

PERSONAL KNOWLEDGE BASE DESIGNER

User manual

Version 2018.02



www.knowledge-core.ru

N.O. Dorodnykh, A.Yu. Yurin, V.A. Kazakov

Phone: +7 (3952) 45-30-19

E-Mail: iskander@icc.ru

WEB: www.knowledge-core.ru

Irkutsk, 2018



Contents

| | |
|---|----|
| About..... | 3 |
| Installation..... | 4 |
| 1 Quick Start..... | 5 |
| 2 Software Description..... | 7 |
| 2.1 Graphic User Interface..... | 7 |
| 2.1.1 Top Menu..... | 9 |
| 2.1.2 Toolbar..... | 16 |
| 2.1.3 Explorer (Navigator)..... | 17 |
| 2.1.4 Topic..... | 18 |
| 2.1.5 The main workspace..... | 19 |
| 2.2 Functions..... | 21 |
| 2.2.1 Creating a knowledge base..... | 21 |
| 2.2.2 Creating a template of facts (cases)..... | 22 |
| 2.2.3 Creating a template of rules..... | 25 |
| 2.2.4 Creating rules..... | 28 |
| 2.2.5 Creating initial facts (cases)..... | 30 |
| 2.2.6 Testing (Run)..... | 33 |
| 2.2.7 Import..... | 39 |
| 2.2.8 Export..... | 40 |
| 2.2.9 Report building..... | 40 |
| 3 An example..... | 41 |



About

«Personal Knowledge Base Designer» is a specialized software designed for the development and prototyping knowledge bases (KB) of rule-based expert systems (ES).

Main functions:

- ability to create elements of rule-based KBs (templates of facts and rules, as well as facts and rules) by non-programming user, through the use of a set of wizards, pre-prepared templates of facts and rules;
- ability to use the original notation namely RVML (Rule Visual Modeling Language) for visualizing logical rules;
- integration with the IBM Rational Rose CASE tool, in terms of importing conceptual models (UML class diagrams) that can be used at the conceptualization stage;
- integration with CLIPS (C Language Integrated Production System), in terms of synthesis of the program codes, as well as its testing;
- ability to operate in the «domain-specific» mode, using pre-developed descriptions of templates of fact and rules and limiting the possibility of their change;
- specialized reports building.



Installation

Installation of the software is carried out in automatic mode - it is enough to run the installation file (Fig. 0.1).

Minimum system requirements:

OS: Windows 2000, XP, Vista, 7, 8, 8.1, 10
CPU: 500 MHz
Free HDD space: 6 Mb
RAM: 256 Mb
Other software: MS Word (for the report generation module)

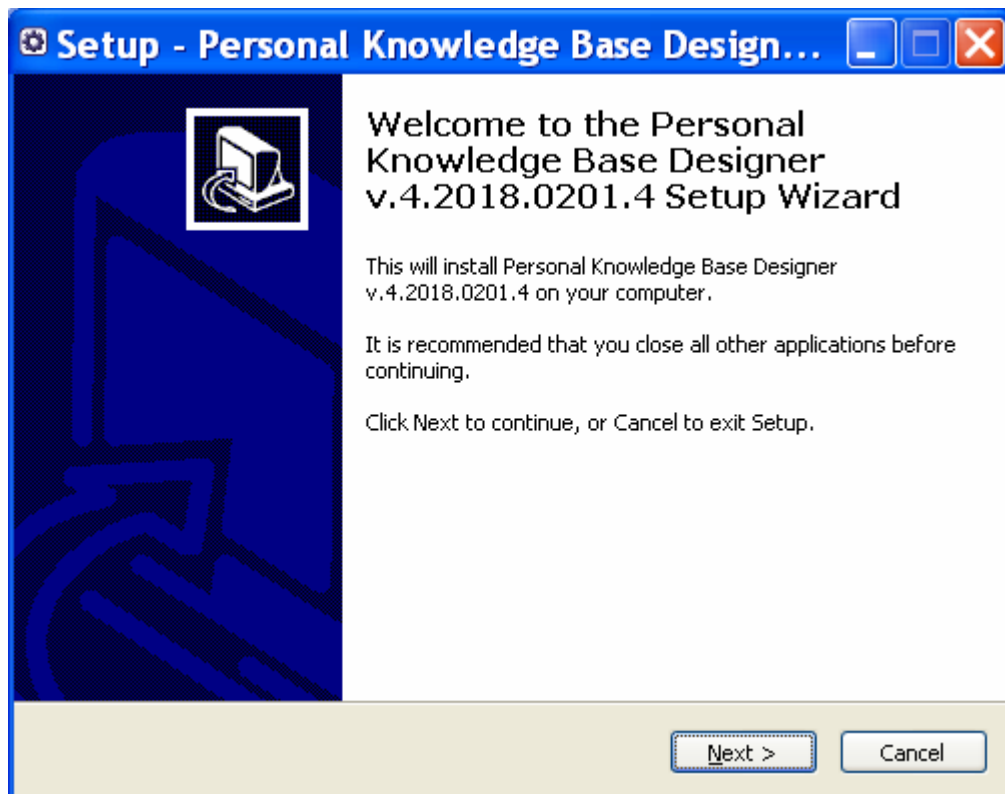



Figure 0.1 – The Personal Knowledge Base Designer installation window


Next, you need to specify the directory to install and additional settings. When the installation is complete, the program can be started.





1 Quick Start

«Personal Knowledge Base Designer» is a specialized software, so it is necessary to get acquainted with the basic concepts from the field of expert systems for its effective use.

 **Artificial intelligence (AI)** is a field of research aimed at the study and creation of methods and means to simulate intelligent human activity in solving various problems.

 **Knowledge** is the laws of the subject area (principles, connections, laws), obtained as a result of practical activities and professional experience, allowing specialists to set and solve problems in this area.

 **Knowledge base (KB)** is a set of knowledge units, which are a formal reflection of the objects of the subject domain and their relationships.

 **The expert system (ES)** is a complex software that accumulates the knowledge of specialists in the specific subject domain and replicates this empirical experience for consultations of less qualified users.

To create knowledge bases of expert systems with the aid of software it is necessary:

1. To create a knowledge base (see 2.2.1). A knowledge base is a collection of templates, facts, and rules.
2. To create fact templates (see 2.2.2). Fact templates are the basis for creating facts and rules. An analogue of the «fact template» concept is the «class» concept of the object-oriented approach, as a set of entities with a common description and behavior.



3. To create rule templates (see 2.2.3). Rule templates are formed on the basis of fact templates and represent logical statements of type:
IF «fact Template 1» **THEN** «fact Template 2».
4. To create rules (see 2.2.4). The rules describe the regularities between the concepts of the problem to be solved.
5. To create initial facts (see 2.2.5). The facts describe the problem situation or the current state of the system for which it is necessary to find a solution based on the previously formed rules.
6. To check the consistency of the created knowledge base (see 2.2.6). The consistency check consists in initiating a logical inference based on the initial facts.
7. To export the created knowledge base to the format of the knowledge base programming language (see 2.2.7).

It should be noted that step 1 and 2 can be automated using CASE-tools, in particular, IBM Rational Rose, XMind, CMap Tools. Using these tools, you can create a class diagram or main map and import it into the software (see 2.2.8). The classes and concept are converted to fact templates, and the relationships between them are converted to rule templates.



2 Software Description

В данном разделе проведено краткое описание программы «Personal Knowledge Base Designer», ее интерфейса и основных функций.

This section provides a brief description of the «Personal Knowledge Base Designer», its GUI and main functions.

2.1 Graphic User Interface

Software provides a simple GUI. The main screen is divided into several workspaces (Fig. 2.1):

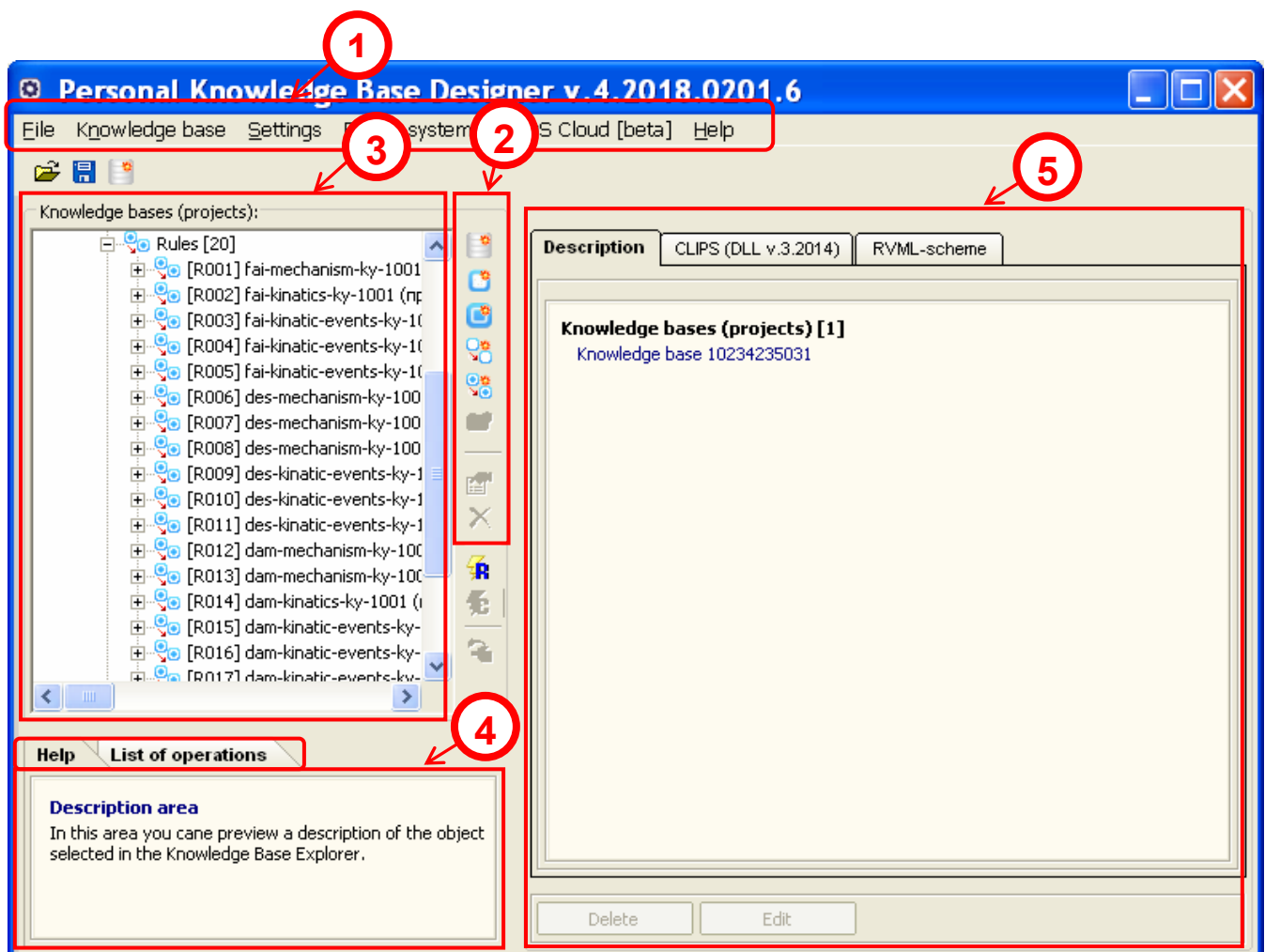


Figure 2.1 – GUI main workspaces



1

«**Top menu**» - provides access to the main functions and includes the following main sections:

- **File**: access to open, save, import and export knowledge base operations;
- **Knowledge base**: access to knowledge base item creation operations;
- **Service**: program settings;
- **Help**: information about the program and documentation.

