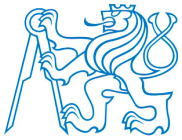

Software Requirements Specification

for project

Semantic Pipelines Editor

by

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December 3, 2016

Contents

1 Introduction

1.1 Purpose

This document describes the Semantic Pipelines Editor software, a specialized graph editor for the Semantic Pipelines framework, as of version 1.0.

1.2 Intended Audience

This document is intended for developers, interested in Semantic Pipelines Editor, Semantic Pipelines infrastructure and its integration structure.

1.3 References

JSON-LD Primer
RDF Primer
P. Křemen, Z. Kouba, Ontology-Driven Information System Design
ESWC 2016, JOPA: Efficient Ontology-based Information System Design

2 Overall Description

2.1 Product Scope

Semantic Pipelines Editor is an application, whose purpose is to be integrated with Semantic Pipelines framework and to provide a graphical editor in form of an oriented graph for it with a possibility to execute pipelines from the editor itself. It is also capable of module saving and loading, which is provided by persisting data into the ontology storage. The main goal is to provide a free and open source software edition tool for the above-stated framework and to enable developers to interact and manage pipelines in a self-explanatory and convenient way without having to deal with proprietary software or restrictive licenses.

2.2 Product Functions

Product functions can be divided into two groups:

- Graph CRUD operations
- Pipeline execution

Functions are described in more detail in chapter System Features.

2.3 User Classes and Characteristics

Users are distinguished based on user rights, specified in the ontology storage. As of version 1.0 rights are the following:

1. Create pipelines
   User having this right can create new pipelines.
   Applicable FRQs:
   FRQ1,FRQ2

2. Load pipelines
   This right allows user to load pipelines from ontology storage. Applicable FRQs:
   FRQ1,FRQ3

3. Save pipelines
   This right provides possibility to save pipelines into ontology storage. Applicable FRQs:
   FRQ1,FRQ4

4. Alter pipelines
   User granted this right is allowed to add/remove nodes and edges to the pipeline. Applicable FRQs:
   FRQ1,FRQ5

5. Execute pipelines
   This right lets user to execute pipelines. Applicable FRQs:
   FRQ1,FRQ6,FRQ7,FRQ8,FRQ9

6. See execution history
   User having this right can see the history of pipeline execution. Applicable FRQs:
   FRQ1,FRQ10

7. Debug modules
   User can execute modules in debug mode only if he has this right. Applicable FRQs:
   FRQ1,FRQ11

8. User management
   User having this right is allowed to add/remove other user's rights. Applicable FRQs:
   FRQ1,FRQ12

Each user can be granted any or none of this rights.

2.4 Operating Environment

Operating environment consists of several parts:

- Application Server
  The software is meant to be run inside of a container like an application server. Originally Semantic Pipelines Editor was designed to run inside of Tomcat 8 application server, but should work in any other.

- Database Server
  The application is designed to work with RDF4J ontology storage.
- Semantic Forms
  Functionality is partially dependent on the Semantic Forms to be available as a web service.

2.5 Design and Implementation Constraints

There are several constraints that rigidly specify the product's relation to the infrastructure and possible ways of application.

- Semantic Forms Integration
  Semantic Pipelines Editor is relying on Semantic Forms for the form generation so the WS communication is done in a very specific way which requires bigger changes for the form generation strategy to be replaced.
- Ontology Storage
  Data is stored in the ontology storage (RDF4J), which makes for the specific way of entity objects design.
  Another constraint regarding ontology is a very limited set of frameworks and libraries available, which also influences the implementation.
- Java/Scala Interoperability
  All the business logic of the application is implemented in Scala programming language. This is done in order to minimize the unnecessary (from the business standpoint) implementation details for the logic layer to be clearer and more refined for the developer. However, Scala's interoperability with Java is limited in some specific areas.
- JavaScript-based client Semantic Pipelines Editor has a thin client and most of user interaction is made with JavaScript. Therefore the application is meant to be accessed with a web browser that is can run JavaScript code.

2.6 Third Party Dependencies

- JDK Oracle JDK or OpenJDK is required for running the backend
- Scala SDK Scala SDK is required for running the backend
- Spring Several components of the Spring Framework are used for IoC
- JOPA Persistence layer is done with JOPA
- Apache Maven Apache Maven build tool is used for building the project and sources generation
- JUnit Testing is partially made with JUnit

- ServletAPI ServletAPI is required by the web application
- Logback Logback is used for logging
- JSON-Core JSON-Core is required for JSON operations in Java and Scala
- Jaxb-JSONLD-Jackson Jaxb-JSON-LD-Jackson provides JSON-LD support
- Mockito REST WS testing is done with Mockito
- Sigma.js Sigma.js is providing frontend graph representation
- ReactJS ReactJS is required for UI implementation

3 External Interface Requirements

3.1 User Interfaces

Interaction with the user is provided by a web interface, built around the JavaScript library for graph representation Sigma.js. The main window consists of two parts: left panel and a working surface for editing graphs (Figure 2). Left panel contains elements for authorization, saving and loading graph and list of available types of nodes that can be added to the graph. Search feature with autocompletion provides more convenient navigation. At the working surface user can see the current graph (loaded or created), edit it (move nodes, draw edges etc.). Node double click shows the form generated from this node and its dependencies in the popup (Figure 3). User management is done in the separate window (Figure 4).

