work presented at CIDOC 2005 and 2006 by describing a design a framework for organising virtual museum, using information provided by the collaborating museums in the form of web services. The museum content published by the collaborating museums is organised in a homogeneous virtual exhibition space by an exhibition curator and is accessible from a single point of entry – the Virtual Exhibition site. By using an XMLSchema for specification of the common exhibition information and utilising contemporary information technologies for processing XML data over the web. This paper will introduce a design of a framework for exchange of information between several independent museums over the web. The system presented is built entirely using a public domain stack of technologies for processing XML data and web service packages. The main aim of using UML is to be able to produce detailed object models and designs from system requirements, in addition to identifying the use case diagrams for the proposed system and expanding them into full behavioural designs. The design of the virtual museum shows the entire important diagram such as analysis of use case diagram, activity diagram and sequences diagram that shows how the system processes this activity. The aim of the framework is to demonstrate good practice in developing a web-based system for the exchange of information between museums. Furthermore, the paper will describe one further step in the direction of accomplishment of truly pan-European collaboration for organisation of virtual museums. The approach adopted demonstrates how to add a new European dimension in the inter-museum collaboration and to achieve wider access to the rich European cultural heritage. A demonstration of the system is available.

1 INTRODUCTION

As the Web becomes increasingly the world's official media, many museums, achieves, libraries, and cultural heritage centres throughout the world invest in documenting their collections and in publishing their material via the web, making their information accessible on the Internet. Generally, museums use many different styles in presenting their collections on their Web pages. In addition, some museums provide sophisticated searching facilities so that the user can retrieve information about required items by subject, date, and place. It is fairly certain that with such sophisticated new technologies, the need for standards to manage the information that these collections contain becomes more and more urgent.

As a result, several projects have been conducted in the last few years in order to develop a unified standard for organizing and managing data and information in such institutions. In the same way, many museum organisations are working together to develop standards and techniques and to make their resources more widely and easily available. On this basis, (ICOM-CIDOC) and CIDOC documentation standard working group (DSWG) have engaged in the creation of a general data model for museums. CIDOC have particularly focused on information interchange. As a result, this effort resulted in 1999 in the first complete package of the “CIDOC Conceptual Reference Model” (CRM). Such an achievement was a result of intensive hard work from many experts in the field of IT and museum information many specialists contributed to this work, in order to fully exploit the potential of the CRM as a means to enable information interchange and integration in the museum community and beyond [ICOM-CIDOC 1995]. As we know, data is very important to every industry, the way data is stored and transferred between applications, and the means to reduce the redundancy and inefficiency have gained in importance. A great deal of work in managing data has been done for e-commerce applications using EDI (Electronic Data Interchange).

Currently work is being done on XML for data handling. In today’s world data presentation over the web is of concern. XML is one such technology that has created a revolution in handling and managing data [W3C 2004]. XML started out as a way of presenting data over the Web and has later extended to a wide range of applications because of its platform independent interoperable nature. The features such as data presentation over the web and interoperable nature have made XML popular in a wide range of applications. The coming of XML has widened the scope for companies and technologists world over [W3C 2000, W3C 2004]. It has enabled them to explore possibilities in the area of efficient data exchange, presentation of data and querying of the data. XML documents are self-describing and platform independent. Also the XML makes data exchange between different databases and different platforms relatively easy [Bourret 2004, Bourret 2005]. Furthermore XML is fast emerging as the dominant standard for *representing* and *exchanging* information between the web applications and different platforms where it is relatively suitable. So if data is stored and represented as XML documents, then it should be possible to query the contents, extract, present, transform and search of data become simpler. To be more specific, XML (eXtensible Markup Language) is a markup language defined by the W3C that provides a way to create extensible format for describing structured data in electronic documents and to express rules about this data [W3C 2004]. The main aim of using XML is to be able to produce detailed object models and designs from system requirements, in addition to identifying the use case diagrams for the proposed system and expanding them into full behavioural designs [J. Conallen 1999].

The paper introduces a design of a framework for organising virtual museums, which uses information provided by the collaborating museums in the form of Web services. The museum content published by the collaborating museums is organised into a homogeneous virtual exhibition space by an exhibition curator and is accessible from a single point of entry – the Virtual Exhibition site. The rest of the paper is structured as follows: Section 2 presents the related work. Section 3 presents the design of the museum system. A subsection 3.1 introduces the analysis of the use cases for the system and the subsection of 3.2 presents the activities diagrams for each use case. A subsection 3.1 leads to the sequences diagrams of the system. A subsection 3.4 presents the entity relation diagram. A subsection 3.5 and 3.6 introduces the component and deployment diagrams respectively.

2 RELATED WORK

[Elbekai & Rossiter 2006] presented an implementation of a framework for organising virtual exhibitions, which uses information provided by the collaborating museums in the form of Web services. [Elbekai & Rossiter 2005] presented a prototype of a framework for organising virtual exhibitions and describes one further step in the direction of accomplishment of truly pan-European collaboration for organisation of virtual exhibitions using a single

XMLSchema for specification of the common exhibition information and utilising contemporary information technologies for processing XML data over the Web. [Vassil Vassilev et al 1999] present both a general description and a technical specification of the information system for museum information processing. [Vassil Vassilev et al 2000] worked on previous projects for publishing museum content over the Web (in archaeology, in watermark images and in industrial heritage).

[Crofts Nicholas 2003] described a practical application of the CIDOC CRM in integrating a large and diverse set of data sources. These data sources, accumulated over a number of years, all contain information relating to Geneva's architectural and cultural heritage.

[IGMOI 1995, ICOM-CIDOC 1996-2003, CIDOC CRM 2004] that is being developed into an ISO standard as a joint effort of the CIDOC CRM SIG and ISO/TC46/SC4 (ISO/AWI 21127). CIDOC is the result of work done by the CIDOC Documentation Standards Group, from 1994-2000, and the CIDOC CRM Special Interest Group from 2000-2002, as the result of an initiative to define the underlying semantics of database schemata and document structures needed in museum documentation for the support of good practice in conceptual modeling, data transformation, data exchange, information integration and mediation of heterogeneous. [Bourret 2004] noted that XML and its related technologies have many facilities in common with real databases such as storage (XML documents), schemas (DTDs, XML schema languages) and programming interfaces (SAX, DOM, and JDOM. [Wiederhold 1993] adopted a wrapper mediator architecture and provide a uniform user interface to query integrated views of heterogeneous information sources. This work extends the work we have presented at the CIDOC 2005 and CIDOC 2006.

3 ANALYSES AND DISAGN OF THE MUSEUM SYSTEM

This section will introduce a design of a framework for organising virtual museum over the Web. The system according to the CIDOC standard and its extensions could be entirely characterized in terms of the tables and relationships shown on these diagrams. The system presented is build entirely using public domain stack of technologies for processing XML data in Java (J2SE, J2EE and additional XML and Web Services packages). It functions as entirely server-side Web application executed by Tomcat server connected to a backend database (one for each participating museum).