2

«**Toolbar**» - provides access to the operations of the knowledge base elements:

- **To create** a new knowledge base;
- **To create** a new sample/template for facts;
- **To create** a new fact;
- **To create** a new model/template for the rules;
- **To create** a new rule;
- **To test the** knowledge base;
- **To create** an expert system;
- **To create** a report.

3

«**Explorer**» – provides a tree view of knowledge base elements.

4

«**Topic**» – provides a mapping context tips and list of user operations.

5

«**The main workspace**» - the main working area, provides the ability to view the description of the selected element in one of the three forms:

- in natural language,
- in the programming language of knowledge bases, in particular, CLIPS (C Language Integrated Production System),
- in the form of visual diagrams of RVML (Rule Visual Modeling Language);



2.1.1 Top Menu

Let's consider the main menu items.

The «File» menu item provides access to open, save, import, and export knowledge bases (Fig.2.2).

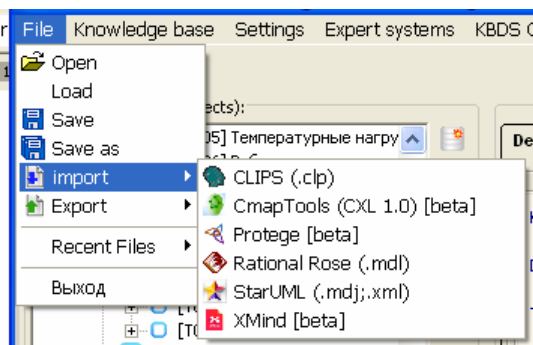


Figure 2.2 – The «File» menu item

To store information about knowledge bases, the program uses its own format EKB, based on XML and provides the ability to open and save files with a description of knowledge bases.

For selective saving of knowledge base elements it is necessary to use the «Save as» menu item (Fig.2.3).

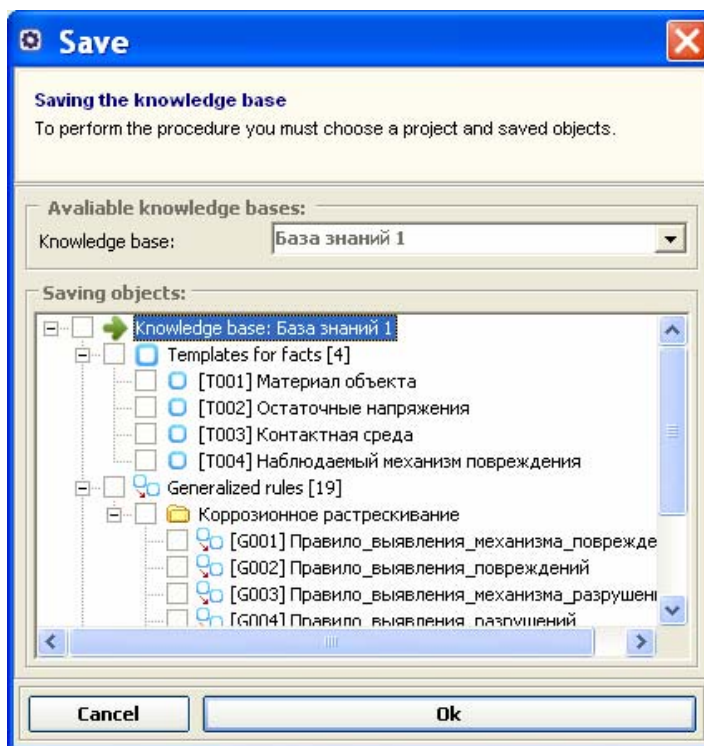



Figure 2.3 – The selective saving of knowledge base elements



Software is integrated with some CASE-tools (IBM Rational Rose, CMap Tools, Xmind, Protégé, Star UML) and the CLIPS knowledge base programming language (CLP format) for importing and exporting knowledge base elements.

Access to these functions is available via the «**Export**» and «**Import**» menu items.

 **CLIPS** it is one of the widely used tool and language for the development of rule-based expert systems due to its speed, efficiency and free. CLIPS designed for use as direct language of logical inference (forward chaining) and in its original version does not support backward inference (backward chaining).

To exit the program, click on the «**Exit**» button, and the program will suggest to save the changes in the knowledge base (Fig.2.4).



Figure 2.4 – Request to save changes to the knowledge base



The «Knowledge Base» menu item provides access to operations create elements of knowledge bases (Fig.2.5).

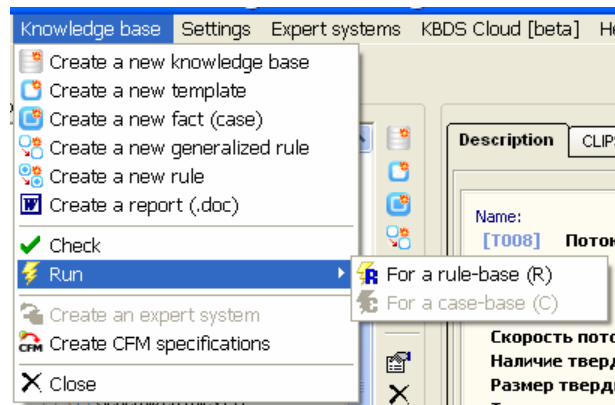


Figure 2.5 – The «Knowledge base» menu item

In particular:

- The «Create a new knowledge base» menu sub-tem (Fig.2.6) allows you to create a knowledge base of case-based or rule-based type, enter its name and description.

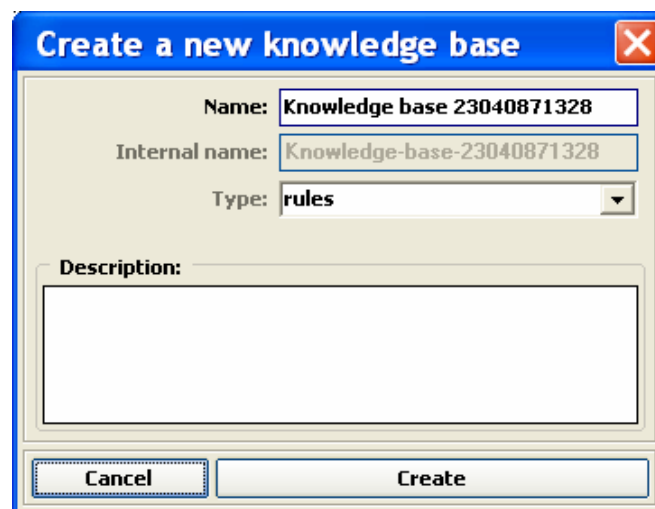


Figure 2.6 – A GUI Form of creating a knowledge base

- The «Create a new template» menu sub-item allows you to activate the fact template creation wizard (Fig.2.7). Fact templates are the basis for building



facts.



The fact templates are consistent with the CLIPS deftemplate construction.

Figure 2.7 – A GUI form of a new fact template creation (Steps 1 и 2)

- The «Create a new fact (case)» menu sub-item allows you to activate the fact entry wizard (Fig.2.8).




Entered the facts are consistent with the CLIPS deffacts construction and will be used in testing the knowledge base.

Figure 2.8 – A GUI form of a new fact creation (Steps 1 и 2)



!! Before you can create facts, you must create at least one fact template, because of facts are created from templates.

- The «Create a new rule» menu sub-item allows you to activate the rule entry wizard (Fig.2.9).

 The entered rules correspond to the CLIPS `defrule` construction.

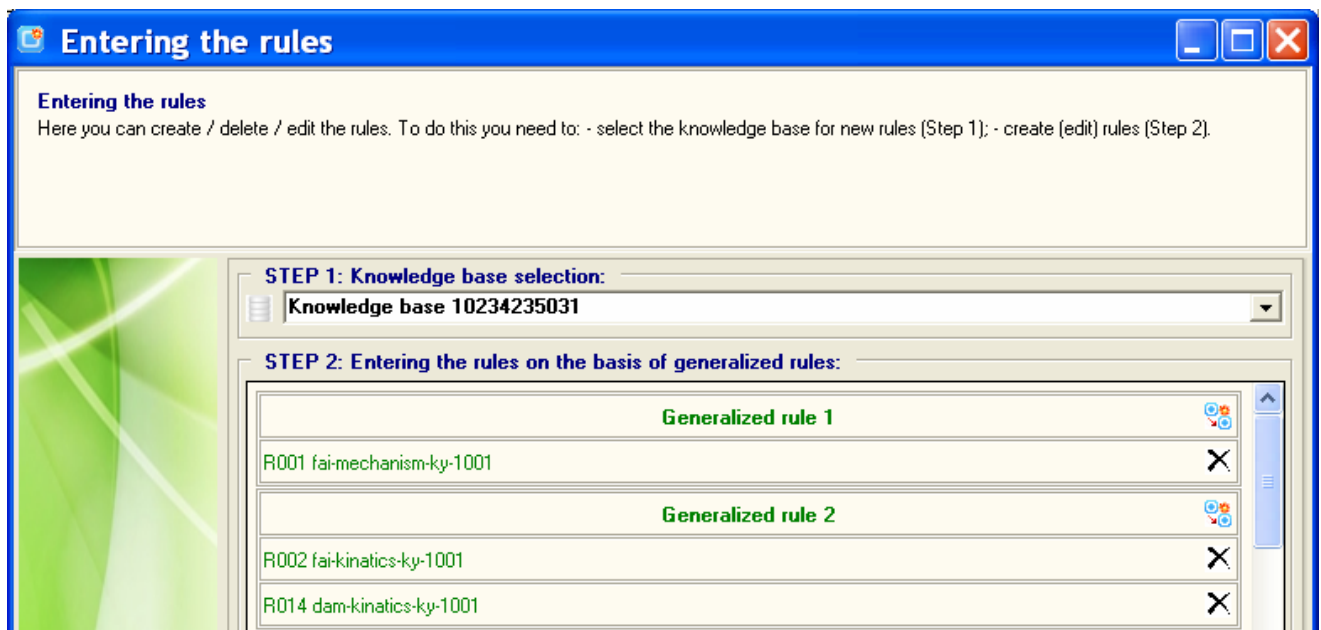


Figure 2.9 – A Rule creation GUI form

!! Before you can create rules, you must create at least one rule template (a generalized rule), because of rules are created from rule templates.

- The «Create a report (.doc)» menu sub-item allows you to generate a report in MS Office (Fig.2.10) with description of knowledge base elements in the form of tables and non-formalized descriptions.

