

CS-5604
Information Storage and Retrieval

Project Report

Scenario/Class Diagram Synthesis
(American South 2)

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1. Project title

- Conversion of scenarios and class diagrams from 5SL XML format to textual representation for SUIP tool input.

2. Project brief description

- Perform mapping of the 5SL XML description of the scenarios (class diagram) to the textual representation of collaboration diagrams (class diagram) that the SUIP scenario synthesis algorithm takes as input.

3. Aim of the project

This project is aimed at creating an XML Schema and generating corresponding documents for the representation of scenarios and class diagrams in 5SL XML. This XML format shall be used as the starting point to derive the corresponding text format document, which serves as an input to the SUIP tool. The SUIP tool shall in-turn generate the corresponding User Interface Prototype for the scenarios. Diagrammatically this can be shown as in figure 1 below.

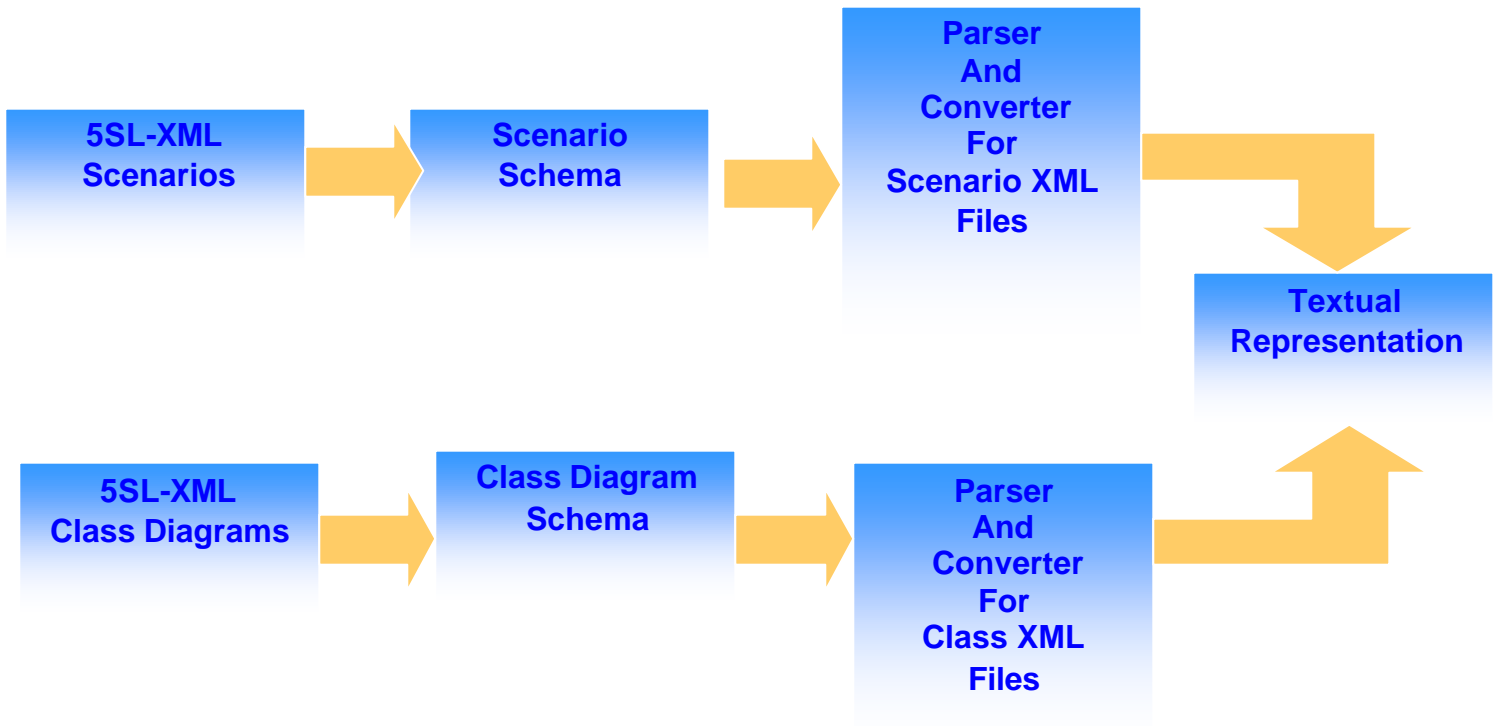


Figure 1: High level Diagram of the project

The corresponding concept map for the project can be shown as in figure 2 below.