3.1 Use Cases Diagram

A use case is a sequence of actions that an actor performs within a system to achieve a particular goal. Also, the use case diagram shows the interactions between the roles of the system users, called actors, and subsets of system functionality [David Carlson 2001]. Analysis starts with the search for the actors (categories of users) of this access museum system. An actor represents a generic role played by someone or something interacting with the system. A use case diagram captures a model of several use cases, which depend on one another and how one or more actors interact with those use cases. Figure 1 shows a use case diagram for the museum system and the relationships between the actors and the use cases. It is not always easy to determine the boundaries of the system but by definition, the actors are always outside it. In the following more information on important diagram such as analysis of use case diagram, activity diagram and sequences diagram that shows how the system processes this activity. Each activity which can be registered with the museum information system according to the CIDOC standard and its extensions [Vassilev 1999] could be entirely characterized in terms of the tables and relationships shown on these diagrams.

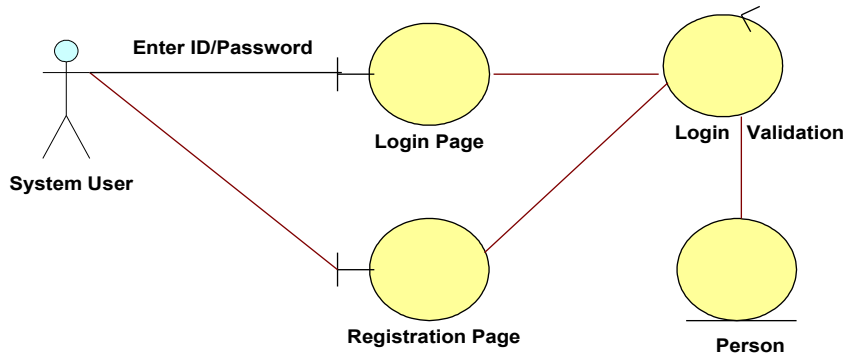
Figure 1: Use Case Diagram



- **Login and Registration Diagram**

As show in Figure 1.1 the login activity is responsible for registration procedure for how the system users (Curator and staff) and login procedure. This activity has the main interface page with the user. Such extended activity is required when Web visitors want to *Sign in* for the first time.

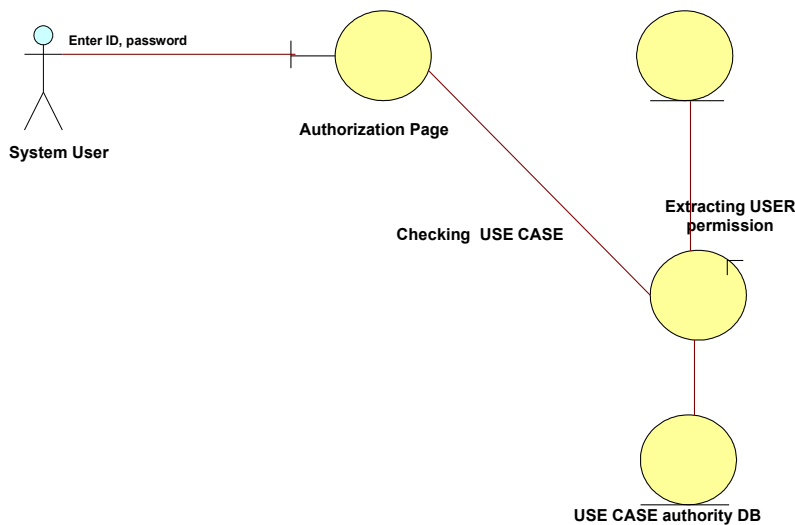
Figure 1.1: Login Activity Diagram



- **Authorization Diagram**

Authorization activity is responsible for (who can do what) on the system. Figure 1.2 shows more details on the authorization activity.

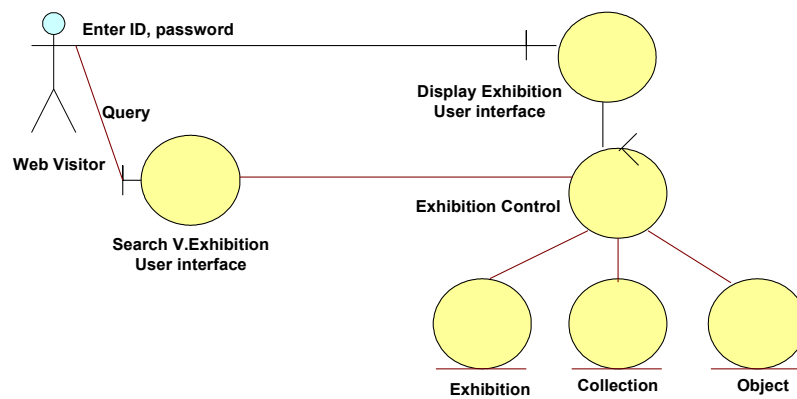
Figure 1.2: Authorization Activity Diagram



- **Search and display virtual exhibition**

This activity is for Search and Browse Virtual Exhibition that allow the Web visitors to browse the Virtual Exhibition over the web (freely). Figure 1.2 shows more details on the search and display activity.

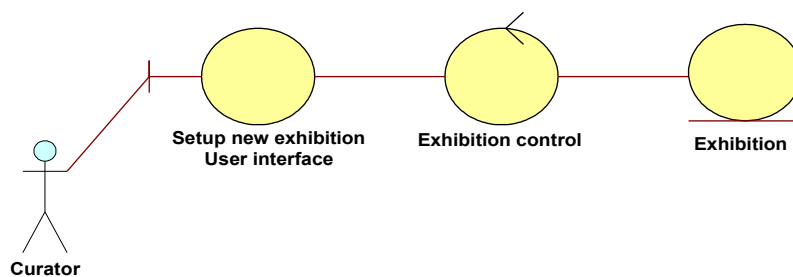
Figure 1.3: Search and Display Activity



- **Setup new exhibition**

This activity includes setting up new exhibition, providing the system. Figure 1.4 shows more details on the setup new exhibition activity.

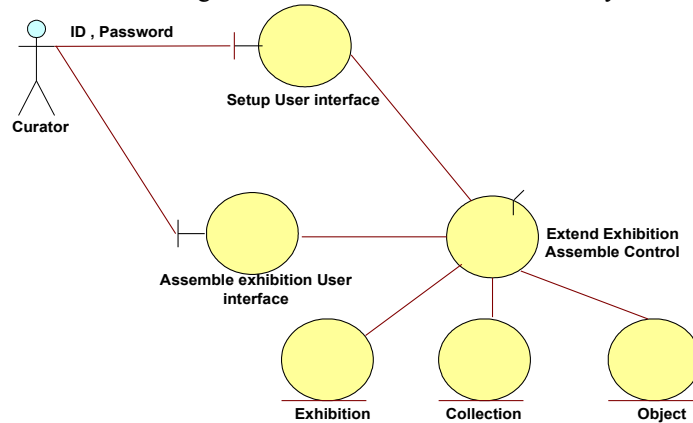
Figure 1.4: Setup new Exhibition Activity.



- **Assemble Exhibition**

This activity includes assembling published objects and collections for the intended exhibition. Figure 1.5 shows more details on the assemble exhibition activity.