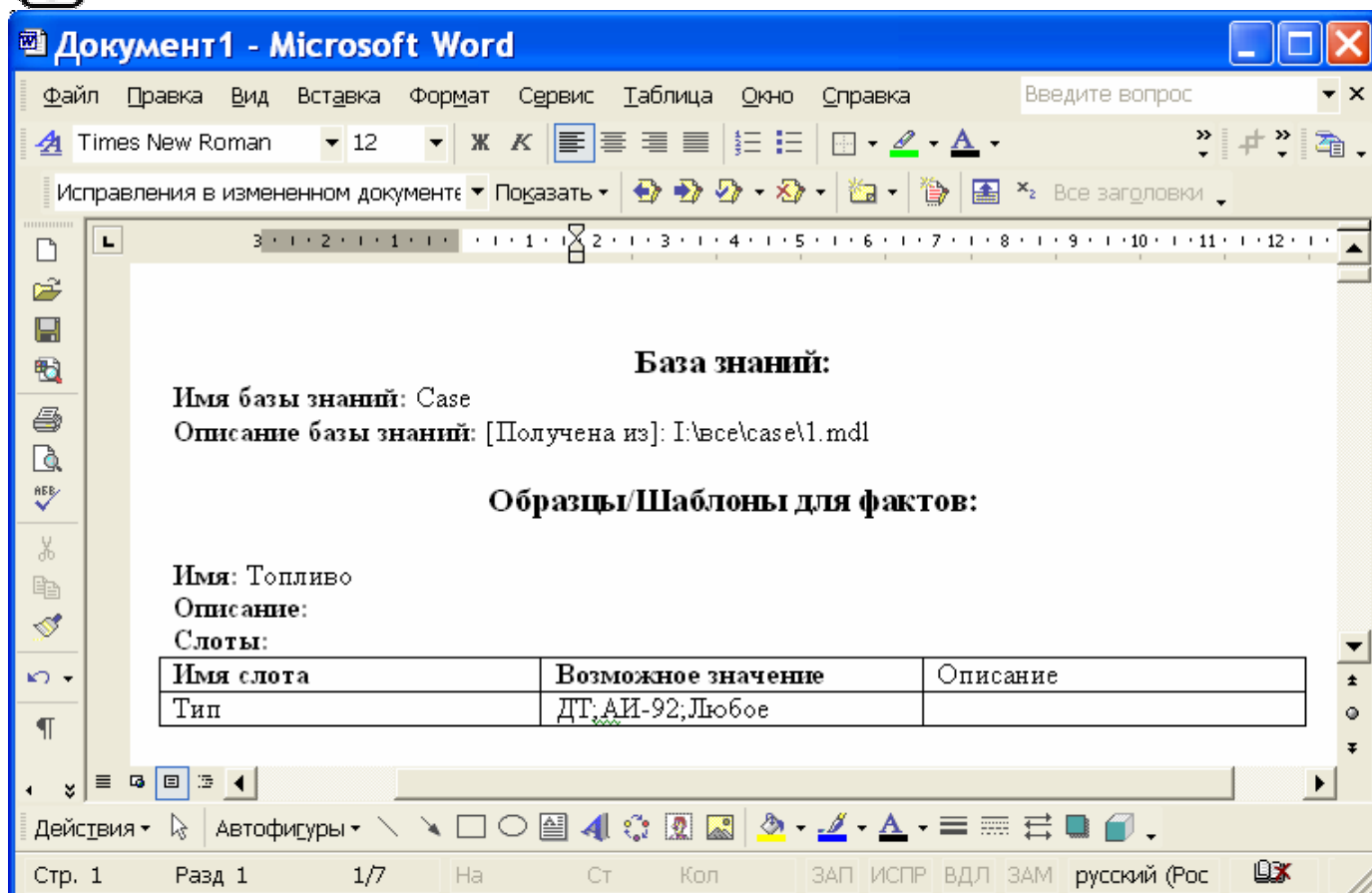


Figure 2.10 – A Knowledge base report

!! You need MS Office to generate a report.

!! You need to select the knowledge base in the PKBD explorer to generate a report, otherwise a warning message will appear (Fig.2.11)

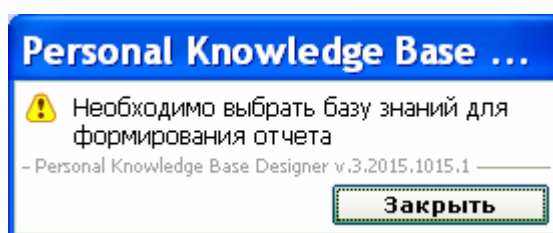


Figure 2.11 – Warning message

- The «Run» menu sub-item allows you to test the developed knowledge base.



The «Settings» menu item (Fig.2.12) provides the ability to select a user role when operating in the «Domain-specific editor» mode (Operator or Administrator), as well as the choice of output machine for testing and language.

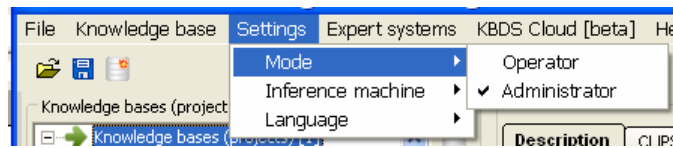


Figure 2.12 – The «Settings» menu item

The «Help» menu item provides the ability to get brief information about the program (Fig.2.13), including information about software modules (components) and their versions and send a request to the support team with a description of the requests or bugs, and to open documentation.

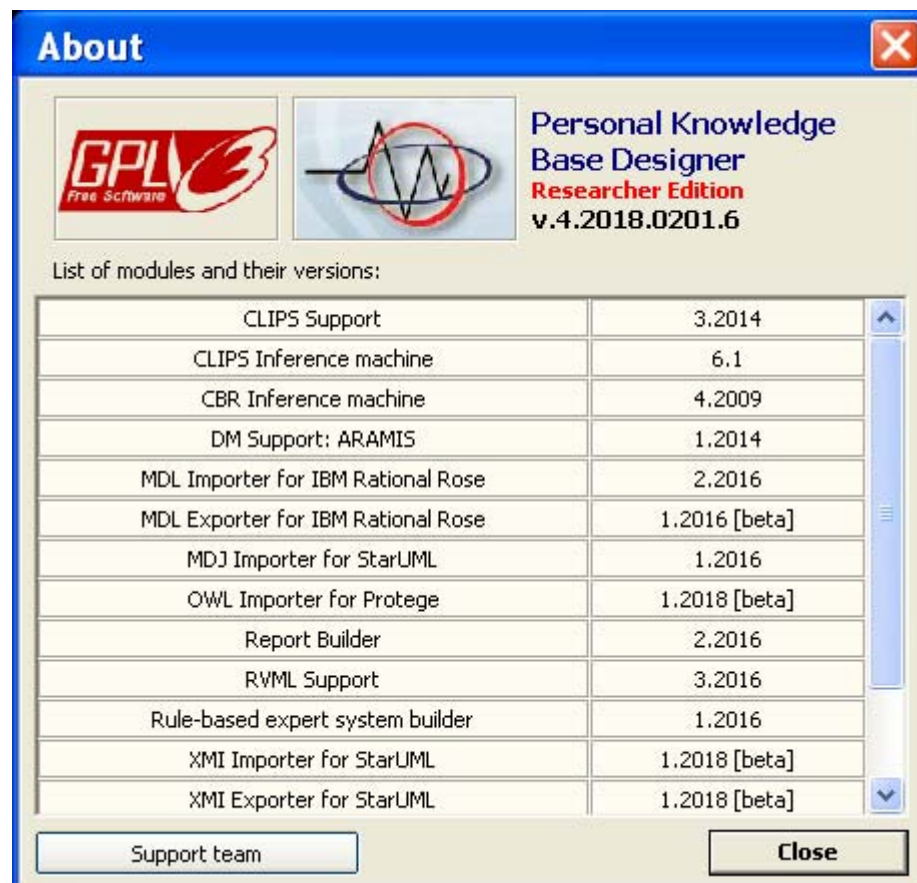


Figure 2.13 – The «About» menu item



2.1.2 Toolbar

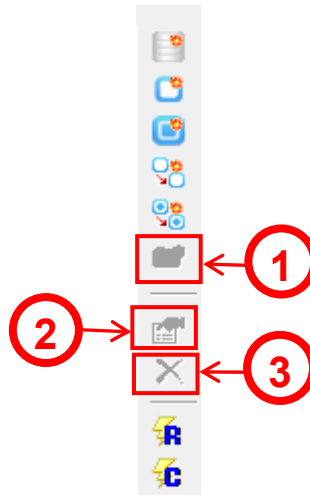


Figure 2.14 – Toolbar

The toolbar provides more convenient access to the main functions of the «Knowledge Base» main menu item.

Also provided the ability to:

- ① to create folders (packages) - used to organize the nested structure of the knowledge base project;
- ② to change the properties of the selected knowledge base item;
- ③ to delete the element knowledge base or off the knowledge base.



2.1.3 Explorer (Navigator)

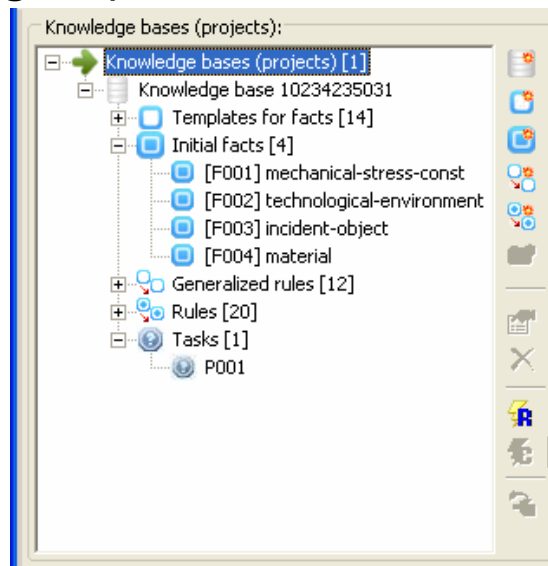


Figure 2.15 – Explorer (Navigator)

The explorer (navigator) provides a preview of the knowledge base elements grouped by the following sections (Fig.2.15):

- Templates for facts;
- Initial facts;
- Templates for rules (Generalized rules);
- Rules;
- Tasks (the results of the validation of knowledge bases).

Explorer (Navigator) also allows you to open the context menu (Fig.2.16), duplicating access to the functions of adding the elements and forming the report.

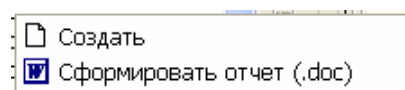


Figure 2.16 – The explorer (navigator) context menu



2.1.4 Topic

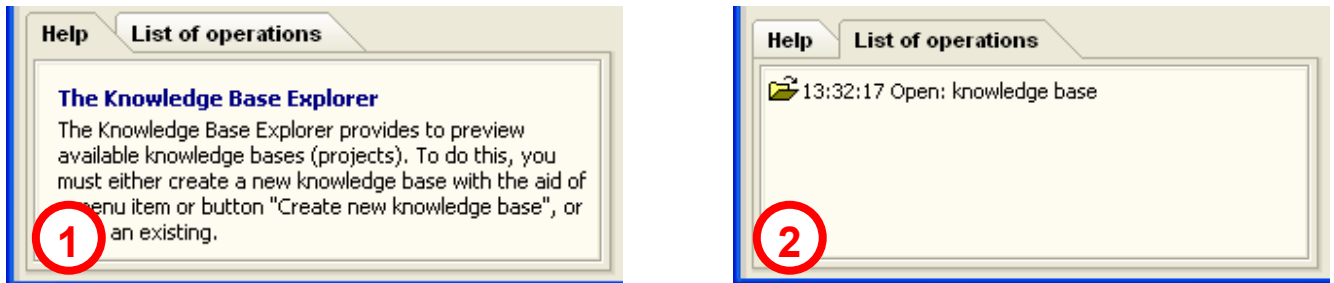


Figure 2.17 – Tabs of the «Topic» workspace

The «Topic» workspace includes the following tabs:

- 1 «Help» - contains a description (context hint) of the active elements (on which the mouse pointer is hovered).
- 2 «List of operations» - displays the history of user actions.



2.1.5 The main workspace

The main working area of the program (Fig.2.18) - provides a preview of the description of the selected item and contains three tabs:

- for description in natural language (Fig.2.18),
- for description in the programming language for knowledge bases, in particular, CLIPS (C Language Integrated Production System) (Fig.2.19),
- for description in RVML (Rule Visual Modeling Language) (Fig.2.20).