3.2 Software Interfaces

Application consists of frontend and backend parts with backend accessing the ontology storage as well as a Semantic Pipelines web service. Communication between backend and frontend is implemented with JSON-LD format messages sent through REST API. All communication is done through unsecured HTTP protocol. Authentication encryption is provided by integrated Spring Security tools.

4 System Features

4.1 Functional Requirements

FRQ1 **See pipelines**
Pipelines are represented in form of an oriented graph. Nodes represent modules and edges are dependencies between them, which makes for intuitive and functional user interface.

FRQ2 **Create pipelines**
There exists a possibility for creating new pipelines from scratch by adding individual modules and dependencies between them.

FRQ3 **Load pipelines**
The software allows loading pipelines from the ontology storage.

FRQ4 **Save pipelines**
The software allows saving pipelines into the ontology storage.

FRQ5 **Alter pipelines**
Pipelines can be modified by adding or deleting modules, changing their properties and dependencies between them.

FRQ6 **Execute pipeline to point**
Certain module of a pipeline can be executed. During execution module dependencies are processed recursively.

FRQ7 **Execute entire pipeline**
Execution of the entire pipeline can be done. In this case all the modules are executed.

FRQ8 **See execution progress**
Semantic Pipelines Editor provides user with an indication of execution progress.

FRQ9 **See execution results**
The results are shown once execution is finished.

FRQ10 **See execution history**
There is a possibility to see the history of executions of a pipeline.

FRQ11 **Module debug**
Modules can be executed with debug flags.

FRQ12 **Manage users**
Users granted special permission can manage other user's access to the application's features.

4.2 System Limitations

As of version 1.0 the application does not feature the following capabilities:

- Creating new module types
- Editing module type definitions
- Communication with other systems in a format different from JSON-LD
- Serving as a general-purpose graph editor

5 Other Requirements

- The application is licensed under the GNU GPLv3 license

Appendix A: Diagrams

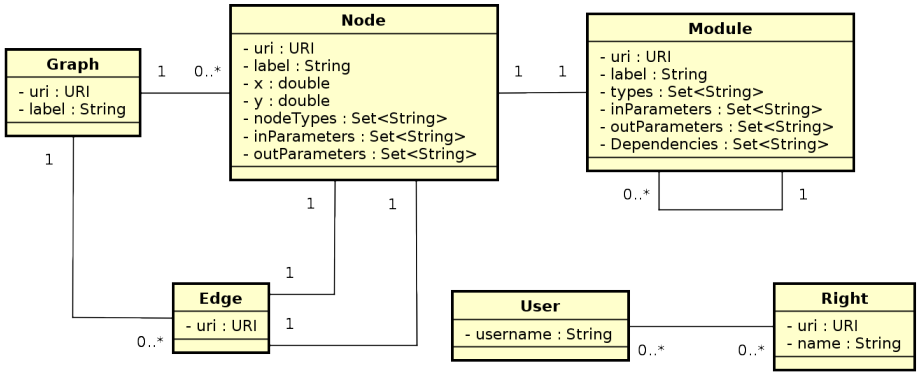

Figure 1: Class Diagram

Appendix B: Glossary

API - Application Programming Interface
FRQ - Functional requirement
JDK - Java Development Kit
JOPA - Java OWL Persistence API
JSON - JavaScript Object Notation
JSON-LD - JavaScript Object Notation for Linked Data
OWL - Web Ontology Language
RDF - Resource Description Framework
RDF4J - RDF for Java programming language
REST - Representational State Transfer
SDK - Software Development Kit
UI - User Interface
WS - Web service