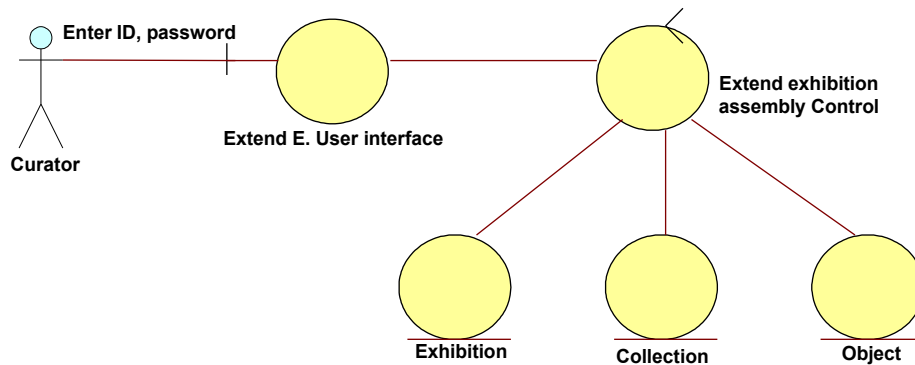
Figure 1.5: Assemble Exhibition Activity



- **Extending an exhibition**

This activity includes updating Exhibition activities. Figure 1.6 shows more details on the extending exhibition activity.

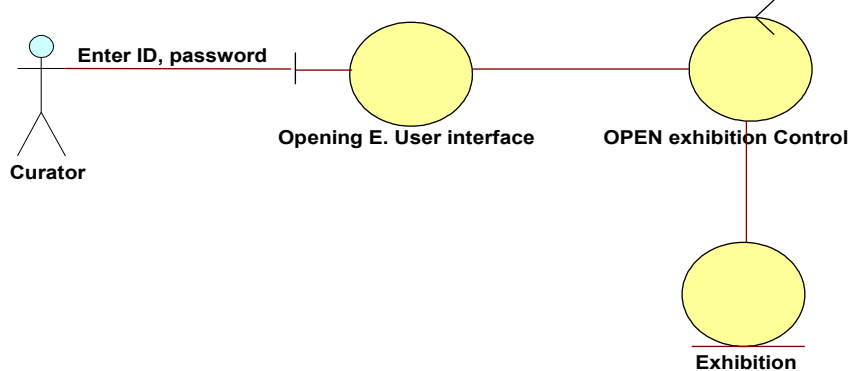
Figure 1.6: Extending Exhibition Activity



- **Open an exhibition**

This activity is responsible for opening the exhibition and includes such kind of exhibition (any information about virtual exhibition or public display). Figure 1.7 shows more details on this activity.

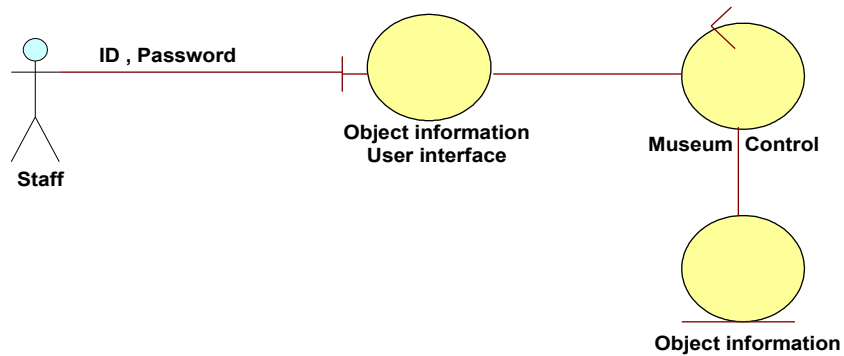
Figure 1.7: Open an Exhibition Activity



- **Object information**

This activity includes updating museum objects information and also this activity can be used for updating Institutions information (any information related to institutions). Figure 1.8 shows more details on the object information activity.

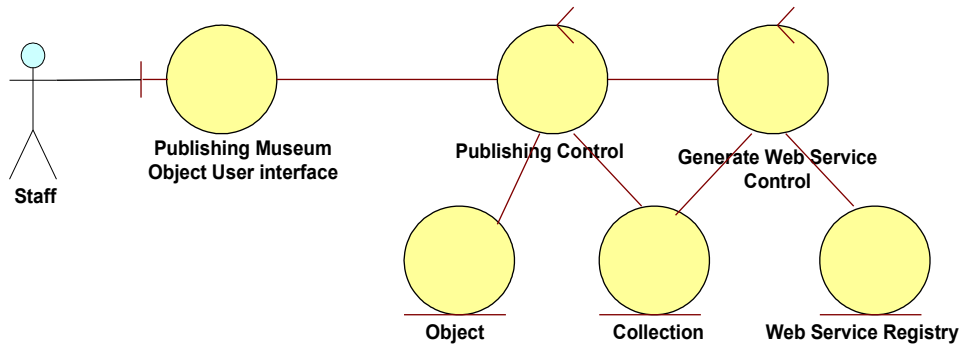
Figure 1.8: Object Information Activity



- **Publishing museum objects**

This activity includes publishing museum collections and also constructing collections (set of objects). Figure 1.9 shows more details on the publishing museum objects activity.

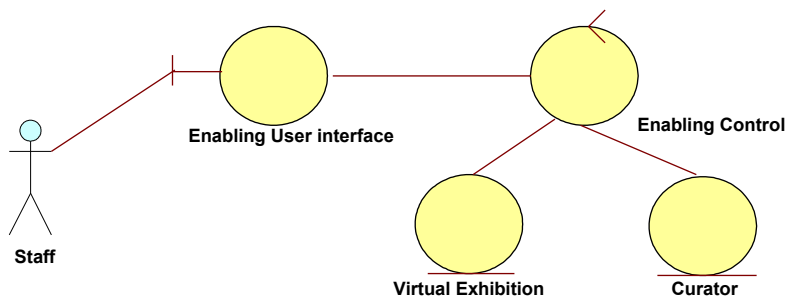
Figure 1.9: Publishing Museum Objects Activity



- **Enabling museum activities**

This activity includes constructing collections (set of objects). Figure 1.10 shows more details on the enabling museum activity.