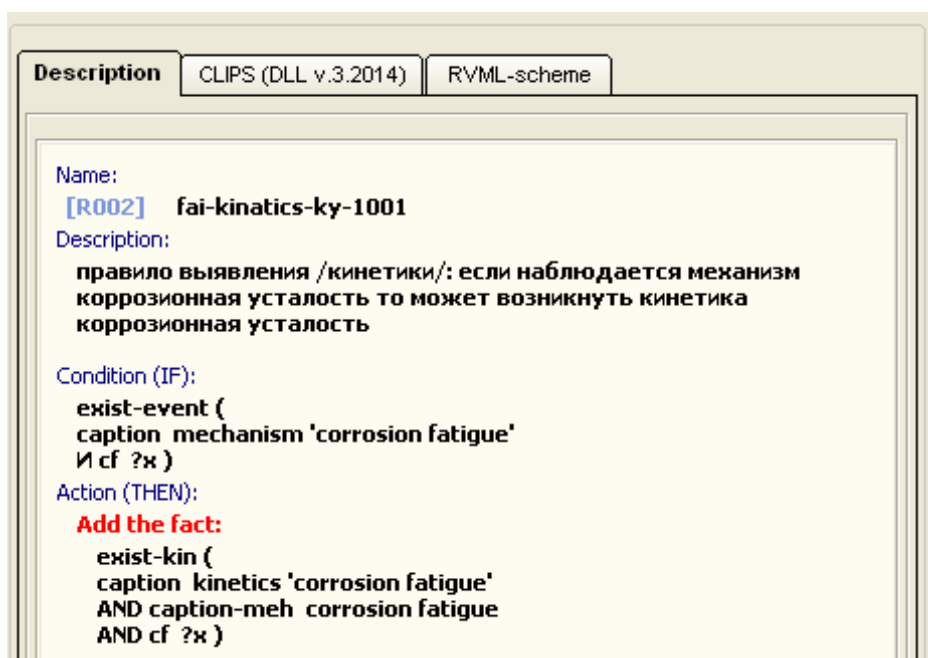


Figure 2.18 – Information about the element, the «Description» tab

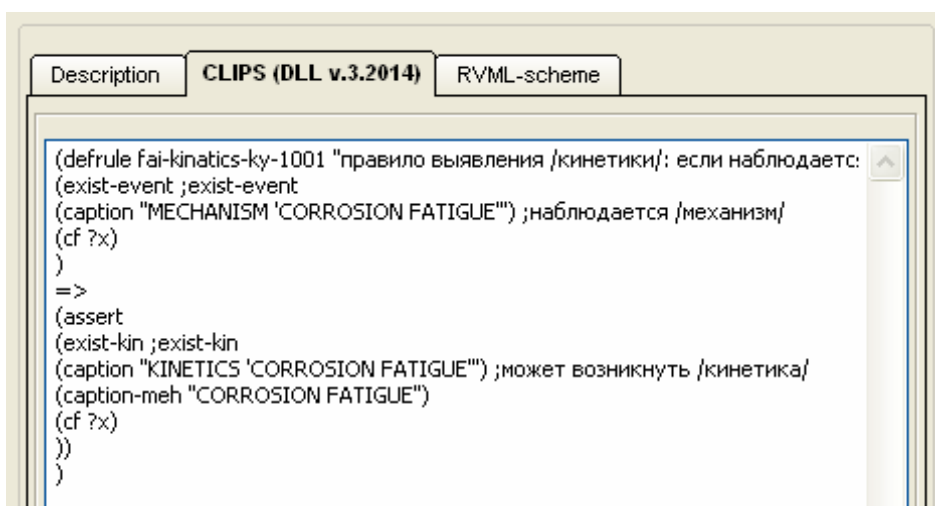


Figure 2.19 – Information about the element, the «CLIPS» tab

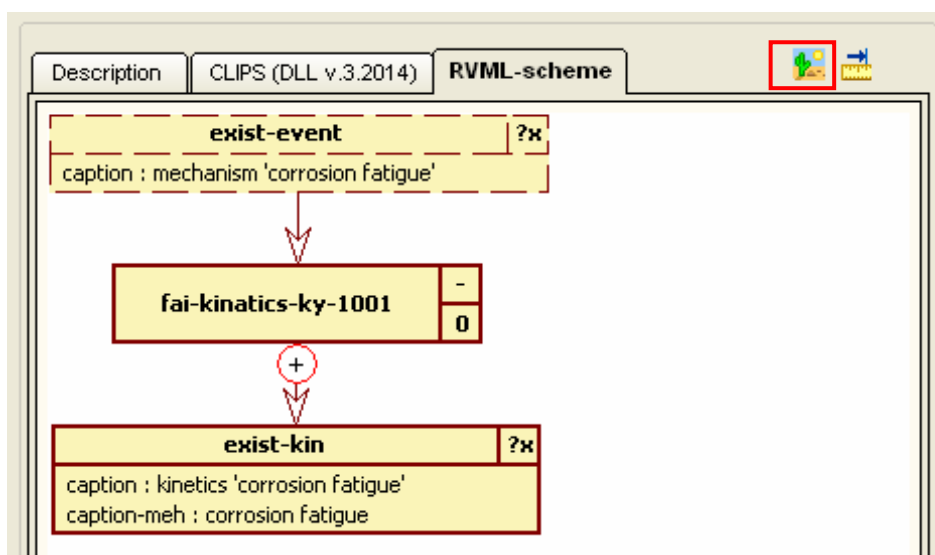


Figure 2.20 – Information about the element, the «RVML scheme» tab

To save the RVML diagram as a graphic file of BMP format, use the button.



2.2 Functions

Access to the main functions of the program is possible both from the top menu and from the toolbar.

2.2.1 Creating a knowledge base

There are three ways to access to the knowledge base creation function (Fig.2.21): (A) at the program startup; (B) from the toolbar; (C) from the top menu.

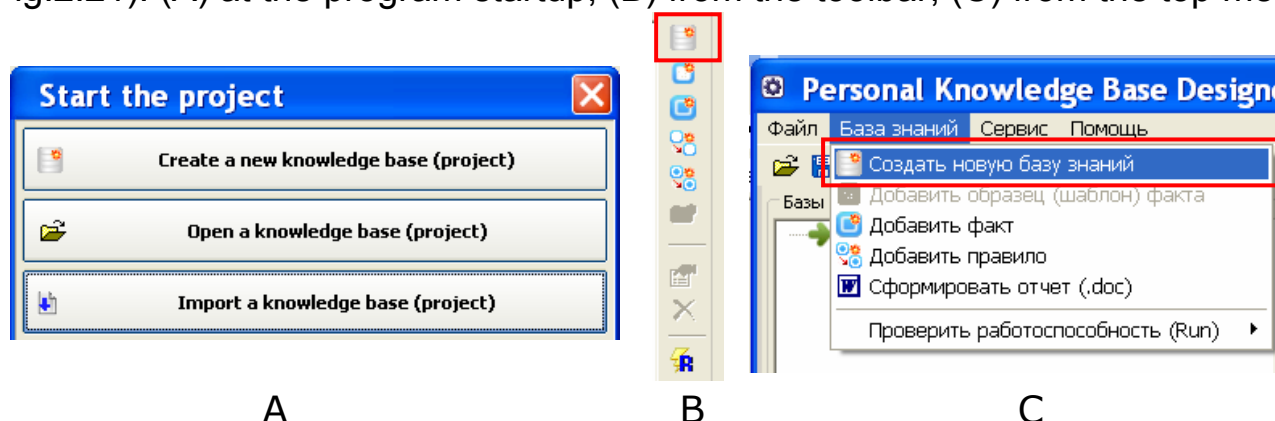


Figure 2.21 – The access to the knowledge base creation function

The following fields have to complete when you create a knowledge base (Fig.2.22):

1. «Name» – it will be used when displaying information about the knowledge base in the program. The entered name will be automatically converted into a «internal name», which, in its turn, will be used in the process of logical inference and code generation.
2. «Type» of the knowledge base defines a type of knowledge base elements, in particular:
 - a. rules – provides to describe the subject area using logical rules and facts; knowledge base contains elements: fact templates, facts, rule templates, rules.



- b. cases –provides to describe a subject area with typical situations (cases); the knowledge base contains the elements: a case template, cases.
- 3. «Description» – a brief non-formalized description of the knowledge base (comments).

Figure 2.22 – A GUI Form of creating a knowledge base

2.2.2 Creating a template of facts (cases)

Depending on the knowledge base type, it is possible to create templates of facts (cases), which will later be used as a basis (structured template) to describe the concepts of the subject area.

There are three ways to access the function of the creation of templates of facts (cases) (Fig.2.23): (A) from the explorer context menu; (B) from the toolbar; (C) from the top menu.

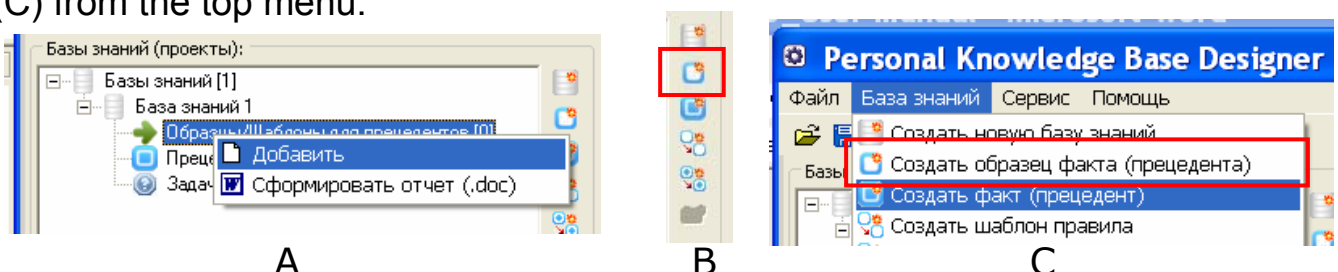


Figure 2.23 – The access to the creation fact (case) template function

Creating a new template is implemented as a wizard (Fig.2.24) containing the following sequence of steps:

1. Selection of the available knowledge base (Fig.2.24, 1).



2. Entering a name and description for the template (Fig.2.24, 2).
3. Description of the template's properties (slots) (Fig.2.25).
4. Check (preview) the entered data in the tabular form (Fig.2.27).

Editing the template

Creating (editing) the template for facts (cases)
To do this you need to: - select the knowledge base (Step 1); - select the template (Step 2) and enter the values of slots (properties).

STEPS 1 and 2: Knowledge base selection and entering a name and description of the template

STEP 1: Knowledge base selection
Knowledge base 10234235031

STEP 2: Entering the name and description of the template:
Template: [T001] incident-object
object of the incident

STEP 3: Entering the properties

STEP 4: Entered data preview

Figure 2.24 – Creating a fact (case) template, steps 1 and 2

To create new properties (slots) of the template, click the «Add new slot (property)» button, represented as an icon (Fig.2.25).

Editing the template

Creating (editing) the properties (slots)
To do this you need to (Step 3) clarify the properties: by entering names, datatypes, possible default values and descriptions.

STEPS 1 and 2: Knowledge base selection and entering a name and description of the template

STEP 3: Entering the properties:
Template: [T001] incident-object

| Slot name | Datatype | Value by default | Description |
|-----------|----------|------------------|------------------|
| cf | Integer | 1 | certainty factor |
| caption | String | нет данных | name of the obj |

STEP 4: Entered data preview

Figure 2.25 – Creating a fact (case) template, step 3



After clicking the button, an empty description of the new slot (properties) will be added (Fig.2.26), for which you can enter a name, type, default value, description.

Создание нового шаблона факта (прецедента)

Ввод (изменение) свойств
Для ввода (изменения) описания шаблона факта (прецедента) необходимо (ШАГ 3) уточнить его свойства: указать их название, тип, возможное свойство по умолчанию и описание.