Appendix C: Illustrations

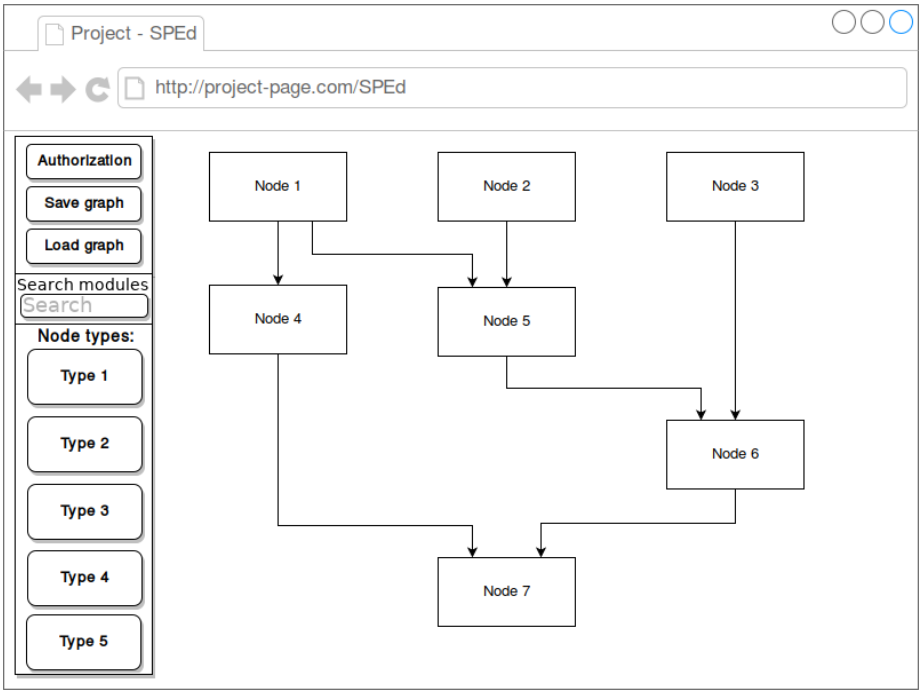

Figure 2: Main window

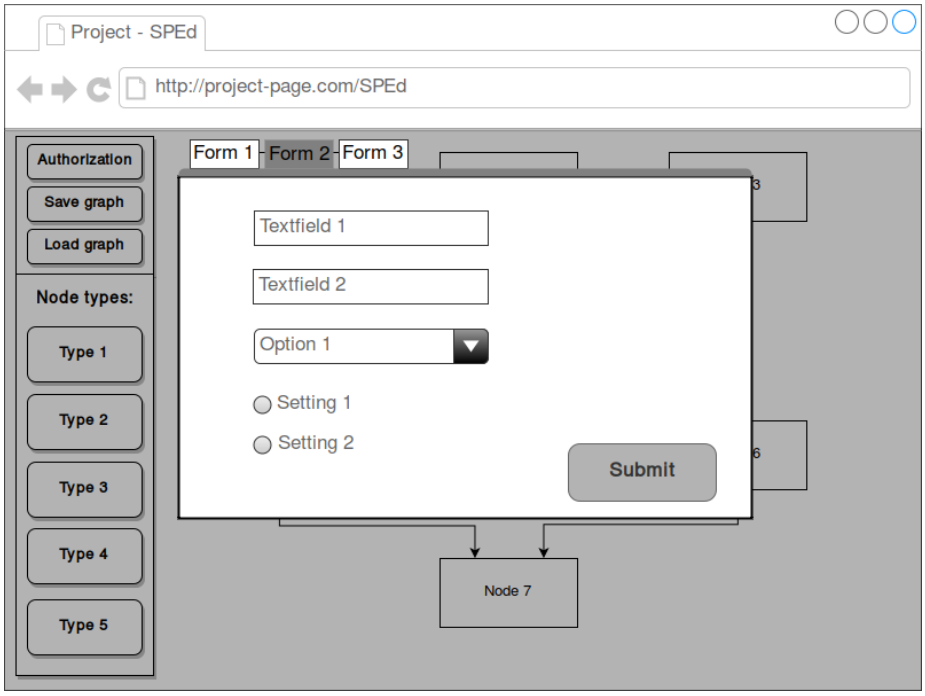

Figure 3: Generated form

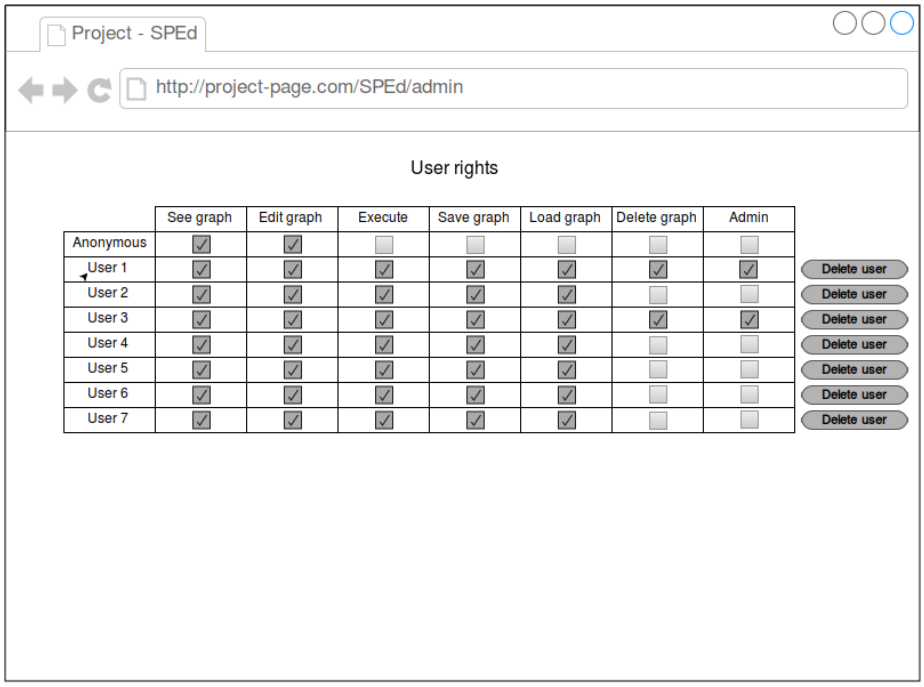

Figure 4: User management window