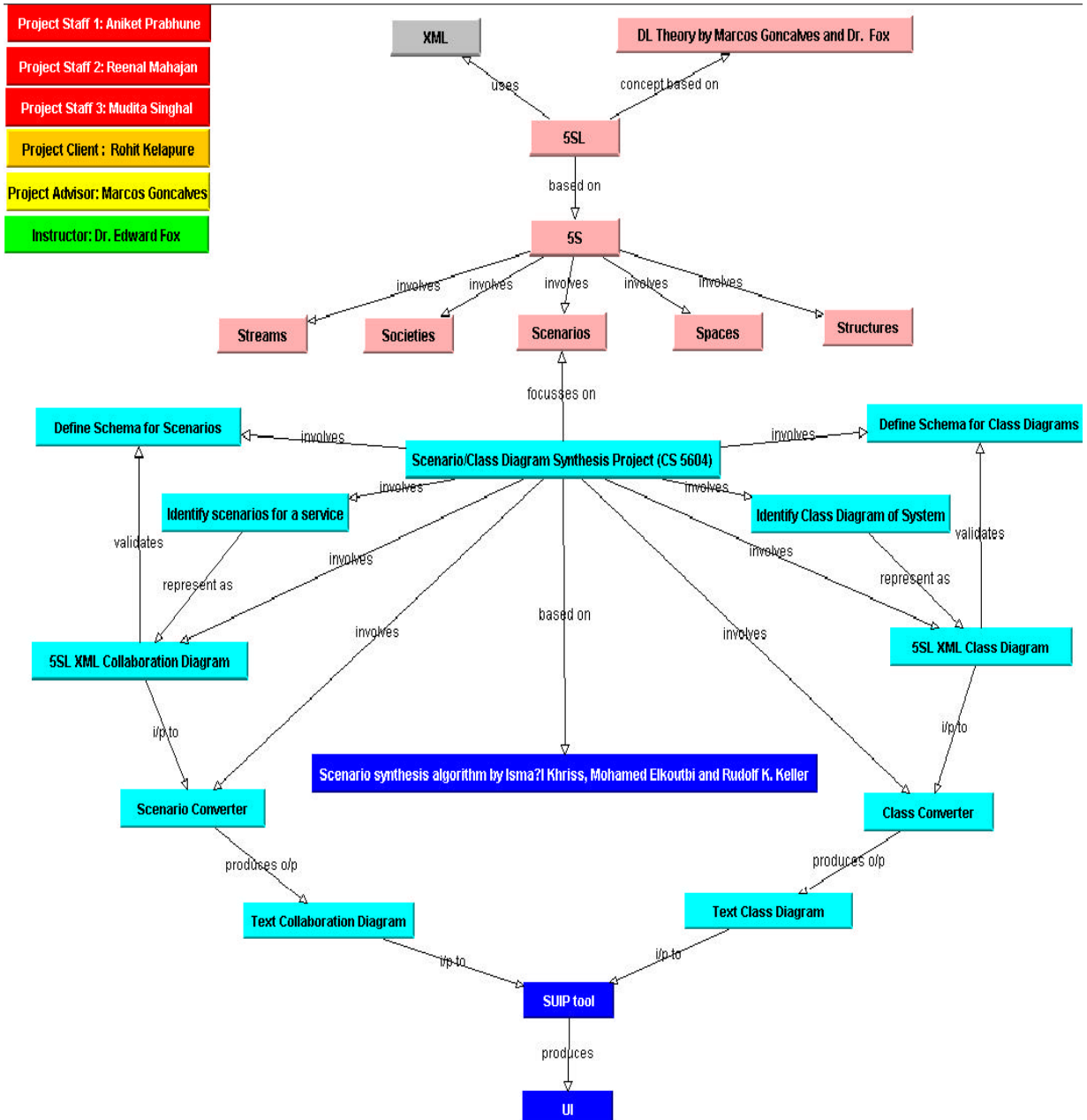


Figure 2: Concept map of the project

4. Approach

We followed the following steps to achieve the goal of the project:

1. Understood the scenario synthesis algorithm by Ismaïl Khriiss and other relevant work.
2. Understood 5SL Concept.
3. Explored the Scenario-based User Interface Prototyping tool (SUIP).
4. Understood the textual input format for the scenarios that the SUIP tool expects.
5. Developed a concept map for the group project.
6. Defined a XML schema for the scenarios in 5SL-XML.
7. Created XML instances for the scenario of a known service (Loan scenarios of the Library system on the website:
<http://www.iro.umontreal.ca/labs/gelo/suip/Library.html> that confirms the XML Schema defined in step 6.
8. Understood the textual input format for the class diagrams that the SUIP tool expects.
9. Defined a XML schema for the class diagram in 5SL-XML.
10. Created XML instances for the class diagram of a known system (Library system) on the website:
<http://www.iro.umontreal.ca/labs/gelo/suip/Library.html> that confirms the XML Schema defined in step 8.
11. Defined, developed and tested a parser component that parses the scenario XML files and interprets them.
12. Defined, developed and tested a parser component that parses the XML files for class diagram and interprets them.
13. Understood and defined the mapping between the 5SL-XML format and the text format for scenarios and class diagrams.
14. Defined and developed a converter component that converts the 5SL-XML formats to the text format required.

15. Tested the Parser and Converter components together on the scenarios and class diagrams of the example Loan scenarios of the Library system by generating the input files for scenario based user interface prototyping tool (SUIP) and generated UI prototypes for the interface object of the system.

5. Technology Used

- **J2SE (Java™ 2 Platform, Standard Edition):** Programming environment.
- **XML (eXtensible Markup Language):** For defining the instances of the scenarios and class diagrams in 5SL-XML.
- **XML Schema:** For defining the structure, content and semantics of the scenarios and class diagram XML files.
- **JDOM:** Open source, tree-based, pure Java API for parsing, creating, manipulating, and serializing XML documents

6. Developers Guide (Working of the Project)

- The project involves 2 different phases: Parsing and Conversion. The reason for keeping these two phases separate is extensibility. i.e. any of these phases could be modified further without affecting each other.
- In the parsing phase of the class diagram (scenario diagram), the name of the class XML file (scenario XML file) is provided to the parser. The parser creates a JDOM tree on this XML file by identifying the various elements of the XML recursively.
- The class parser (scenario parser) also stores the information that it parses from the underlying XML file in a hierarchy of class (scenario) objects. For e.g., the hierarchy for the class diagram objects is as shown in the figure 3 below and the hierarchy for the scenario diagram objects is as shown in the figure 4 below.