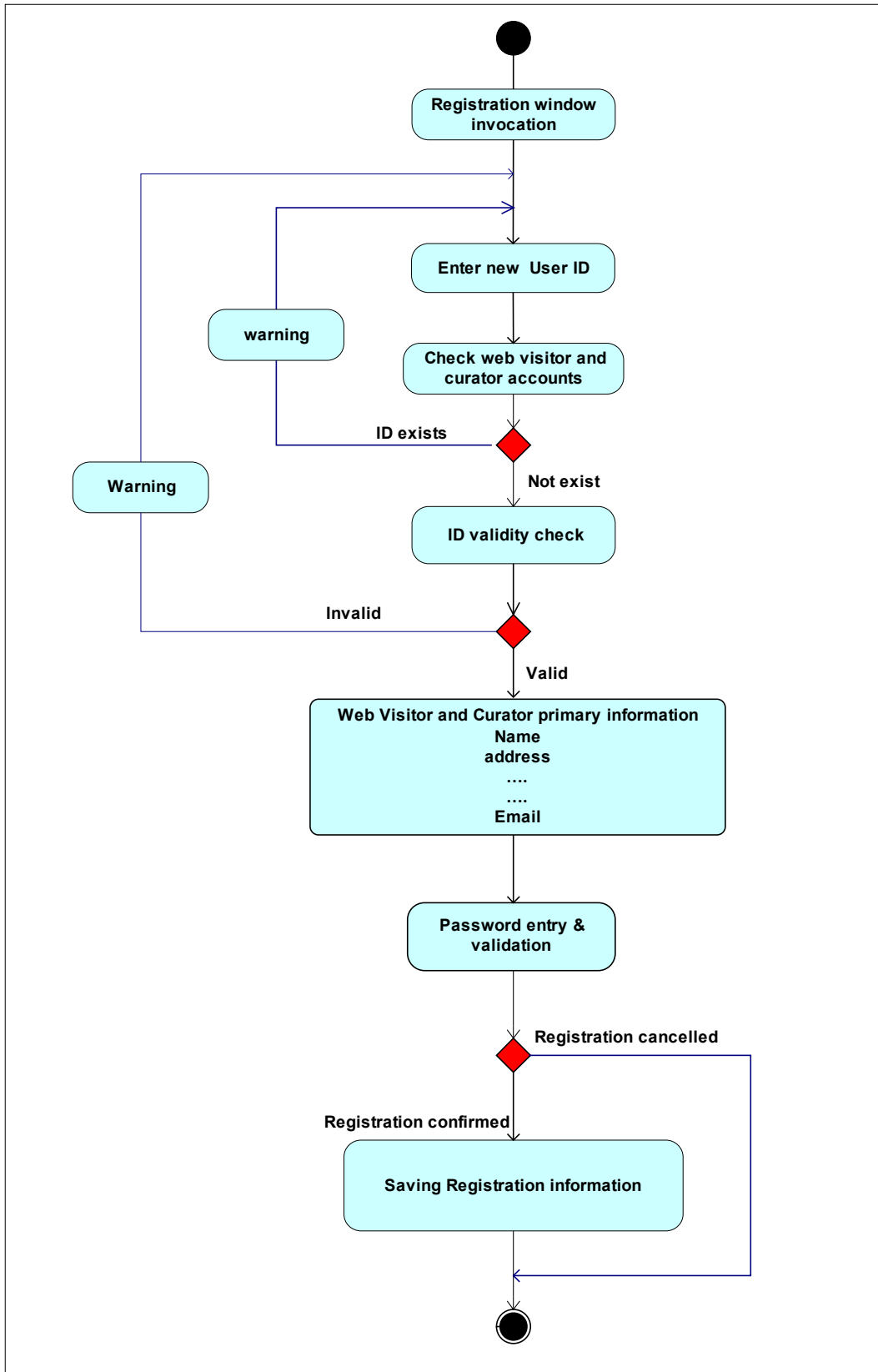
Figure 1.10: Enabling Museum Activity



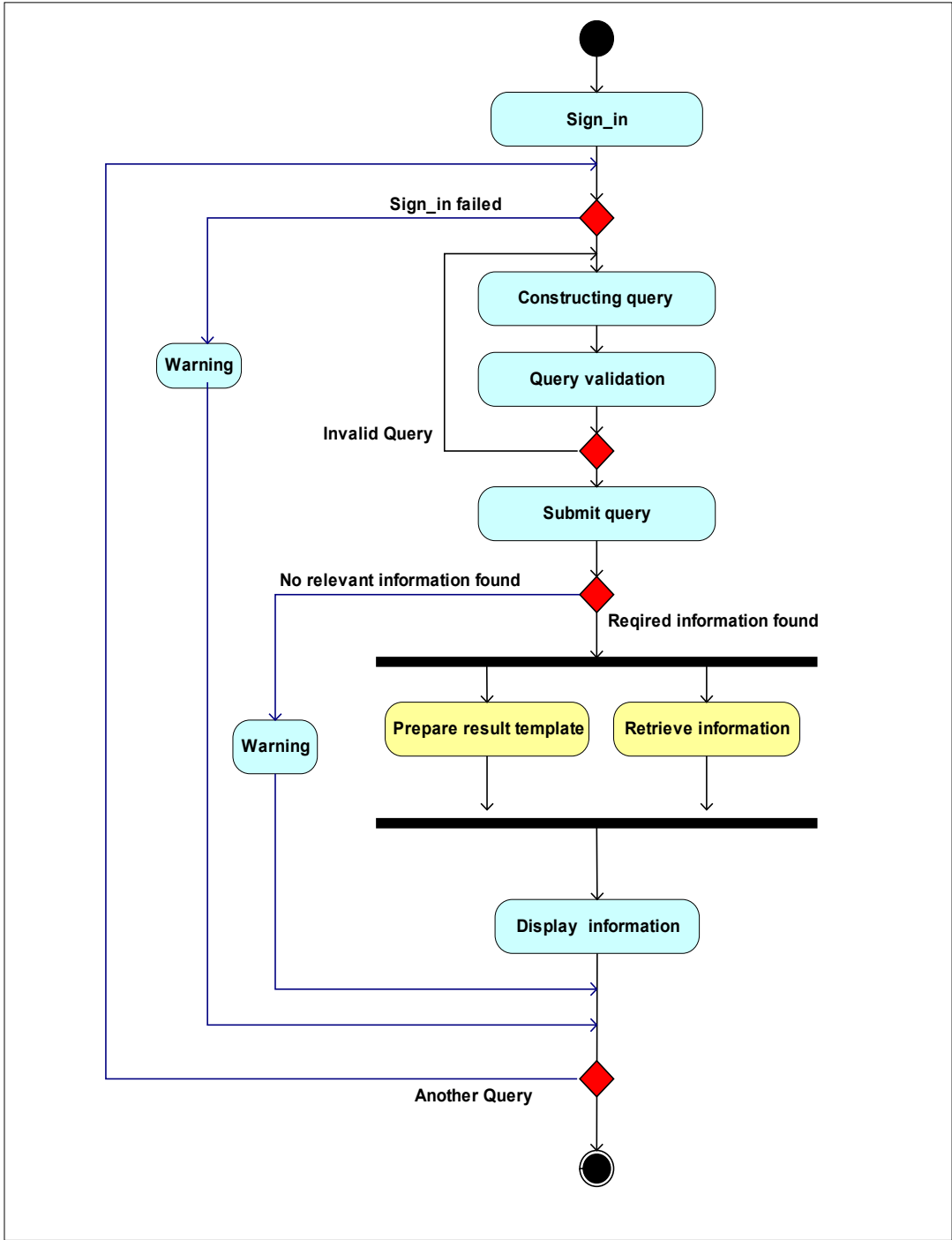
3.2 Activity Diagrams for the Museum System

UML Activity diagrams are the object-oriented equivalent of flowcharts and data-flow diagrams from structured development. They are used to explore the logic of a several use cases and the software processes. The following diagrams such as login diagram, search on object collection information, setup new exhibition, assemble exhibition, extend exhibition, object information, publication museum objects, collection assembly and update exhibition activity diagrams explain in more details how to process of all the above use cases in the museum system.