ШАГ 3: Описание свойств:
Шаблон: [T001] Шаблон-факта-T001

| Имя слота (свойства) | Тип данных | Значение по умолчанию | Описание |
|----------------------|------------|-----------------------|----------|
| Slot-0 | String | | |

Buttons: String, String, Number, Fuzzy, and a delete icon (X) are visible next to the first row.

Figure 2.26 – Creating a fact (case) template, add a new property

The added slots can be removed (Fig.2.26), by clicking on the «Delete slot (property)» icon.

Editing the template

Preview (checking) of entered data
Here you can check the formal correctness of the template represented in the form of the table.

STEP 4: Entered data preview:
Template: [T001] incident-object

| Slot name | Datatype | Value by default | Description |
|-----------|----------|------------------|--------------------|
| cf | | 1 | certainty factor |
| caption | String | нет данных | name of the object |


Buttons: Cancel, << Back, Ok

Figure 2.27 – Creating a fact (case) template, step 4



If you need to make changes in the template description, just return to the previous step by pressing the «<< Back» button. After the template is successfully created, it will be added to Explorer as a new element of the knowledge base.

!! *At least one knowledge base is required to create a template.*

 *Changing the template is similar to the creation procedure.*

2.2.3 Creating a template of rules

!! *At least one knowledge base and a fact (case) template are required to create a rule template.*

!! *Creating a rule template is only possible for rule-based knowledge bases.*

There are three ways to access the function of the creation of templates of rules (Fig.2.28): (A) from the explorer context menu; (B) from the toolbar; (C) from the top menu.

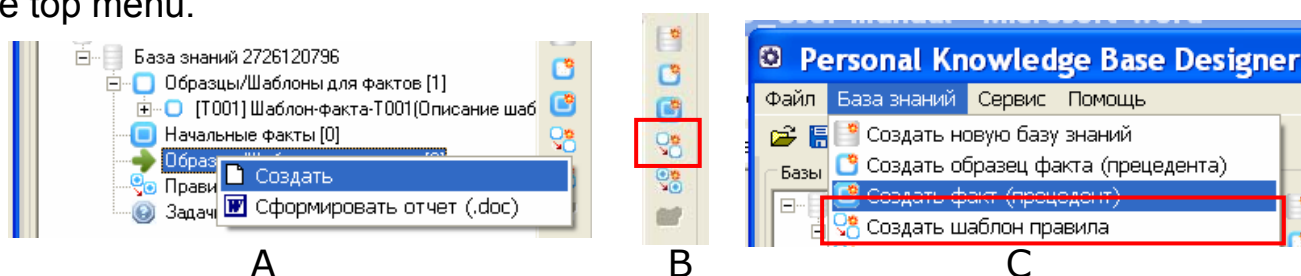


Figure 2.28 – The access to the Create rule template procedure

Creating a new template is implemented as a wizard (Fig.2.29) containing the following sequence of steps:

1. Selection of the available knowledge base (Fig.2.29).
2. Entering a name and description for the template (Fig.2.29).
3. Description of conditions and actions (Fig.2.30). You can select the available fact templates as conditions and actions.
4. Checking (previewing) the entered data in the form of RVML-scheme (Fig.2.32).

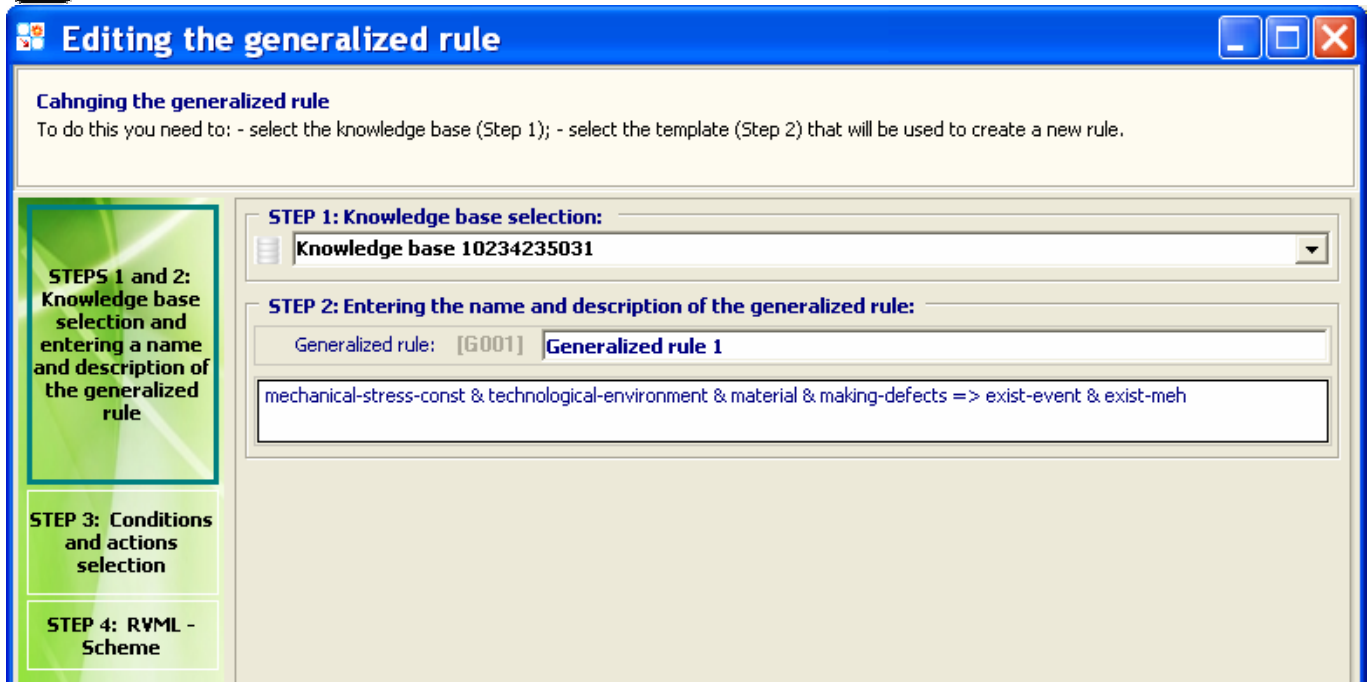


Figure 2.29 – Creating a rule template, step 1 and 2

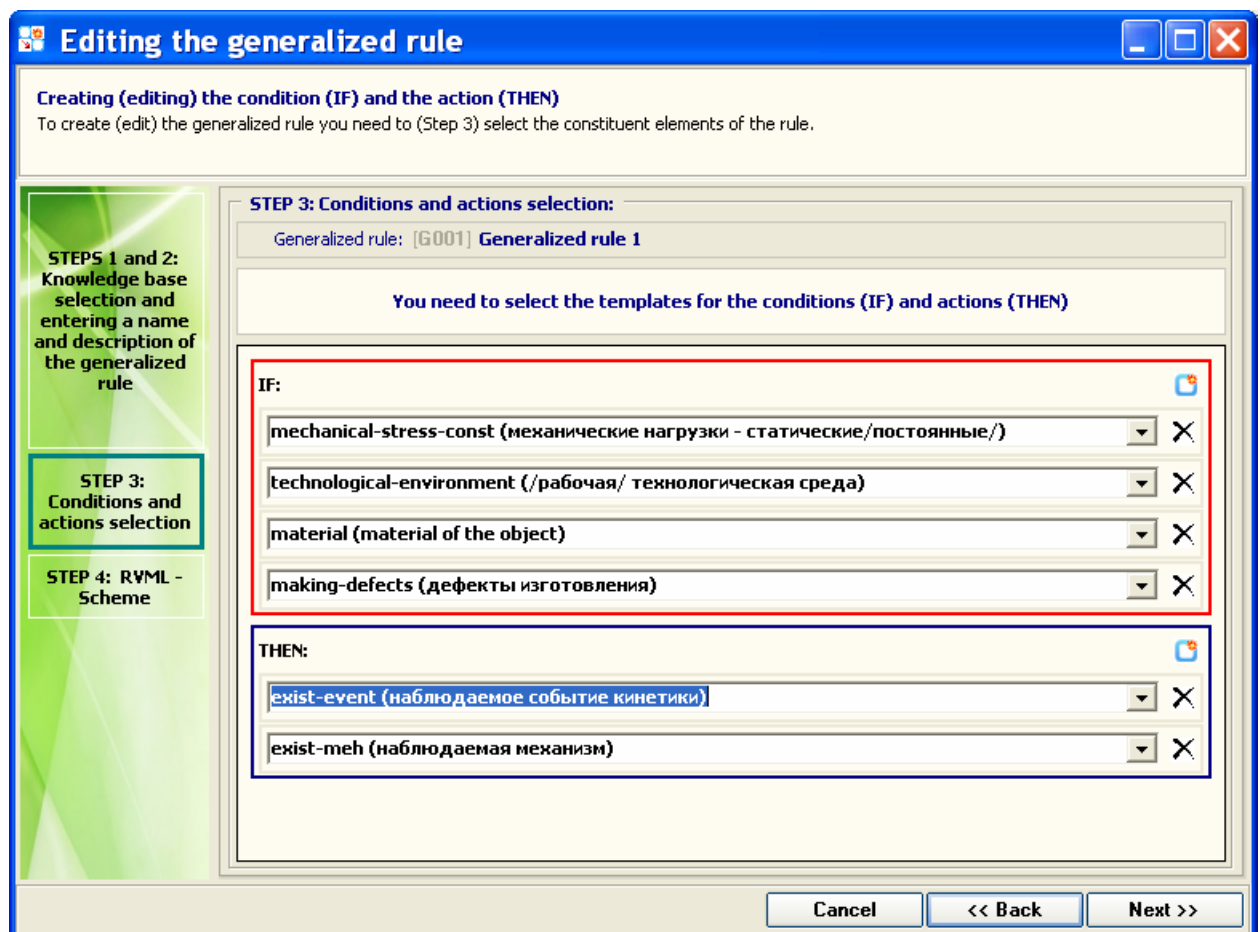


Figure 2.30 – Creating a rule template, step 3



To add a new rule element just click the «Add fact template to rule» icon (Fig.2.30), and then take from the list the required fact template (Fig.2.31).

ШАГ 3: Назначение условий и действий

ШАГ 4: RVML-схема

ЕСЛИ:

Шаблон-факта-T001 (Описание шаблона факта T001)

ТО (СЛЕДУЕТ):

Figure 2.31 – Description of the rule element

Rule elements can be removed by clicking on the «Remove template from rule» icon (Fig.2.31). The created rule can be represented as an RVML-scheme (Fig.2.32).