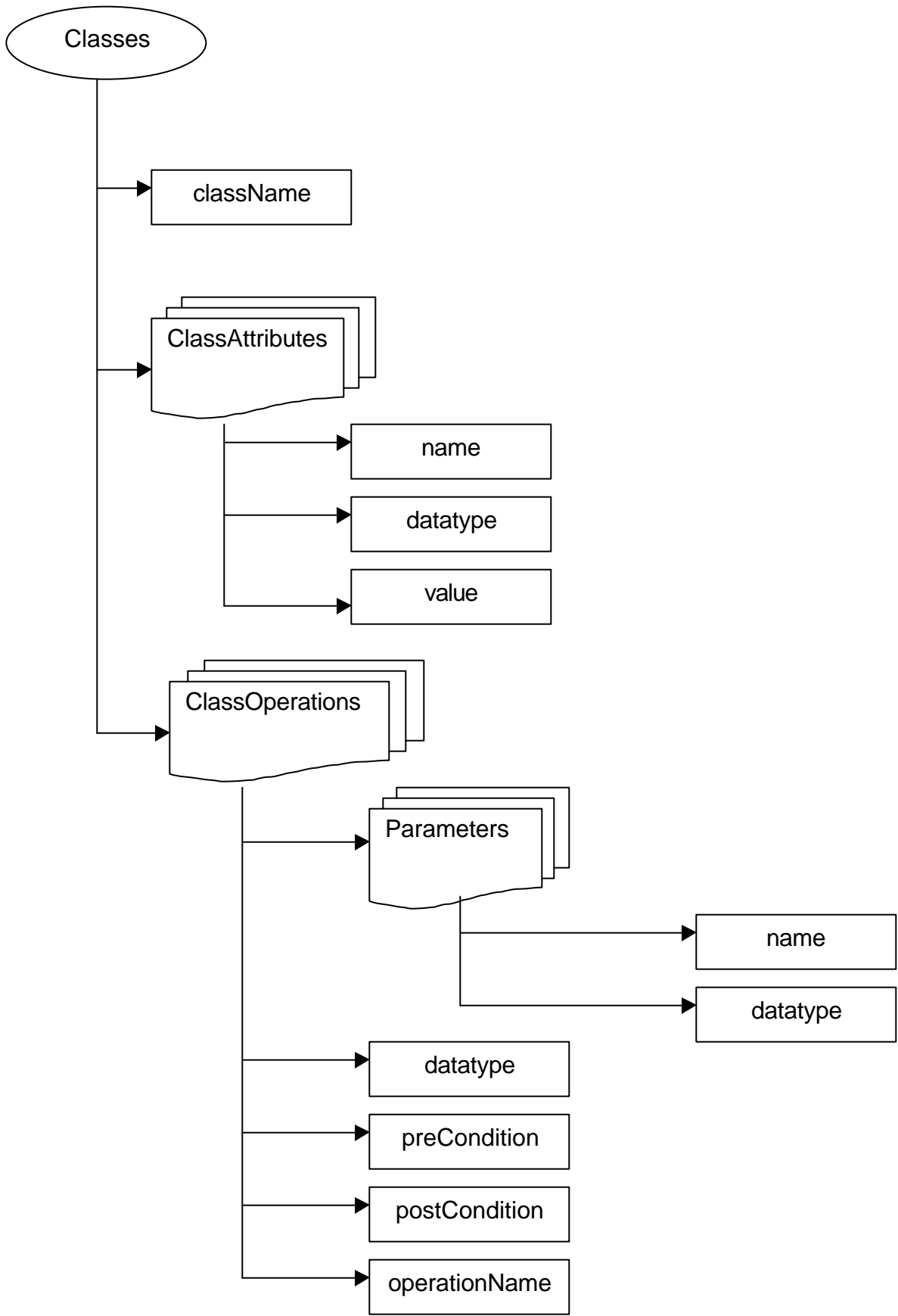


Figure 3: Hierarchy of class objects

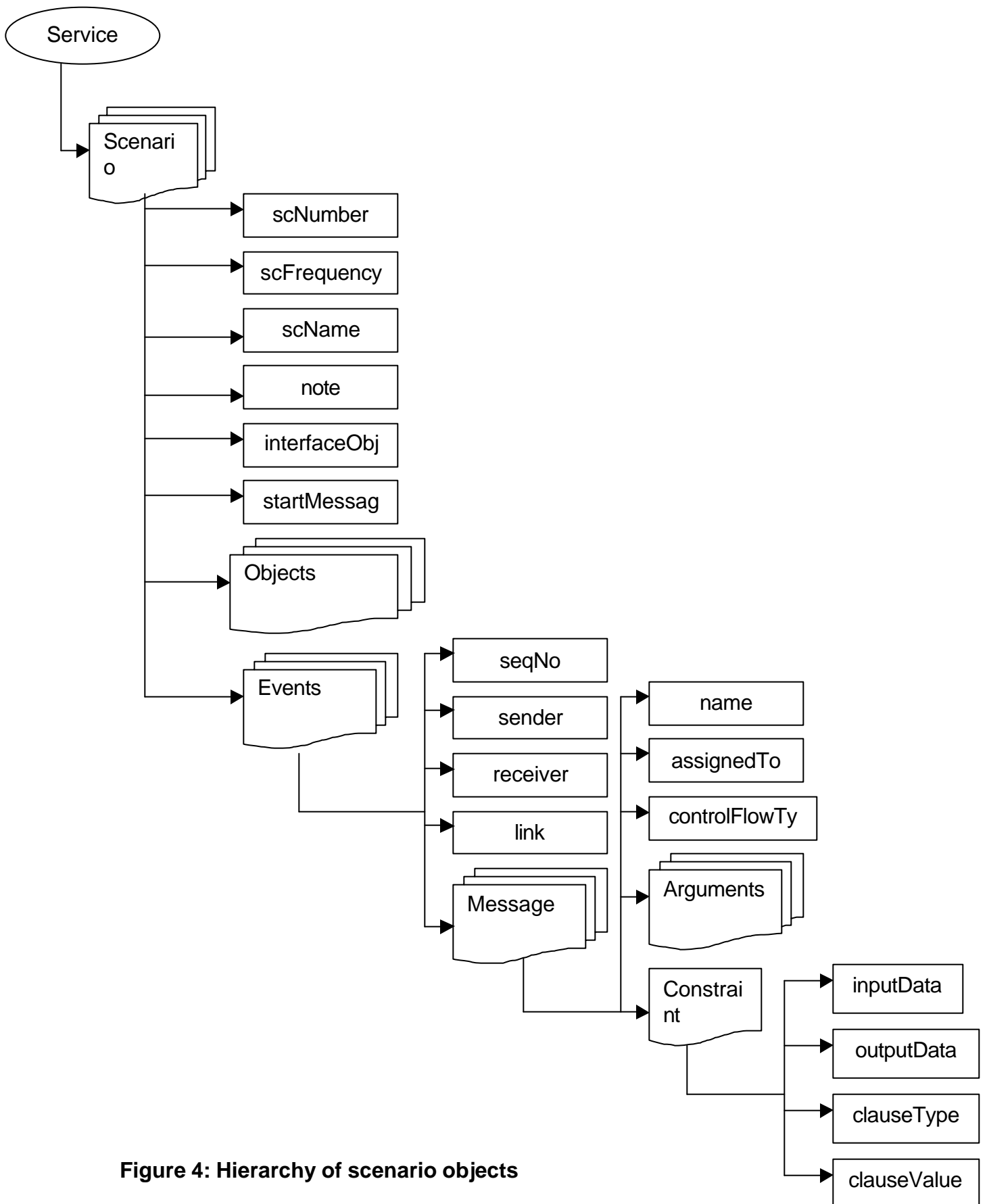


Figure 4: Hierarchy of scenario objects

- In the phase 2 i.e. Conversion, files are generated with the names as specified in the class (scenario) XML file (s) and the above object tree structure is used to generate the corresponding textual version by applying the necessary mapping of the information from the XML to the text version.

7. Usage Guide

1. **Preparation:** Before you can run the programs and convert the class and scenarios from 5SL-XML to their corresponding text versions you need to set the class path to the current directory and also you will need to include the jdom.jar and xerces.jar in the classpath.. For e.g., if your project work directory is C:\myproj\ and the jdom.jar and xerces.jar files are in the same directory then on the command prompt use the following command to set the class path:

```
C:\myproj> set classpath=.;xerces.jar;jdom.jar
```

The dot indicates current directory. If the project files are located in some other directory, then specify that directory name instead of the dot. It applies to the location of the xerces.jar and jdom.jar files.

2. **Class Diagram Conversion:** To generate the text class (.classD) simply run the class diagram converter with the corresponding class diagram XML as input as follows:

```
C:\myproj> java ClassConverter Library_class.xml
```

This will result into the corresponding text file equivalent of the 5SL-XML class diagram. The name of the file is as per the CLASS_NAME attribute of the top level CLASSDIAGRAM element of the 5SL-XML for the class diagram.

3. **Scenario Conversion:** To generate the scenarios (.CCollID) simply run

the scenario converter with the corresponding service XML file as input as follows:

```
C:\myproj> java ScenarioConverter Loan_scenario.xml
```

This will result into the text files corresponding to the various scenarios defined in the 5SL-XML scenario file. The names of these files are as per the SCENARIO_NAME attribute of the SCENARIO elements within the SERVICE element of the 5SL-XML for the scenarios.

Appendix A: Class Diagram Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified" attributeFormDefault="unqualified">

  <xs:element name="DATATYPE">
    <xs:annotation>
      <xs:documentation>This defines the datatype for the
        parameters passed to an operation and the datatype of the
        return value of an operation.
      </xs:documentation>
    </xs:annotation>
    <xs:simpleType>
      <xs:restriction base="xs:string">
        <xs:enumeration value="string"/>
        <xs:enumeration value="float"/>
        <xs:enumeration value="integer"/>
        <xs:enumeration value="char"/>
        <xs:enumeration value="boolean"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:element>

  <xs:complexType name="PARAMETERTYPE">
    <xs:annotation>
      <xs:documentation>
        This represents the name and datatype of a parameter
        passed to an operation.
      </xs:documentation>
    </xs:annotation>
    <xs:sequence>
      <xs:element name="NAME" type="xs:string"/>
      <xs:element ref="DATATYPE"/>
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="LISTOFPARAMETERTYPE">
    <xs:annotation>
      <xs:documentation>This defines a list of parameters passed
        to an operation.
      </xs:documentation>
    </xs:annotation>
    <xs:sequence>
      <xs:element name="PARAMETER" type="PARAMETERTYPE"
        minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="OPERATIONTYPE">
    <xs:annotation>
      <xs:documentation>This defines an operation as consisting
        of operation name, list of parameters to the operation,
        return datatype, precondition of the operation and post
        condition of the operation.
      </xs:documentation>
    </xs:annotation>
  </xs:complexType>
```