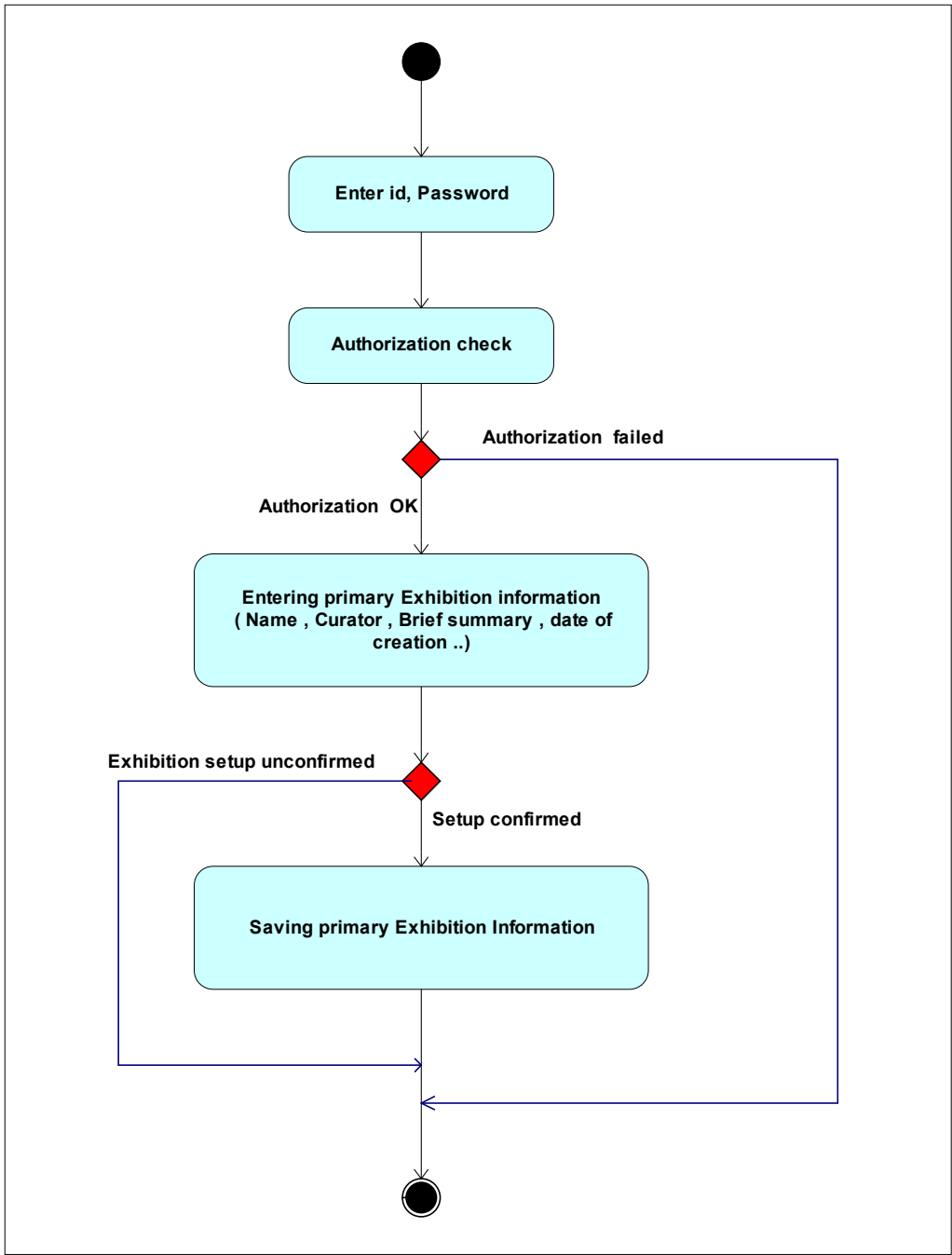
- **Login and Registration Activity Diagram**



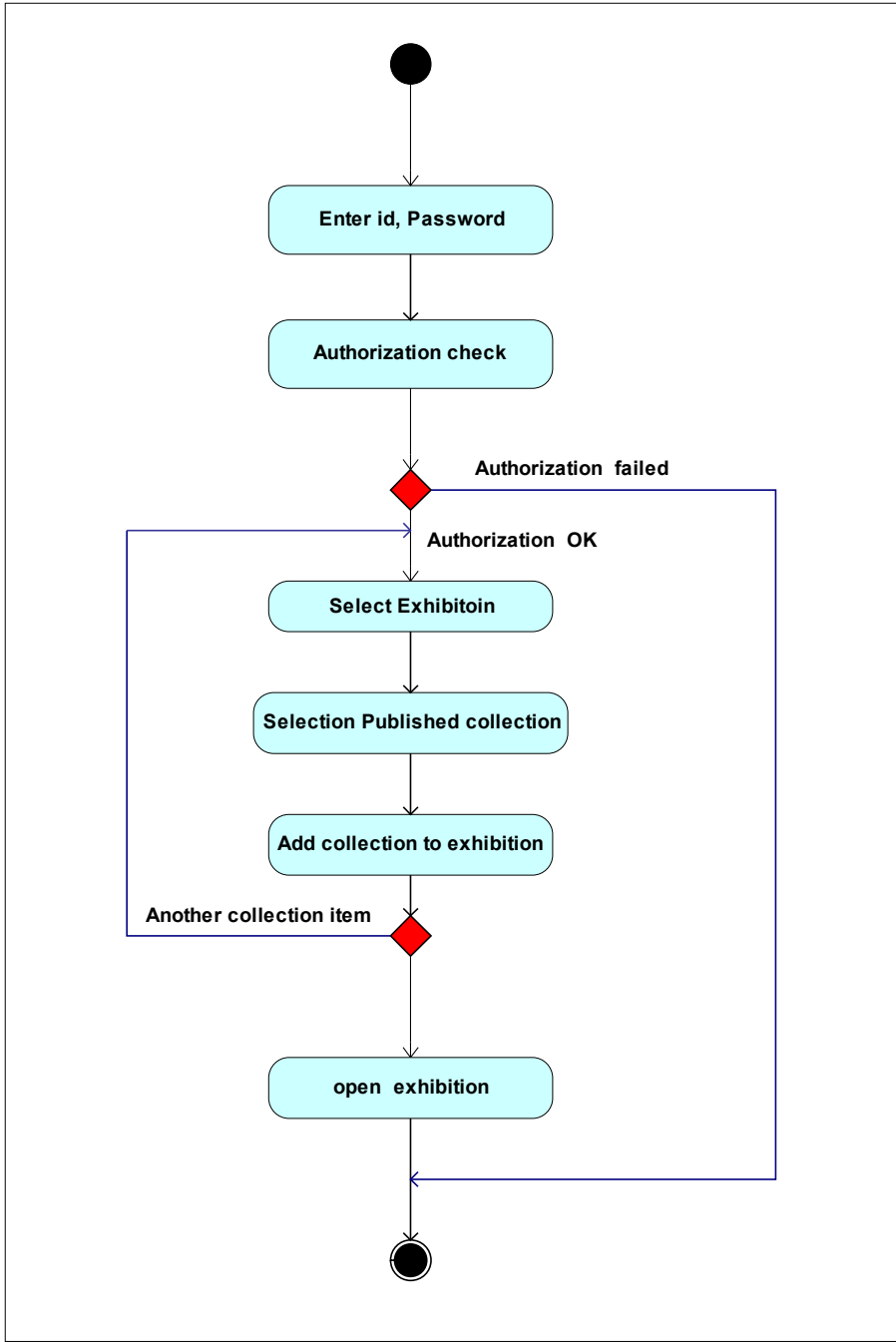
- Search and Display Object Collection Information Activity Diagram