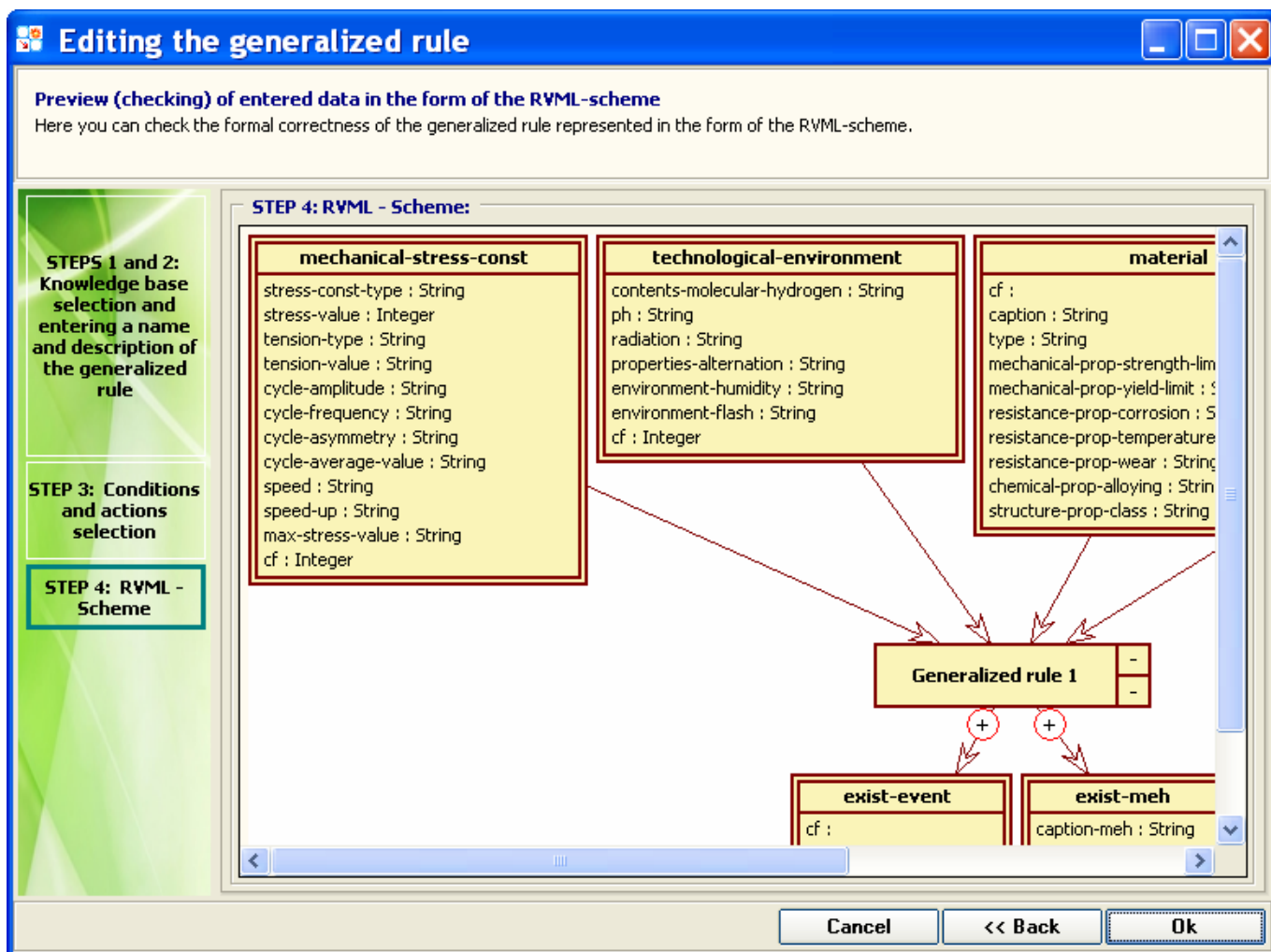


Figure 2.32 – Creating a rule template, step 4



Changing the template is similar to the creating procedure.



2.2.4 Creating rules

!! At least one knowledge base and a rule template are required to create a rule.

!! Creating a rule is only possible for rule-based knowledge bases.

There are three ways to access the function of the creation of rules (Fig.2.33): (A) from the explorer context menu; (B) from the toolbar; (C) from the top menu.

Creating a new rule is implemented as a wizard (Fig.2.34) containing the following sequence of steps:

1. Select the knowledge base and rule template from the list of available (Fig.2.34). To specify a specific template, click either the «Add new rule» icon (Fig.2.34) or the name of the rule template.
2. Description of the rule name (Fig.2.35, 1).
3. Description of rule conditions (Fig.2.35, 2).
4. Check (preview) the entered data in tabular form (Fig.2.36).
5. Description of rule actions.
6. Check (preview) the entered data in the tabular form.
7. Preview the generated rules in the form RVML schema (Fig.2.37).

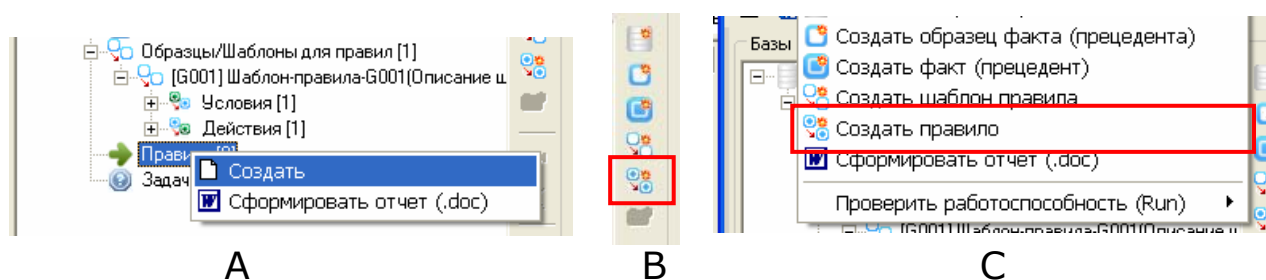


Figure 2.33 – The access to the create rule procedure

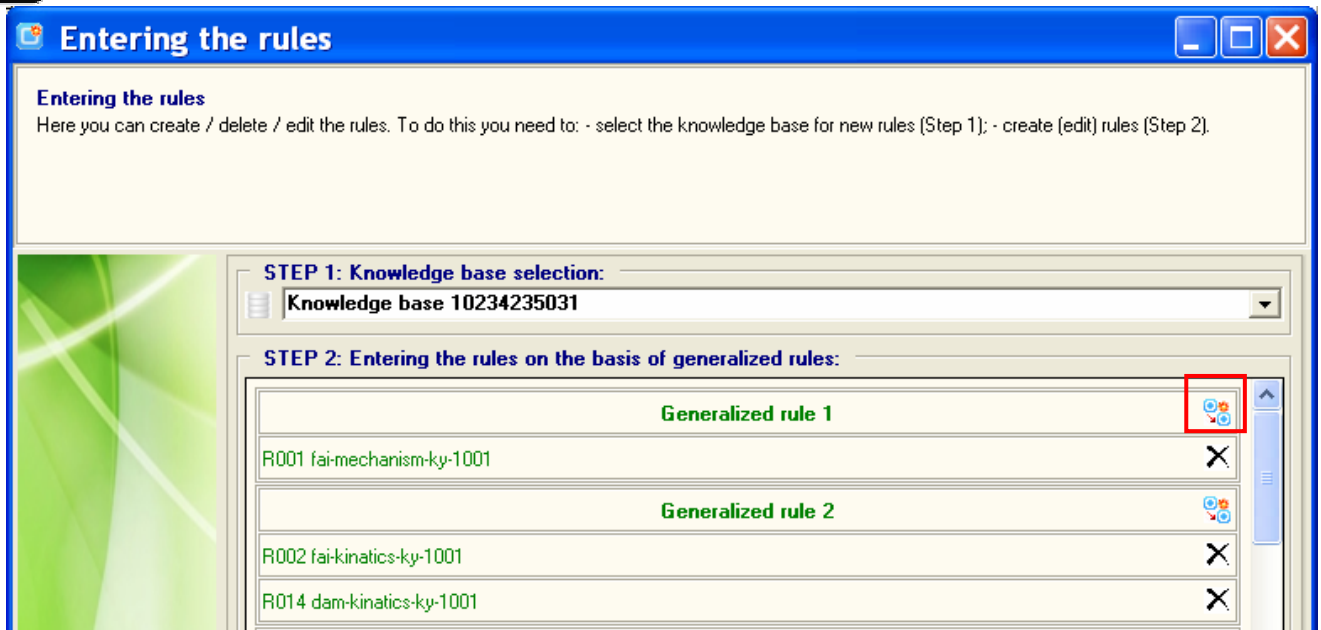


Figure 2.34 – Creating a rule: selecting a knowledge base and a rule template

You can add or remove additional elements to the condition and action when creating rules, (Fig.2.35). An additional condition element is formed on the basis of the fact templates entered earlier.

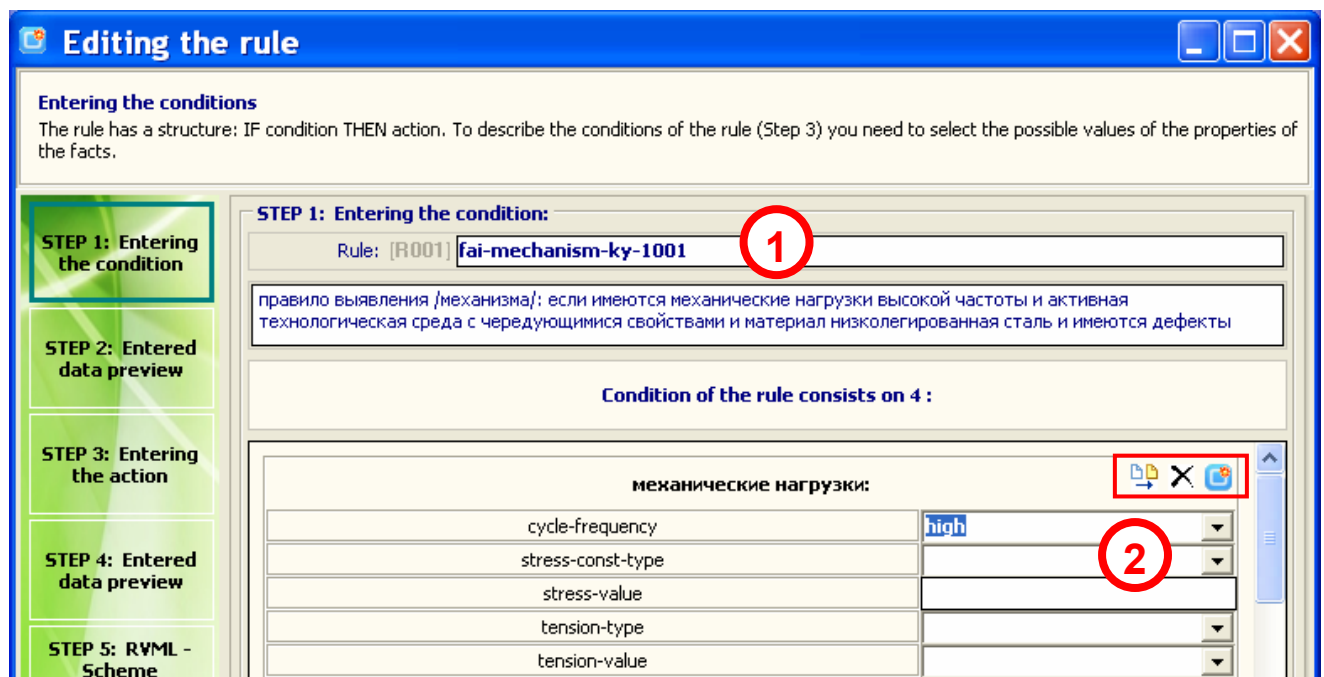


Figure 2.35 – Creating a rule: description of conditions



Ввод нового правила

Предварительный просмотр (проверка) введенных данных
Здесь Вы можете проверить правильность описания условия правила (ШАГ 2). Если хотя бы для одного условия правила не введены значения, то система сообщает «нет данных» и не позволяет продолжить процесс ввода правила для обеспечения корректности созданного правила.