```

<xs:sequence>
  <xs:element name="OPERATIONNAME" type="xs:string"/>
  <xs:element name="LISTOFPARAMETERS"
    type="LISTOFPARAMETERTYPE" minOccurs="0"
    maxOccurs="unbounded"/>
  <xs:element ref="DATATYPE" minOccurs="0"/>
  <xs:element name="PRECONDITION" type="xs:string"/>
  <xs:element name="POSTCONDITION" type="xs:string"/>
</xs:sequence>
</xs:complexType>

<xs:complexType name="ATTRIBUTETYPE">
  <xs:annotation>
    <xs:documentation>This represents the name, datatype and
      value of the attributes.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="NAME" type="xs:string"/>
    <xs:element ref="DATATYPE"/>
    <xs:element name="VALUE" type="xs:string" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="LISTOFATTRIBUTETYPE">
  <xs:annotation>
    <xs:documentation>This represents a list of attributes of a
      class.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="ATTRIBUTE" type="ATTRIBUTETYPE"
      maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="LISTOFOPERATIONTYPE">
  <xs:annotation>
    <xs:documentation>This represents a list of operations
      of a class.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="OPERATION" type="OPERATIONTYPE"
      maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="CLASSTYPE">
  <xs:annotation>
    <xs:documentation>This defines a class consisting of the
      name of the class, list of attributes, and a list of
      operations.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>

```

```

        <xs:element name="CLASSNAME" type="xs:string"/>
        <xs:element name="LISTOFATTRIBUTES"
            type="LISTOFATTRIBUTETYPE"/>
        <xs:element name="LISTOFOPERATIONS"
            type="LISTOFOPERATIONTYPE"/>
    </xs:sequence>
</xs:complexType>

<xs:complexType name="LISTOFCLASSTYPE">
    <xs:annotation>
        <xs:documentation>This represents a list of classes
            involved in the class diagram.
        </xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element name="CLASS" type="CLASSTYPE"
            maxOccurs="unbounded"/>
    </xs:sequence>
</xs:complexType>

<xs:element name="CLASSDIAGRAM">
    <xs:annotation>
        <xs:documentation>This is the outermost element of the
            class diagram, which consists of the name of the resulting
            .classD file as an attribute and in turn has list of
            classes.
        </xs:documentation>
    </xs:annotation>
    <xs:complexType>
        <xs:sequence>
            <xs:element name="LISTOFCLASSES" type="LISTOFCLASSTYPE"
                maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="CLASS_NAME" type="xs:string"
            use="required"/>
    </xs:complexType>
</xs:element>

</xs:schema>

```

Appendix B: Class Diagram Instance

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<!--
```

If the tag DATATYPE is not found for a particular operation then assume no value is returned

Change the hardcoded location of the schema.

```
-->
```

```
<CLASSDIAGRAM CLASS_NAME="libprj.ClassD"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="C:\WINNT\Profiles\Administrator\Desktop\
ISR Project\class.xsd">
```

```
<LISTOFCLASSES>
```

```
<CLASS>
```

```
<CLASSNAME>Terminal</CLASSNAME>
```

```
<LISTOFATTRIBUTES>
```

```
<ATTRIBUTE>
```

```
<NAME>screen</NAME>
```

```
<DATATYPE>string</DATATYPE>
```

```
<VALUE>"empty"</VALUE>
```

```
</ATTRIBUTE>
```

```
</LISTOFATTRIBUTES>
```

```
<LISTOFOPERATIONS>
```

```
<OPERATION>
```

```
<OPERATIONNAME>enter_user_id</OPERATIONNAME>
```

```
<DATATYPE>string</DATATYPE>
```

```
<PRECONDITION>((screen = "loan") OR (screen =
"return"))
```

```
</PRECONDITION>
```

```
<POSTCONDITION>(screen = "User_Id_entered")
```

```
</POSTCONDITION>
```

```
</OPERATION>
```

```
<OPERATION>
```

```
<OPERATIONNAME>confirm_uid</OPERATIONNAME>
```

```
<PRECONDITION>(screen = "User_Id_entered")
```

```
</PRECONDITION>
```

```
<POSTCONDITION>((screen = "correct_Id") OR (screen =
"Incorrect_Id"))
```

```
</POSTCONDITION>
```

```
</OPERATION>
```

```
<OPERATION>
```

```
<OPERATIONNAME>display_user_info</OPERATIONNAME>
```

```
<PRECONDITION>(screen = "correct_Id")</PRECONDITION>
```

```
<POSTCONDITION>(screen = "Telephone_displayed")
```

```
</POSTCONDITION>
```

```
</OPERATION>
```

```
<OPERATION>
```

```
<OPERATIONNAME>display_user_name</OPERATIONNAME>
```

```
<PRECONDITION>(screen = "correct_Id") </PRECONDITION>
```

```
<POSTCONDITION>(screen = "Name_displayed")
```

```
</POSTCONDITION>
```

```
</OPERATION>
```

```
<OPERATION>
```

```
<OPERATIONNAME>display_user_address</OPERATIONNAME>
```

```
<PRECONDITION>(screen = "Name_displayed")</PRECONDITION>
```

```
<POSTCONDITION>(screen = "Address_displayed")
```

```

    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_user_telephone</OPERATIONNAME>
    <PRECONDITION>(screen = "Address_displayed")
    </PRECONDITION>
    <POSTCONDITION>(screen = "Telephone_displayed")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>enter_document_id</OPERATIONNAME>
    <DATATYPE>string</DATATYPE>
    <PRECONDITION>(screen = "Telephone_displayed")
    </PRECONDITION>
    <POSTCONDITION>(screen = "Document_Id_entererd")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>confirm_did</OPERATIONNAME>
    <PRECONDITION>(screen = "Document_Id_entererd")
    </PRECONDITION>
    <POSTCONDITION>((screen = "Document_available") OR
    (screen = "Document_unavailable"))
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_doc_Info</OPERATIONNAME>
    <PRECONDITION>(screen = "Document_available")
    </PRECONDITION>
    <POSTCONDITION>(screen = "Due_date_displayed")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_document_title</OPERATIONNAME>
    <PRECONDITION>(screen = "Document_available")
    </PRECONDITION>
    <POSTCONDITION>(screen = "Title_displayed")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_document_authors</OPERATIONNAME>
    <PRECONDITION>(screen = "Title_displayed")
    </PRECONDITION>
    <POSTCONDITION>(screen = "Authors_displayed")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_document_status</OPERATIONNAME>
    <PRECONDITION>(screen = "Authors_displayed")
    </PRECONDITION>
    <POSTCONDITION>(screen = "Status_displayed")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_date_due</OPERATIONNAME>
    <PRECONDITION>(screen = "Status_displayed")
    </PRECONDITION>