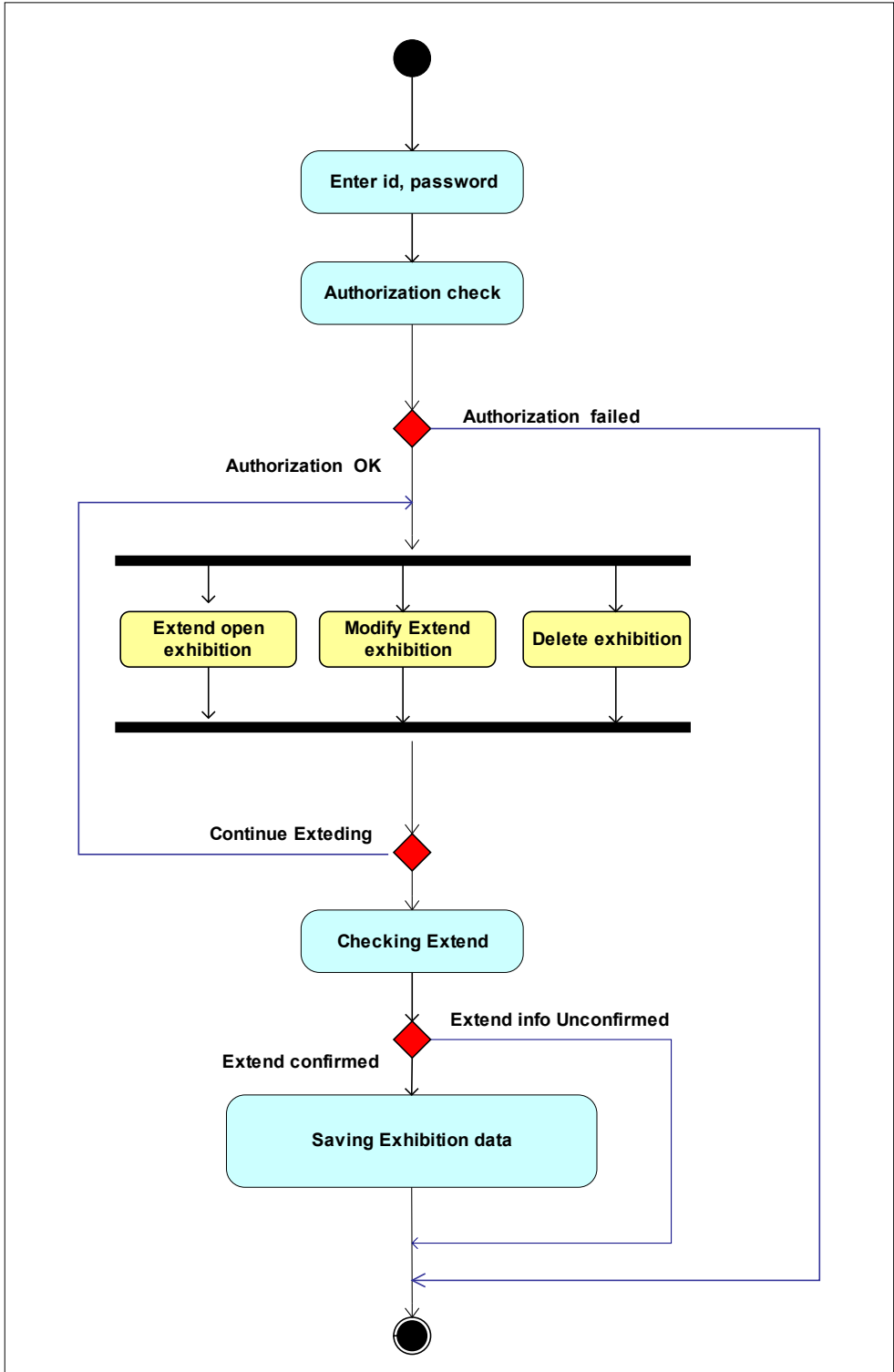
- Setup New Exhibition Activity Diagram



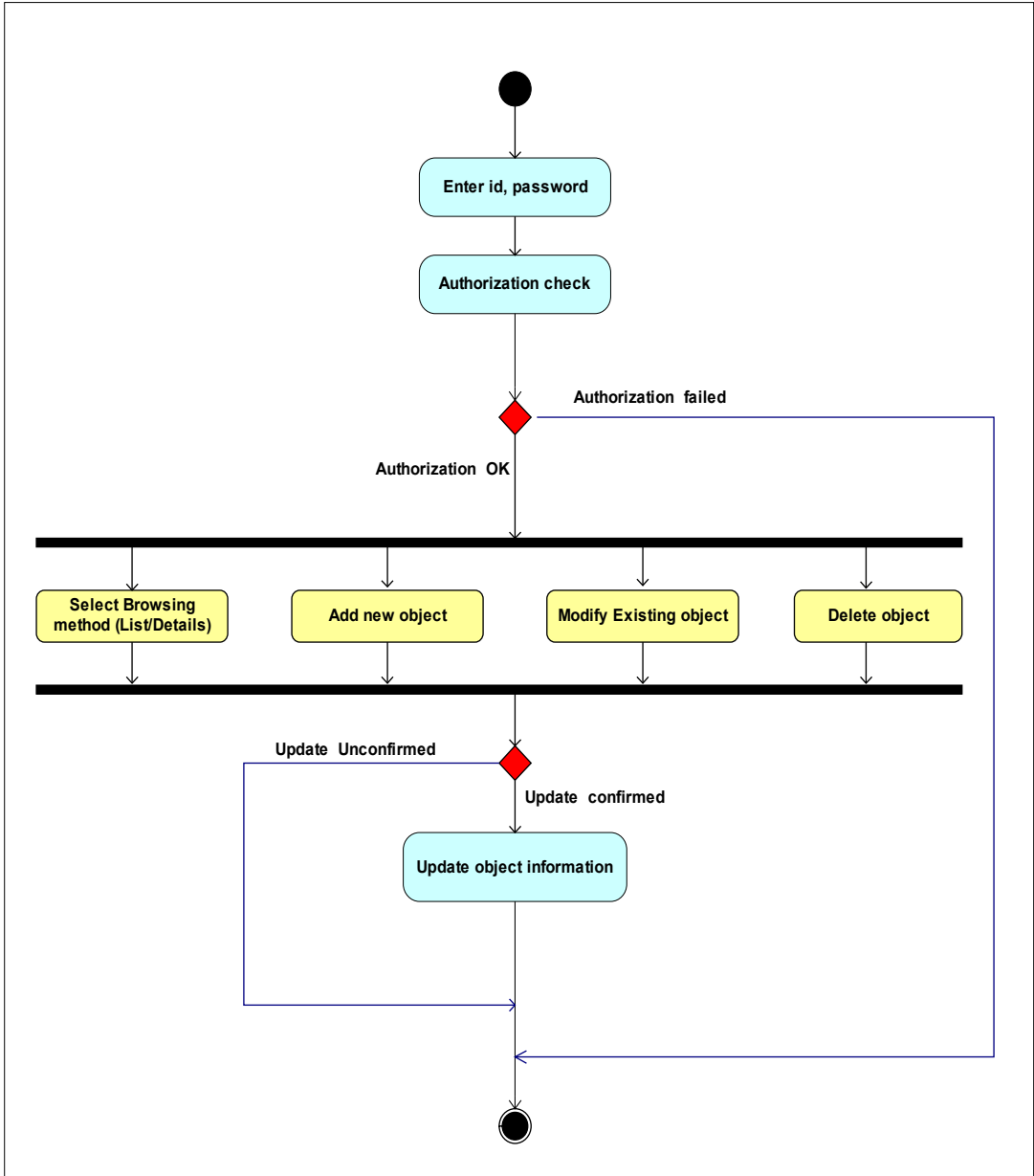