ШАГ 1: Описание условия

ШАГ 2: Проверка (просмотр) введенных данных:

Правило: [R001] Шаблон-правила-G001

Шаблон-факта-T001:

| | |
|--------|----|
| Slot-0 | 23 |
| Slot-1 | 1 |

Figure 2.36 – Creating a rule: check (preview) the entered data in the tabular form

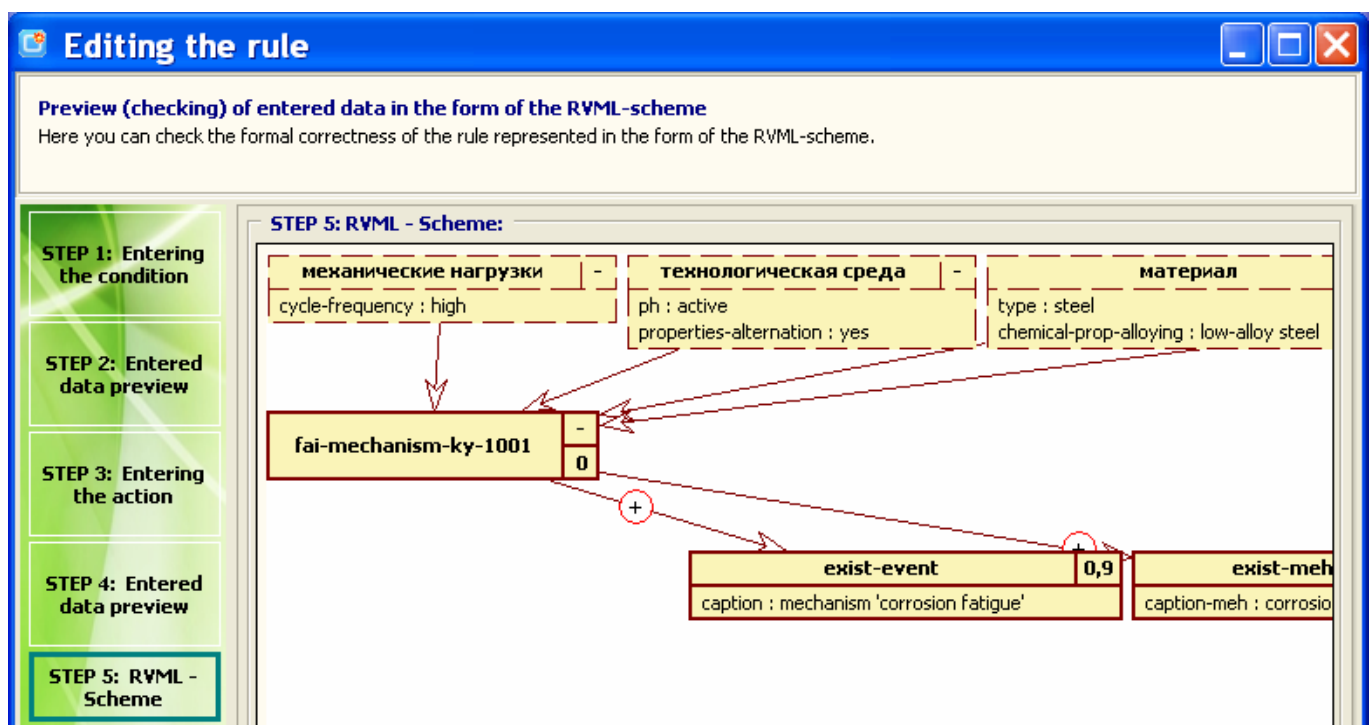


Figure 2.37 – Creating a rule: preview the generated rules in the form RVML schema

The created rule will be displayed on the knowledge base and rule selection with the possibility of its removal.

2.2.5 Creating initial facts (cases)

Depending on the type of the knowledge base, the created facts will be either typical situations (cases) or initial facts - conditions leading to the activation (firing) of the rules during the logical inference.

!! At least one knowledge base and a fact template are required to create a fact.



There are three ways to access the function of the creation of facts (cases) (Fig.2.39): (A) from the explorer context menu; (B) from the toolbar; (C) from the top menu.

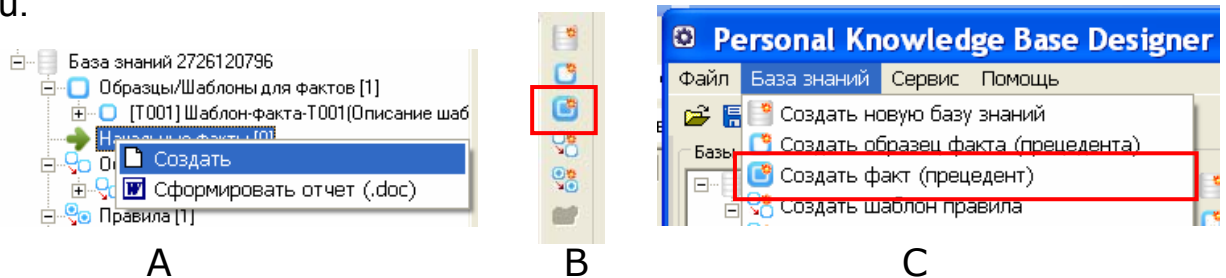


Figure 2.39 – The access to the create fact (case) procedure

Creating a new fact (case) is implemented as a wizard (Fig.2.40) containing the following sequence of steps:

1. Selecting a knowledge base from the list of available (Fig.2.40, 1).
2. Choosing a fact (case) template (Fig.2.40, 2).
3. Description of the properties of a fact (case) (Fig.2.41).
4. Checking (previewing) the entered data in the tabular form (Fig.2.42).

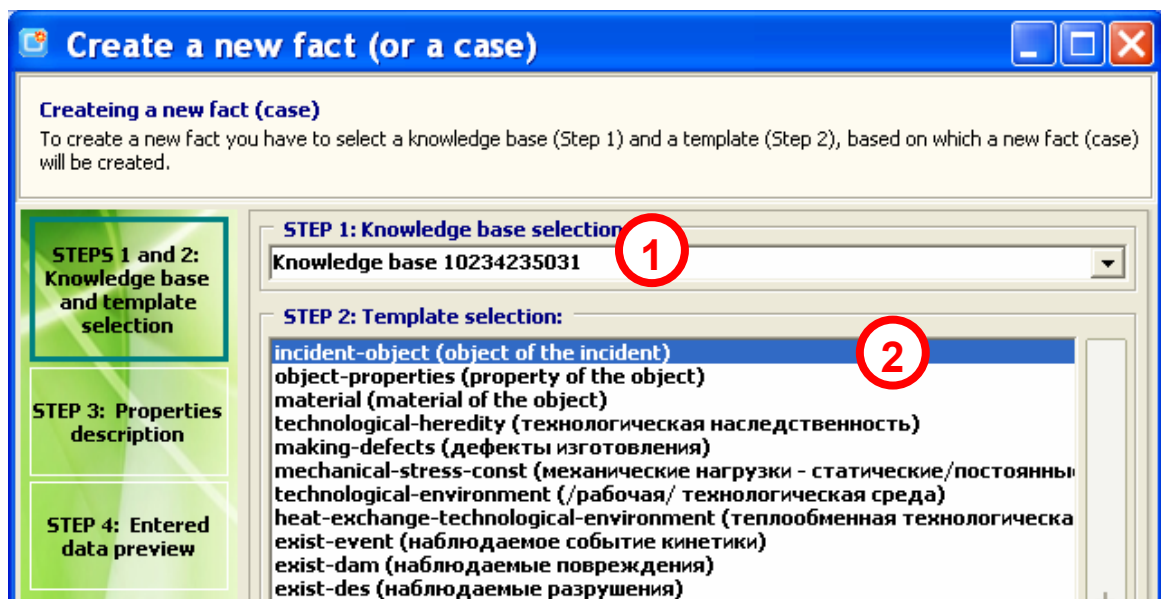


Figure 2.40 – Creating initial facts (cases): selecting a knowledge base and a fact template



Create a new fact (or a case)

Entering the values of properties
To describe a new fact you need to select the possible values of properties (Step 3).

STEP 3: Properties (slots) description:

Fact [F005] material

| | |
|-----------------------------|-------|
| cf | |
| type | сталь |
| mechanical-prop-yield-limit | |
| chemical-prop-alloying | |

Left sidebar steps:
- STEPS 1 and 2: Knowledge base and template selection
- **STEP 3: Properties description**
- STEP 4: Entered data preview

Figure 2.41 – Creating initial facts (cases): description of properties

Create a new fact (or a case)

Preview (checking) of entered data
Please, preview the entered data before you close the window.

STEP 4: Entered data preview:

Fact [F005] material

| | |
|------|-------|
| type | сталь |
|------|-------|

Left sidebar steps:
- STEPS 1 and 2: Knowledge base and template selection
- STEP 3: Properties description
- **STEP 4: Entered data preview**

Figure 2.42 – Creating initial facts (cases): checking (previewing) the entered data in the tabular form



2.2.6 Testing (Run)

One of the main purposes of the program is to check the created knowledge bases. This procedure allows you to initiate the logical inference for the knowledge entered (run them).

Access to the «Run» function is carried out (Fig.2.43): (A) from the toolbar; (B) from the top menu.

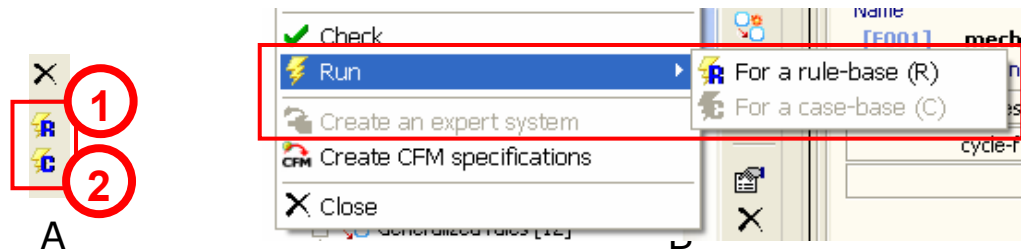


Figure 2.43 – Access to the «Run» function

Depending on the type of knowledge base, the testing will allow you to carry out either a logical inference on the basis of rules (Fig.2.43, 1), or case retrieval (Fig.2.43, 2).

2.2.6.1 Testing the rule-based knowledge bases

Testing implemented as a wizard (Fig.2.44) that is represented as the following sequence of steps:

1. Selecting a knowledge base (Fig.2.44, 1).
2. Initial facts preview (Fig.2.44, 2).
3. Testing results preview (Fig.2.45).

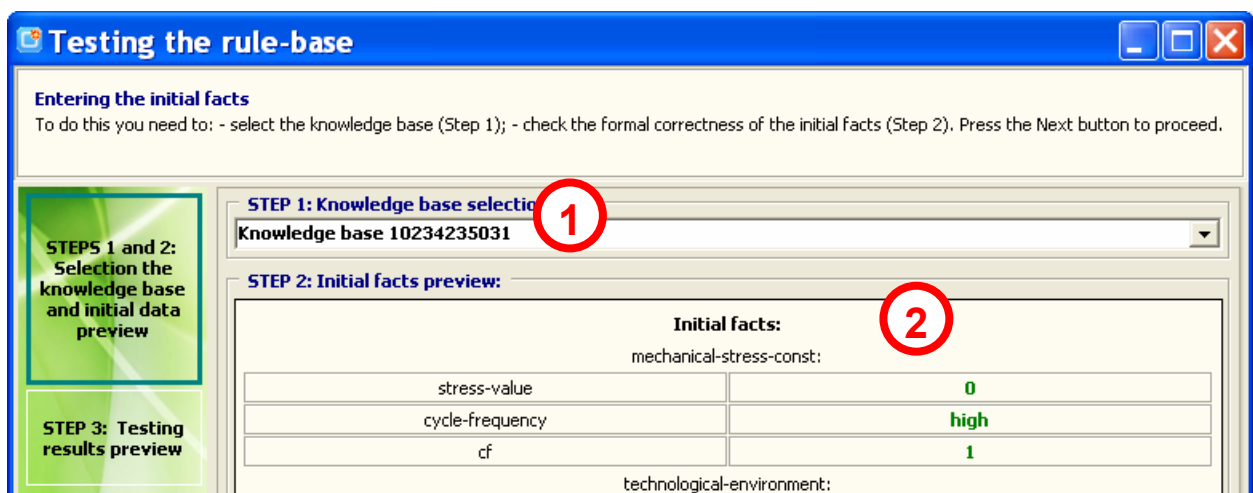


Figure 2.44 – Testing the rule-based knowledge base



!! For testing, you have to enter the initial facts that can activate rules of the knowledge base.