```



```

        <POSTCONDITION>(screen = "Due_date_displayed")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>save_loan</OPERATIONNAME>
    <PRECONDITION>(screen = "Due_date_displayed")
    </PRECONDITION>
    <POSTCONDITION>(screen = "empty")
    </POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>cancel_loan</OPERATIONNAME>
    <PRECONDITION>(screen = "Due_date_displayed")
    </PRECONDITION>
    <POSTCONDITION>(screen = "empty")</POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>save_return</OPERATIONNAME>
    <PRECONDITION>(screen = "Due_date_displayed")
    </PRECONDITION>
    <POSTCONDITION>(screen = "empty")</POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>cancel_return</OPERATIONNAME>
    <PRECONDITION>(screen = "Due_date_displayed")</PRECONDITION>
    <POSTCONDITION>(screen = "empty")</POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_message_doc_error</OPERATIONNAME>
    <PRECONDITION>(screen = "Document_unavailable")</PRECONDITION>
    <POSTCONDITION>(screen = "empty")</POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>display_message_user_error</OPERATIONNAME>
    <PRECONDITION>(screen = "Incorrect_Id")</PRECONDITION>
    <POSTCONDITION>(screen = "empty")</POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>create_loan</OPERATIONNAME>
    <PRECONDITION>(screen = "empty")</PRECONDITION>
    <POSTCONDITION>(screen = "loan")</POSTCONDITION>
</OPERATION>
<OPERATION>
    <OPERATIONNAME>create_return</OPERATIONNAME>
    <PRECONDITION>(screen = "empty")</PRECONDITION>
    <POSTCONDITION>(screen = "return")</POSTCONDITION>
</OPERATION>
</LISTOFOPERATIONS>
</CLASS>
<CLASS>
    <CLASSNAME>Reader</CLASSNAME>
    <LISTOFATTRIBUTES>
        <ATTRIBUTE>
            <NAME>id</NAME>
            <DATATYPE>string</DATATYPE>
            <VALUE>" "</VALUE>
        </ATTRIBUTE>

```

```

<ATTRIBUTE>
  <NAME>name</NAME>
  <DATATYPE>string</DATATYPE>
  <VALUE>" "</VALUE>
</ATTRIBUTE>
<ATTRIBUTE>
  <NAME>address</NAME>
  <DATATYPE>string</DATATYPE>
  <VALUE>" "</VALUE>
</ATTRIBUTE>
<ATTRIBUTE>
  <NAME>tel</NAME>
  <DATATYPE>string</DATATYPE>
  <VALUE>" "</VALUE>
</ATTRIBUTE>
</LISTOFATTRIBUTES>
<LISTOFOPERATIONS>
  <OPERATION>
    <OPERATIONNAME>check_user</OPERATIONNAME>
    <LISTOFPARAMETERS>
      <PARAMETER>
        <NAME>uid</NAME>
        <DATATYPE>string</DATATYPE>
      </PARAMETER>
    </LISTOFPARAMETERS>
    <DATATYPE>string</DATATYPE>
    <PRECONDITION/>
    <POSTCONDITION/>
  </OPERATION>
  <OPERATION>
    <OPERATIONNAME>new</OPERATIONNAME>
    <LISTOFPARAMETERS/>
    <PRECONDITION/>
    <POSTCONDITION/>
  </OPERATION>
  <OPERATION>
    <OPERATIONNAME>update</OPERATIONNAME>
    <LISTOFPARAMETERS/>
    <DATATYPE>boolean</DATATYPE>
    <PRECONDITION/>
    <POSTCONDITION/>
  </OPERATION>
  <OPERATION>
    <OPERATIONNAME>delete</OPERATIONNAME>
    <LISTOFPARAMETERS>
      <PARAMETER>
        <NAME>id</NAME>
        <DATATYPE>string</DATATYPE>
      </PARAMETER>
    </LISTOFPARAMETERS>
    <PRECONDITION/>
    <POSTCONDITION/>
  </OPERATION>
</LISTOFOPERATIONS>
</CLASS>
<CLASS>
  <CLASSNAME>Document</CLASSNAME>

```

```

<LISTOFATTRIBUTES>
  <ATTRIBUTE>
    <NAME>id</NAME>
    <DATATYPE>string</DATATYPE>
    <VALUE>" "</VALUE>
  </ATTRIBUTE>
  <ATTRIBUTE>
    <NAME>title</NAME>
    <DATATYPE>string</DATATYPE>
    <VALUE>" "</VALUE>
  </ATTRIBUTE>
  <ATTRIBUTE>
    <NAME>authors</NAME>
    <DATATYPE>string</DATATYPE>
    <VALUE>" "</VALUE>
  </ATTRIBUTE>
  <ATTRIBUTE>
    <NAME>status</NAME>
    <DATATYPE>string</DATATYPE>
    <VALUE>" "</VALUE>
  </ATTRIBUTE>
  <ATTRIBUTE>
    <NAME>due_date</NAME>
    <DATATYPE>string</DATATYPE>
    <VALUE>" "</VALUE>
  </ATTRIBUTE>
</LISTOFATTRIBUTES>
<LISTOFOPERATIONS>
  <OPERATION>
    <OPERATIONNAME>check_document</OPERATIONNAME>
    <LISTOFPARAMETERS>
      <PARAMETER>
        <NAME>did</NAME>
        <DATATYPE>string</DATATYPE>
      </PARAMETER>
    </LISTOFPARAMETERS>
    <DATATYPE>string</DATATYPE>
    <PRECONDITION>(id = "")</PRECONDITION>
    <POSTCONDITION/>
  </OPERATION>
  <OPERATION>
    <OPERATIONNAME>new</OPERATIONNAME>
    <PRECONDITION/>
    <POSTCONDITION/>
  </OPERATION>
  <OPERATION>
    <OPERATIONNAME>lend_doc</OPERATIONNAME>
    <LISTOFPARAMETERS>
      <PARAMETER>
        <NAME>did</NAME>
        <DATATYPE>string</DATATYPE>
      </PARAMETER>
    </LISTOFPARAMETERS>
    <DATATYPE>boolean</DATATYPE>
    <PRECONDITION>(status = "D")</PRECONDITION>
    <POSTCONDITION>(status = "D") </POSTCONDITION>
  </OPERATION>

```

```

<OPERATION>
  <OPERATIONNAME>return_doc</OPERATIONNAME>
  <LISTOFPARAMETERS>
    <PARAMETER>
      <NAME>did</NAME>
      <DATATYPE>string</DATATYPE>
    </PARAMETER>
  </LISTOFPARAMETERS>
  <DATATYPE>boolean</DATATYPE>
  <PRECONDITION>(status = "R")</PRECONDITION>
  <POSTCONDITION>(status = "R")</POSTCONDITION>
</OPERATION>
<OPERATION>
  <OPERATIONNAME>delete</OPERATIONNAME>
  <LISTOFPARAMETERS>
    <PARAMETER>
      <NAME>id</NAME>
      <DATATYPE>string</DATATYPE>
    </PARAMETER>
  </LISTOFPARAMETERS>
  <PRECONDITION>(status = "D")</PRECONDITION>
  <POSTCONDITION>(status = "D")</POSTCONDITION>
</OPERATION>
</LISTOFOPERATIONS>
</CLASS>
<CLASS>
  <CLASSNAME>Loan</CLASSNAME>
  <LISTOFATTRIBUTES>
    <ATTRIBUTE>
      <NAME>uid</NAME>
      <DATATYPE>string</DATATYPE>
      <VALUE>" "</VALUE>
    </ATTRIBUTE>
    <ATTRIBUTE>
      <NAME>did</NAME>
      <DATATYPE>string</DATATYPE>
      <VALUE>" "</VALUE>
    </ATTRIBUTE>
    <ATTRIBUTE>
      <NAME>loan_date</NAME>
      <DATATYPE>string</DATATYPE>
      <VALUE>" "</VALUE>
    </ATTRIBUTE>
    <ATTRIBUTE>
      <NAME>due_date</NAME>
      <DATATYPE>string</DATATYPE>
      <VALUE>" "</VALUE>
    </ATTRIBUTE>
  </LISTOFATTRIBUTES>
  <LISTOFOPERATIONS>
    <OPERATION>
      <OPERATIONNAME>save</OPERATIONNAME>
      <LISTOFPARAMETERS/>
      <PRECONDITION/>
      <POSTCONDITION/>
    </OPERATION>
  </LISTOFOPERATIONS>
</CLASS>