- Assemble Exhibition Activity Diagram



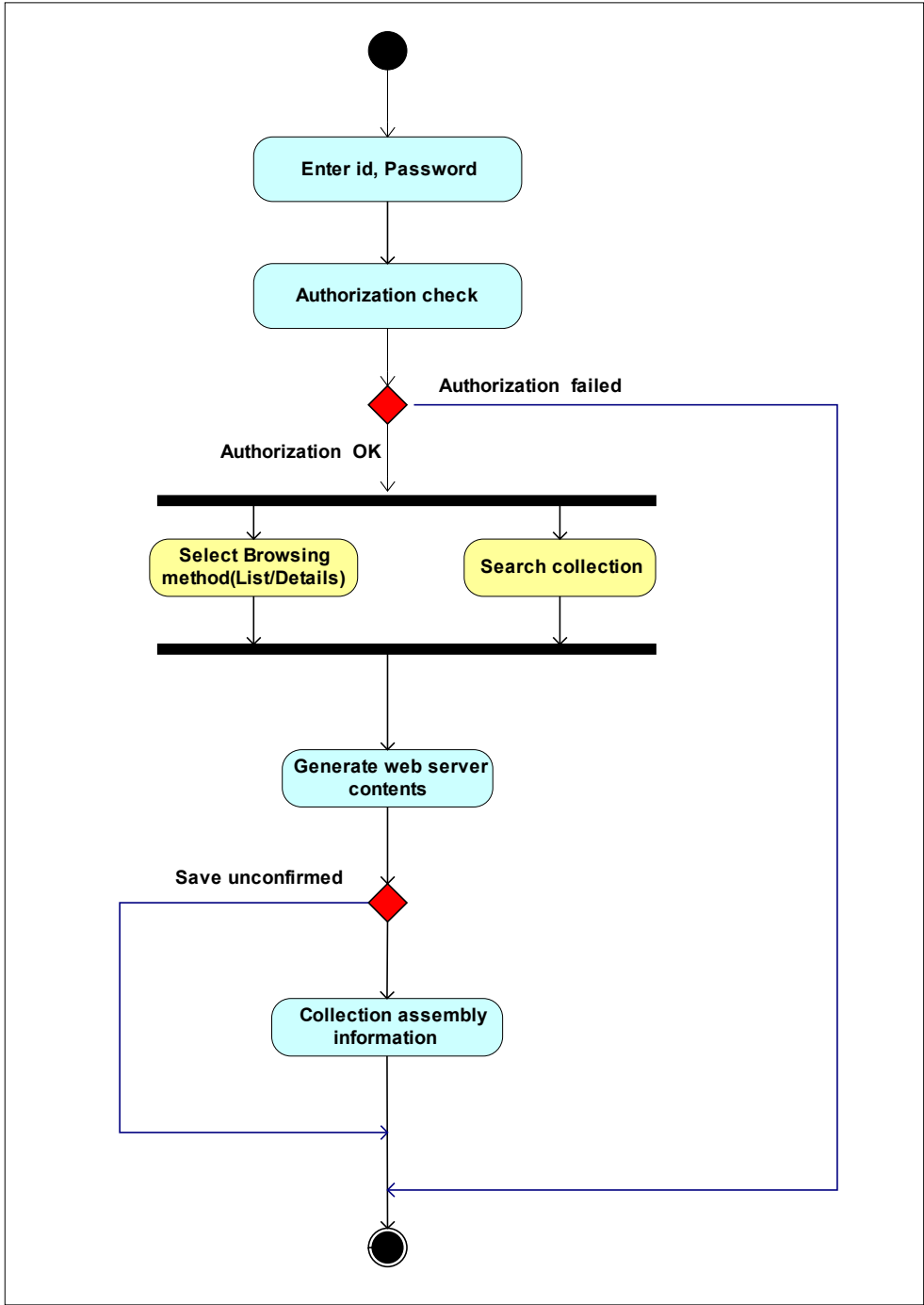
- **Extend Exhibition Activity Diagram**