```

```

        <OPERATIONNAME>delete</OPERATIONNAME>
        <LISTOFPARAMETERS>
            <PARAMETER>
                <NAME>uid</NAME>
                <DATATYPE>string</DATATYPE>
            </PARAMETER>
            <PARAMETER>
                <NAME>did</NAME>
                <DATATYPE>string</DATATYPE>
            </PARAMETER>
        </LISTOFPARAMETERS>
        <PRECONDITION/>
        <POSTCONDITION/>
    </OPERATION>
</LISTOFOPERATIONS>
</CLASS>
<CLASS>
    <CLASSNAME>Attendant</CLASSNAME>
    <LISTOFATTRIBUTES>
        <ATTRIBUTE>
            <NAME>id</NAME>
            <DATATYPE>string</DATATYPE>
            <VALUE>" "</VALUE>
        </ATTRIBUTE>
        <ATTRIBUTE>
            <NAME>name</NAME>
            <DATATYPE>string</DATATYPE>
            <VALUE>" "</VALUE>
        </ATTRIBUTE>
        <ATTRIBUTE>
            <NAME>address</NAME>
            <DATATYPE>string</DATATYPE>
            <VALUE>" "</VALUE>
        </ATTRIBUTE>
        <ATTRIBUTE>
            <NAME>tel</NAME>
            <DATATYPE>string</DATATYPE>
            <VALUE>" "</VALUE>
        </ATTRIBUTE>
    </LISTOFATTRIBUTES>
    <LISTOFOPERATIONS>
        <OPERATION>
            <OPERATIONNAME>add</OPERATIONNAME>
            <LISTOFPARAMETERS/>
            <PRECONDITION/>
            <POSTCONDITION/>
        </OPERATION>
        <OPERATION>
            <OPERATIONNAME>delete</OPERATIONNAME>
            <LISTOFPARAMETERS/>
            <PRECONDITION/>
            <POSTCONDITION/>
        </OPERATION>
    </LISTOFOPERATIONS>
</CLASS>
</LISTOFCLASSES>
</CLASSDIAGRAM>

```

Appendix C: Scenario Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified" attributeFormDefault="unqualified">

  <xs:element name="INPUTDATA" type="xs:string"/>
  <xs:element name="OUTPUTDATA" type="xs:string"/>

  <xs:complexType name="CONSTRAINTTYPE">
    <xs:annotation>
      <xs:documentation>This represents the constraint which can be
        either inputdata, outputdata or a clause.
      </xs:documentation>
    </xs:annotation>
    <xs:sequence>
      <xs:element ref="INPUTDATA" minOccurs="0"/>
      <xs:element ref="OUTPUTDATA" minOccurs="0"/>
      <xs:element name="CLAUSE" minOccurs="0">
        <xs:complexType>
          <xs:simpleContent>
            <xs:extension base="xs:string">
              <xs:attribute name="TYPE" use="optional">
                <xs:simpleType>
                  <xs:restriction base="xs:string">
                    <xs:enumeration value="condition"/>
                    <xs:enumeration value="iteration"/>
                  </xs:restriction>
                </xs:simpleType>
              </xs:attribute>
            </xs:extension>
          </xs:simpleContent>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>

  <xs:element name="CONTROLFLOWTYPE">
    <xs:annotation>
      <xs:documentation>This represents the control flow type
        enumeration which can be either procedure call, flat flow or
        asynchronous flow.
      </xs:documentation>
    </xs:annotation>
    <xs:simpleType>
      <xs:restriction base="xs:string">
        <xs:enumeration value="procedure_call"/>
        <xs:enumeration value="flat_flow"/>
        <xs:enumeration value="asynchronous_flow"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:element>

  <xs:element name="ARGUMENT" type="xs:string"/>

  <xs:complexType name="MESSAGETYPE">
```

```

<xs:annotation>
  <xs:documentation>This represents the message of event as
    consisting of arguments, control flow type, constraint along
    with the name and return assignment as its attributes.
  </xs:documentation>
</xs:annotation>
<xs:sequence>
  <xs:element ref="ARGUMENT" minOccurs="0"/>
  <xs:element ref="CONTROLFLOWTYPE"/>
  <xs:element name="CONSTRAINT" type="CONSTRAINTTYPE"
    minOccurs="0"/>
</xs:sequence>
<xs:attribute name="NAME" type="xs:string" use="required"/>
<xs:attribute name="ASSIGNEDTO" type="xs:string" use="optional"/>
</xs:complexType>

<xs:element name="LINK">
  <xs:annotation>
    <xs:documentation>This represents an enumeration of link, which can
      be either association, global, local, self or parameter.
    </xs:documentation>
  </xs:annotation>
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:enumeration value="association"/>
      <xs:enumeration value="global"/>
      <xs:enumeration value="local"/>
      <xs:enumeration value="parameter"/>
      <xs:enumeration value="self"/>
    </xs:restriction>
  </xs:simpleType>
</xs:element>

<xs:complexType name="EVENTTYPE">
  <xs:annotation>
    <xs:documentation>This defines an event consisting of a
      sender, receiver, link, message and sequence number.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="SENDER">
      <xs:complexType>
        <xs:simpleContent>
          <xs:extension base="xs:string">
            <xs:attribute name="type" use="optional"/>
          </xs:extension>
        </xs:simpleContent>
        <xs:restriction base="xs:string">
          <xs:enumeration value="new"/>
          <xs:enumeration value="destroyed"/>
          <xs:enumeration value="transient"/>
        </xs:restriction>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
</xs:element>

```

```

<xs:element name="RECEIVER">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attribute name="type" use="optional">
          <xs:simpleType>
            <xs:restriction base="xs:string">
              <xs:enumeration value="new"/>
              <xs:enumeration value="destroyed"/>
              <xs:enumeration value="transient"/>
            </xs:restriction>
          </xs:simpleType>
        </xs:attribute>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>
<xs:element ref="LINK" minOccurs="0"/>
<xs:element name="MESSAGE" type="MESSAGETYPE"/>
</xs:sequence>
<xs:attribute name="SEQNO" type="xs:string" use="required"/>
</xs:complexType>

<xs:complexType name="LISTOFOBJECTSTYPE">
  <xs:annotation>
    <xs:documentation>This represents a list of objects involved
      in a scenario.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="OBJECT" type="xs:string"
      minOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="LISTOFEVENTTYPE">
<xs:annotation>
  <xs:documentation>This represents a list of events associated with
    a scenario.
  </xs:documentation>
</xs:annotation>
<xs:sequence>
  <xs:element name="EVENT" type="EVENTTYPE" minOccurs="unbounded"/>
</xs:sequence>
</xs:complexType>

<xs:element name="NOTE" type="xs:string">
  <xs:annotation>
    <xs:documentation>This represents any note associated with the
      scenario.
    </xs:documentation>
  </xs:annotation>
</xs:element>

<xs:element name="INTERFACEOBJECT" type="xs:string">
  <xs:annotation>
    <xs:documentation>This represents the interface object.

```



```

    </xs:documentation>
  </xs:annotation>
</xs:element>

<xs:complexType name="SCENARIOTYPE">
  <xs:annotation>
    <xs:documentation>This represents the scenarios consisting of a
      list of objects, interface object a start message and a list of
      events.
    </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element ref="NOTE"/>
    <xs:element name="LISTOFOBJECTS" type="LISTOFOBJECTSTYPE"/>
    <xs:element ref="INTERFACEOBJECT"/>
    <xs:element name="STARTMESSAGE" type="MESSAGETYPE"/>
    <xs:element name="LISTOFEVENTS" type="LISTOFEVENTTYPE"
      maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:attribute name="SC_NUMBER" type="xs:integer" use="required"/>
  <xs:attribute name="SC_NAME" type="xs:string" use="required"/>
  <xs:attribute name="SC_FREQUENCY" type="xs:integer" use="required"/>
</xs:complexType>

<xs:element name="SERVICE">
  <xs:annotation>
    <xs:documentation> Service for which the scenarios will be
      represented.
    </xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element name="SCENARIO" type="SCENARIOTYPE"
        maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
</xs:schema>

```

Appendix D: Example Scenario Instance

```
<?xml version="1.0" encoding="UTF-8"?>
<SERVICE xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="C:\WINNT\Profiles\Administrator\Desktop\
ISR Project\service.xsd">
  <SCENARIO SC_NUMBER="1" SC_NAME="regularLoan.CCollD"
  SC_FREQUENCY="10">
    <NOTE>This is the first scenario of the Use Case Loan </NOTE>
    <LISTOFOBJECTS>
      <OBJECT>Terminal</OBJECT>
      <OBJECT>Document</OBJECT>
      <OBJECT>Reader</OBJECT>
      <OBJECT>Attendant</OBJECT>
      <OBJECT>Loan</OBJECT>
    </LISTOFOBJECTS>
    <INTERFACEOBJECT>Terminal</INTERFACEOBJECT>
      <STARTMESSAGE NAME="create_loan">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      </STARTMESSAGE>
    <LISTOFEVENTS>
      <EVENT SEQNO="1.1">
        <SENDER>Attendant</SENDER>
        <RECEIVER>Terminal</RECEIVER>
        <MESSAGE NAME="enter_user_id" ASSIGNEDTO="uid">
          <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
          <CONSTRAINT>
            <INPUTDATA>Reader.id</INPUTDATA>
          </CONSTRAINT>
        </MESSAGE>
      </EVENT>
      <EVENT SEQNO="1.2">
        <SENDER>Attendant</SENDER>
        <RECEIVER>Terminal</RECEIVER>
        <MESSAGE NAME="confirm_uid">
          <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
          <CONSTRAINT>
            <INPUTDATA>Reader.check_user</INPUTDATA>
          </CONSTRAINT>
        </MESSAGE>
      </EVENT>
      <EVENT SEQNO="1.3">
        <SENDER>Terminal</SENDER>
        <RECEIVER>Reader</RECEIVER>
        <MESSAGE NAME="check_user" ASSIGNEDTO="res">
          <LISTOFARGUMENTS>
            <ARGUMENT>uid</ARGUMENT>
          </LISTOFARGUMENTS>
          <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        </MESSAGE>
      </EVENT>
      <EVENT SEQNO="1.4">
        <SENDER>Terminal</SENDER>
        <RECEIVER>Terminal</RECEIVER>
        <LINK>self</LINK>
        <MESSAGE NAME="display_user_info">
```

```

        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <CLAUSE TYPE="condition">res=true</CLAUSE>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.4.1">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_user_name">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <OUTPUTDATA>Reader.name</OUTPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.4.2">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_user_address">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <OUTPUTDATA>Reader.address</OUTPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.4.3">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_user_telephone">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <OUTPUTDATA>Reader.tel</OUTPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.5">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="enter_document_id" ASSIGNEDTO="did">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <INPUTDATA>Document.id</INPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.6">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="confirm_did">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <INPUTDATA>Document.check_document</INPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>

```

```

    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.7">
  <SENDER>Terminal</SENDER>
  <RECEIVER>Document</RECEIVER>
  <MESSAGE NAME="check_document" ASSIGNEDTO="res">
    <LISTOFARGUMENTS>
      <ARGUMENT>did</ARGUMENT>
    </LISTOFARGUMENTS>
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
  </MESSAGE>
</EVENT>
<EVENT SEQNO="1.8">
  <SENDER>Terminal</SENDER>
  <RECEIVER>Terminal</RECEIVER>
  <LINK>self</LINK>
  <MESSAGE NAME="display_document_info">
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
    <CONSTRAINT>
      <CLAUSE>res=true</CLAUSE>
    </CONSTRAINT>
  </MESSAGE>
</EVENT>
<EVENT SEQNO="1.8.1">
  <SENDER>Terminal</SENDER>
  <RECEIVER>Terminal</RECEIVER>
  <LINK>self</LINK>
  <MESSAGE NAME="display_document_title">
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
    <CONSTRAINT>
      <OUTPUTDATA>Document.title</OUTPUTDATA>
    </CONSTRAINT>
  </MESSAGE>
</EVENT>
<EVENT SEQNO="1.8.2">
  <SENDER>Terminal</SENDER>
  <RECEIVER>Terminal</RECEIVER>
  <LINK>self</LINK>
  <MESSAGE NAME="display_document_authors">
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
    <CONSTRAINT>
      <OUTPUTDATA>Document.authors</OUTPUTDATA>
    </CONSTRAINT>
  </MESSAGE>
</EVENT>
<EVENT SEQNO="1.8.3">
  <SENDER>Terminal</SENDER>
  <RECEIVER>Terminal</RECEIVER>
  <LINK>self</LINK>
  <MESSAGE NAME="display_document_status">
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
    <CONSTRAINT>
      <OUTPUTDATA>Document.satus</OUTPUTDATA>
    </CONSTRAINT>
  </MESSAGE>
</EVENT>
<EVENT SEQNO="1.9">

```