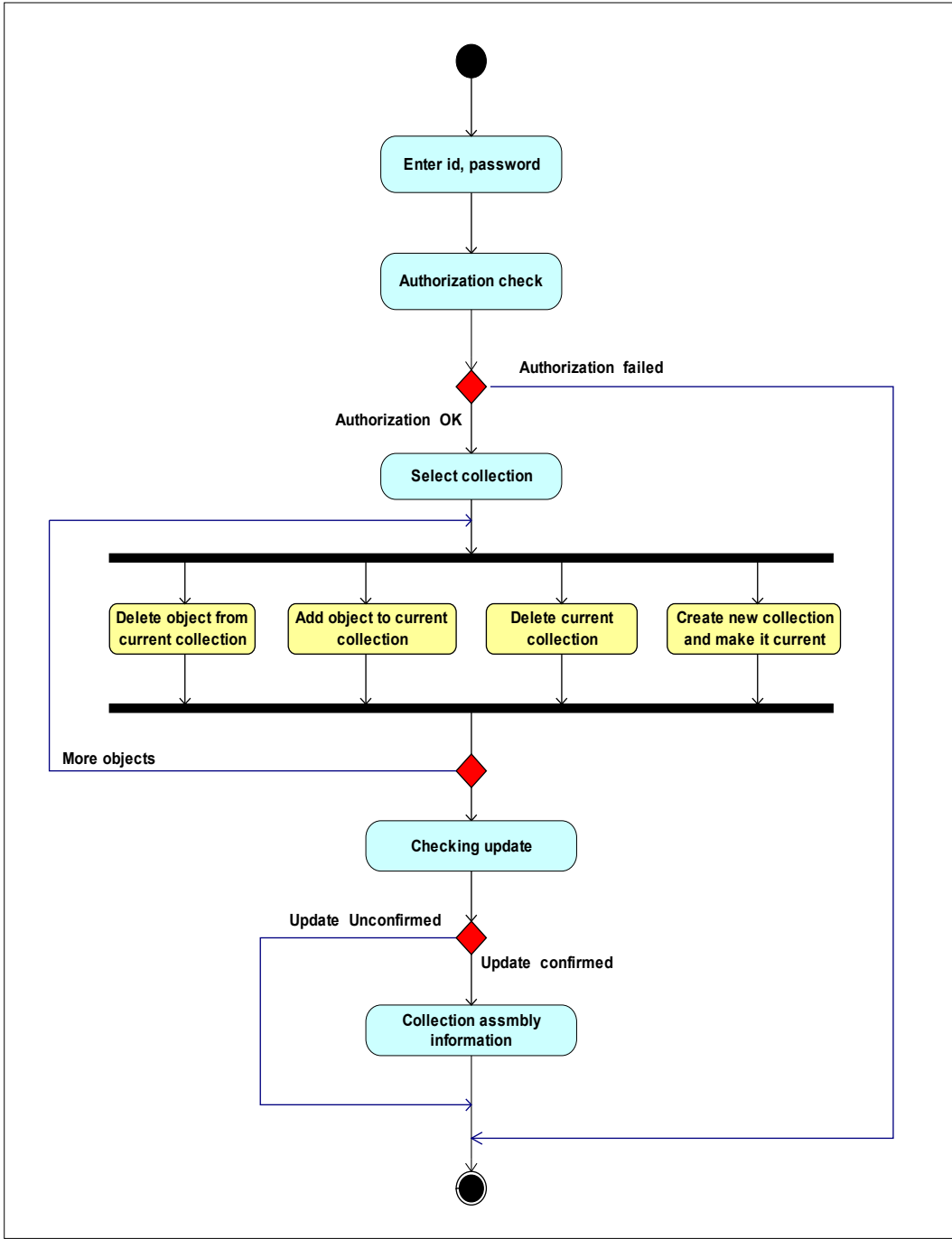
- Object Information Activity Diagram



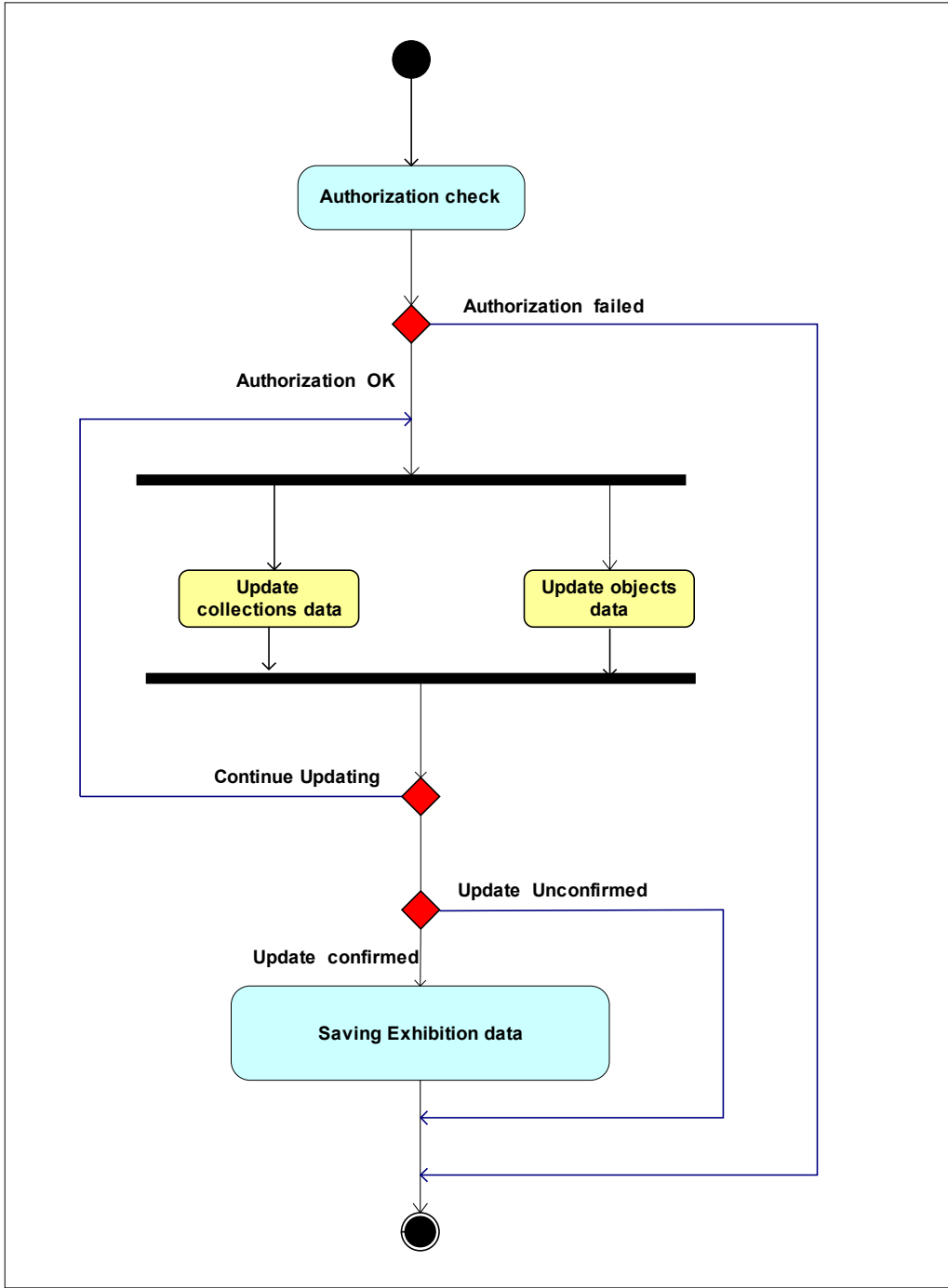
- **Publication Museum Objects Activity Diagram**



- **Collection Assembly Activity Diagram**



- **Update Exhibition Activity Diagram**



3 CONCLUSION

The contribution of this work is that introduces a design of a framework for organising virtual museums, which uses information provided by the collaborating museums in the form of Web services. The museum content published by the collaborating museums is organised in a homogeneous virtual exhibition space by an exhibition curator and is accessible from a single point of entry - the Virtual Exhibition site. The system presented is built entirely using a public domain stack of technologies for processing XML data and web service packages. The main aim of using UML is to be able to produce detailed object models and designs from system requirements, in addition to identifying the use case diagrams for the proposed system and expanding them into full behavioural designs. It functions as an entirely server-side Web application executed by Tomcat server connected to a backend database. Furthermore, this paper introduces a complete design of an activity diagrams for all the museum activities.

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