```

<SENDER>Terminal</SENDER>
<RECEIVER>Terminal</RECEIVER>
<LINK>self</LINK>
<MESSAGE NAME="display_date_due">
  <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
  <CONSTRAINT>
    <OUTPUTDATA>Document.due_date</OUTPUTDATA>
  </CONSTRAINT>
</MESSAGE>
</EVENT>
<EVENT SEQNO="1.10">
  <SENDER>Attendant</SENDER>
  <RECEIVER>Terminal</RECEIVER>
  <MESSAGE NAME="save_loan">
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
    <CONSTRAINT>
      <INPUTDATA>Loan.save</INPUTDATA>
    </CONSTRAINT>
  </MESSAGE>
</EVENT>
<EVENT SEQNO="1.11a">
  <SENDER>Terminal</SENDER>
  <RECEIVER>Document</RECEIVER>
  <MESSAGE NAME="lend_doc">
    <LISTOFARGUMENTS>
      <ARGUMENT>did</ARGUMENT>
    </LISTOFARGUMENTS>
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
  </MESSAGE>
</EVENT>
<EVENT SEQNO="1.11b">
  <SENDER>Terminal</SENDER>
  <RECEIVER>Loan</RECEIVER>
  <MESSAGE NAME="save">
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
  </MESSAGE>
</EVENT>
</LISTOFEVENTS>
</SCENARIO>
<SCENARIO SC_NUMBER="2" SC_NAME="errorUserLoan.CCoidd"
SC_FREQUENCY="4">
  <NOTE>This is the second scenario of the Use Case Loan </NOTE>
  <LISTOFOBJECTS>
    <OBJECT>Terminal</OBJECT>
    <OBJECT>Reader</OBJECT>
    <OBJECT>Attendant</OBJECT>
  </LISTOFOBJECTS>
  <INTERFACEOBJECT>Terminal</INTERFACEOBJECT>
  <STARTMESSAGE NAME="create_loan">
    <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
  </STARTMESSAGE>
  <LISTOFEVENTS>
    <EVENT SEQNO="1.1">
      <SENDER>Attendant</SENDER>
      <RECEIVER>Terminal</RECEIVER>
      <MESSAGE NAME="enter_user_id" ASSIGNEDTO="uid">
        <CONTROLFLOWTYPE>asynchronous_flow

```

```

        </CONTROLFLOWTYPE>
        <CONSTRAINT>
            <INPUTDATA>Reader.id</INPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.2">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="confirm_uid">
        <CONTROLFLOWTYPE>asynchronous_flow
    </CONTROLFLOWTYPE>
    <CONSTRAINT>
        <INPUTDATA>Reader.check_user</INPUTDATA>
    </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.3">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Reader</RECEIVER>
    <MESSAGE NAME="check_user" ASSIGNEDTO="res">
        <LISTOFARGUMENTS>
            <ARGUMENT>uid</ARGUMENT>
        </LISTOFARGUMENTS>
        <CONTROLFLOWTYPE>asynchronous_flow
    </CONTROLFLOWTYPE>
    <CONSTRAINT>
        <INPUTDATA>Reader.check_user
    </INPUTDATA>
    </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.4">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_message_user_error">
        <LISTOFARGUMENTS>
            <ARGUMENT>uid</ARGUMENT>
        </LISTOFARGUMENTS>
        <CONTROLFLOWTYPE>asynchronous_flow
    </CONTROLFLOWTYPE>
    <CONSTRAINT>
        <OUTPUTDATA>"User not Found"</OUTPUTDATA>
        <CLAUSE TYPE="condition">res=false
    </CLAUSE>
    </CONSTRAINT>
    </MESSAGE>
</EVENT>
</LISTOFEVENTS>
</SCENARIO>
<SCENARIO SC_NUMBER="3" SC_NAME="cancelLoan.CCollD"
SC_FREQUENCY="7">
    <NOTE>This is the third scenario of the Use Case Loan </NOTE>
    <LISTOFOBJECTS>
        <OBJECT>Terminal</OBJECT>
        <OBJECT>Document</OBJECT>

```

```

<OBJECT>Reader</OBJECT>
  <OBJECT>Attendant</OBJECT>
</LISTOFOBJECTS>
<INTERFACEOBJECT>Terminal</INTERFACEOBJECT>
<STARTMESSAGE NAME="create_loan">
  <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
</STARTMESSAGE>
<LISTOFEVENTS>
  <EVENT SEQNO="1.1">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="enter_user_id" ASSIGNEDTO="uid">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <INPUTDATA>Reader.id</INPUTDATA>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.2">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="confirm_uid">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <INPUTDATA>Reader.check_user</INPUTDATA>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.3">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Reader</RECEIVER>
    <MESSAGE NAME="check_user" ASSIGNEDTO="res">
      <LISTOFARGUMENTS>
        <ARGUMENT>uid</ARGUMENT>
      </LISTOFARGUMENTS>
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.4">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_user_info">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <CLAUSE TYPE="condition">res=true</CLAUSE>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.4.1">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_user_name">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <OUTPUTDATA>Reader.name</OUTPUTDATA>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>

```

```

        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.4.2">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_user_address">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <OUTPUTDATA>Reader.address</OUTPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.4.3">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_user_telephone">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <OUTPUTDATA>Reader.tel</OUTPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.5">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="enter_document_id" ASSIGNEDTO="did">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <INPUTDATA>Document.id</INPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.6">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="confirm_did">
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
        <CONSTRAINT>
            <INPUTDATA>Document.check_document</INPUTDATA>
        </CONSTRAINT>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.7">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Document</RECEIVER>
    <MESSAGE NAME="check_document" ASSIGNEDTO="res">
        <LISTOFARGUMENTS>
            <ARGUMENT>did</ARGUMENT>
        </LISTOFARGUMENTS>
        <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
    </MESSAGE>
</EVENT>
<EVENT SEQNO="1.8">
    <SENDER>Terminal</SENDER>

```



```

    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_document_info">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <CLAUSE>res=true</CLAUSE>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.8.1">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_document_title">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <OUTPUTDATA>Document.title</OUTPUTDATA>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.8.2">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_document_authors">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <OUTPUTDATA>Document.authors</OUTPUTDATA>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.8.3">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_document_status">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <OUTPUTDATA>Document.status</OUTPUTDATA>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.9">
    <SENDER>Terminal</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <LINK>self</LINK>
    <MESSAGE NAME="display_date_due">
      <CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
      <CONSTRAINT>
        <OUTPUTDATA>Document.due_date</OUTPUTDATA>
      </CONSTRAINT>
    </MESSAGE>
  </EVENT>
  <EVENT SEQNO="1.10">
    <SENDER>Attendant</SENDER>
    <RECEIVER>Terminal</RECEIVER>
    <MESSAGE NAME="cancel_loan">

```

```
<CONTROLFLOWTYPE>asynchronous_flow</CONTROLFLOWTYPE>
<CONSTRAINT>
  <INPUTDATA>Loan.delete</INPUTDATA>
</CONSTRAINT>
</MESSAGE>
</EVENT>
</LISTOFEVENTS>
</SCENARIO>
</SERVICE>
```

References

- Suggestion page for the project:
<http://collab.dlib.vt.edu/runwiki/wiki.pl?IsRprojKelapureTwo>
- Scenario synthesis algorithm 1:
<http://www.iro.umontreal.ca/labs/gelo/suip/GELO-82.pdf>
- Scenario synthesis algorithm 2:
<http://www.iro.umontreal.ca/~labgelo/Publications/Papers/ccpe-2001.pdf>
- Scenario synthesis algorithm 3:
<http://www.iro.umontreal.ca/labs/gelo/suip/bookChapter.pdf>
- The tool for scenario-based prototyping:
<http://www.iro.umontreal.ca/labs/gelo/suip/>
- Concepts of 5SL: <http://www.dlib.vt.edu/projects/5S-Model/p117-goncalves.pdf>