After the initial facts preview, the inference machine is started to build logical chains based on the entered rules. Rules can create facts, which in turn can trigger the activation of other rules. The test results are presented in the form of a table (Fig.2.45) where each line corresponds to an activated rule or a fact added to the working memory.

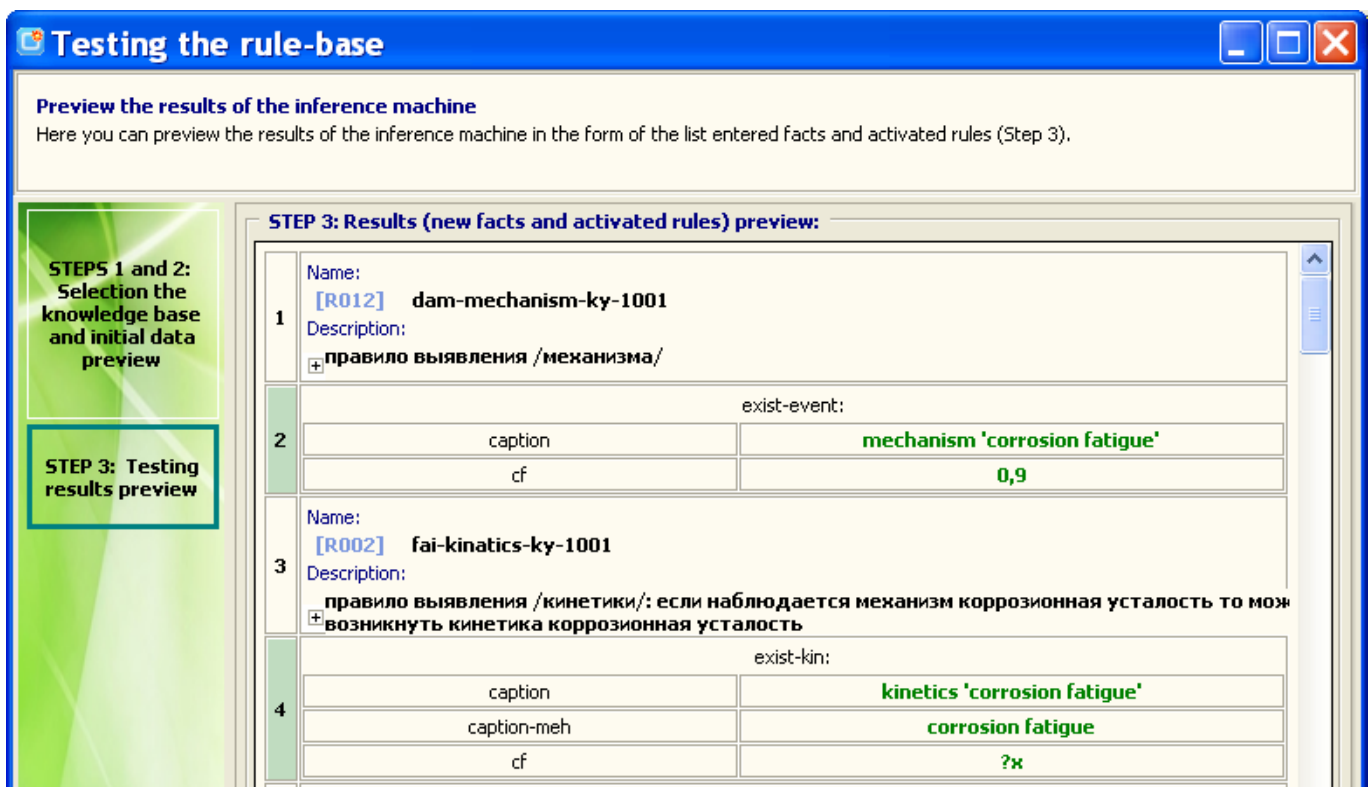


Figure 2.45 – Testing the rule-based knowledge base: results preview

2.2.6.2 Testing the case-based knowledge bases

Testing implemented as a wizard (Fig.2.46) that is represented as the following sequence of steps:

1. Selecting a knowledge base (Fig.2.46, 1).
2. Selecting a case template for formation of the request (the current problem situation) (Fig.2.46, 2).
3. Describing the current problem situation (a request) (Fig.2.47). At this moment you can specify the information weight or the importance of a particular property (Fig.2.47, 1).



4. Previewing the entered data (Fig.2.48) with indication of importance of the entered properties.
5. Previewing the retrieval results (the results of the query to the case database) (Fig.2.49). The results are presented in a tabular form with an assessment of the proximity of the introduced description of the problem situation (request) and cases from the knowledge base.
6. Previewing the results of a multi-criteria decision making (used to confirm case retrieval results) (Fig.2.51).

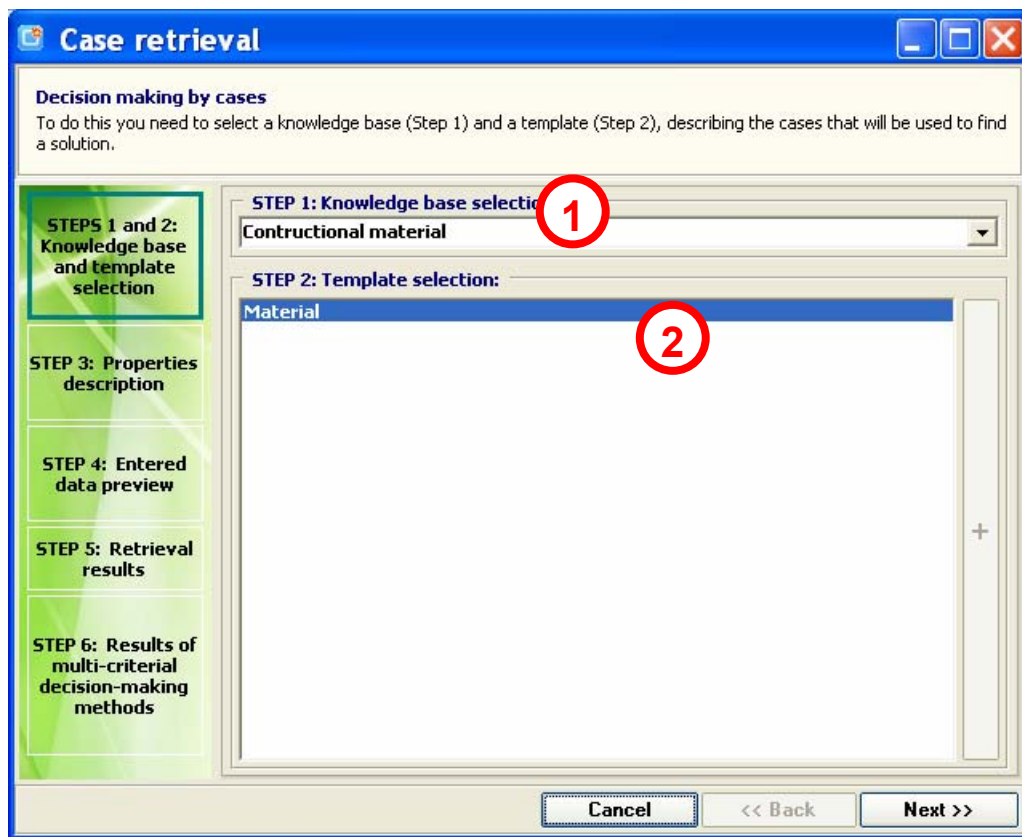


Figure 2.46 – Testing the case-based knowledge base: selecting a knowledge base and a case template



Case retrieval

Entering the values of a targeted case (the current problem description)
To describe a targeted case (the current problem) you need to select the possible values of properties and enter their importance with accordance of a scale (Step 3).

STEP 3: Properties (slots) description:

| Property | Value | Importance |
|-----------------------------|----------------|------------|
| Structural component | | 1 |
| Operation temperature | TO_560_C | 1 |
| Corrosion resistance | | 1 |
| Manufacturability | | 1 |
| Pressure (expl.) | | 1 |
| Agent (expl.) | LOW_AGGRESSIVE | 1 |
| High-temperature resistance | | 1 |
| Heat resistance | | 1 |
| Temperature (expl.) | | 1 |
| Cost | MEDIUM | 1 |
| Crack resistance | | 1 |
| Service life | 1000-10000 | 1 |
| High-temperature strength | | 1 |

STEP 3: Properties (slots) description:

Cancel << Back Next >>

Figure 2.47 – Testing the case-based knowledge base: description of the current problem situation

Case retrieval

Preview (checking) of entered data
Please, preview the entered data before you close the window.

STEP 4: Entered data preview:

| Property | Value | Importance |
|-----------------------|----------------|------------|
| Operation temperature | TO_560_C | 1 |
| Service life | 1000-10000 | 1 |
| Cost | MEDIUM | 1 |
| Agent (expl.) | LOW_AGGRESSIVE | 3 |

Figure 2.48 – Testing the case-based knowledge base: entered data preview

When previewing the retrieval results (Fig.2.49) you can preview a detailed comparison of the descriptions of the current problem situation (request) and a certain case from the knowledge base (Fig.2.50). To do this, simply click on a specific row in the results table. In this case, all non-matching property values in



the descriptions will be marked in red, the importance of the properties will also be indicated (their information weight).

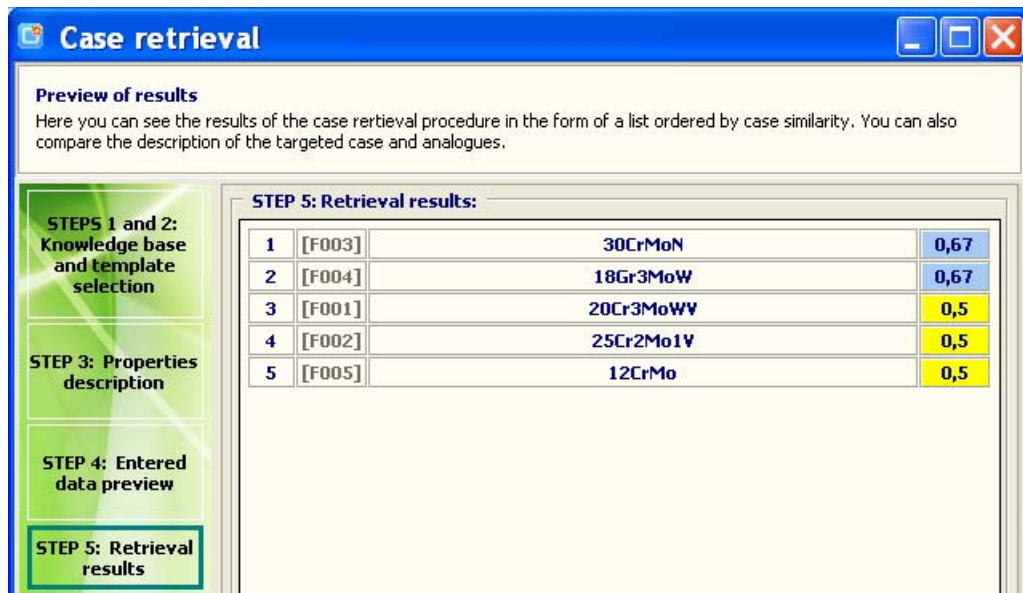


Figure 2.49 – Testing the case-based knowledge base: retrieval results preview

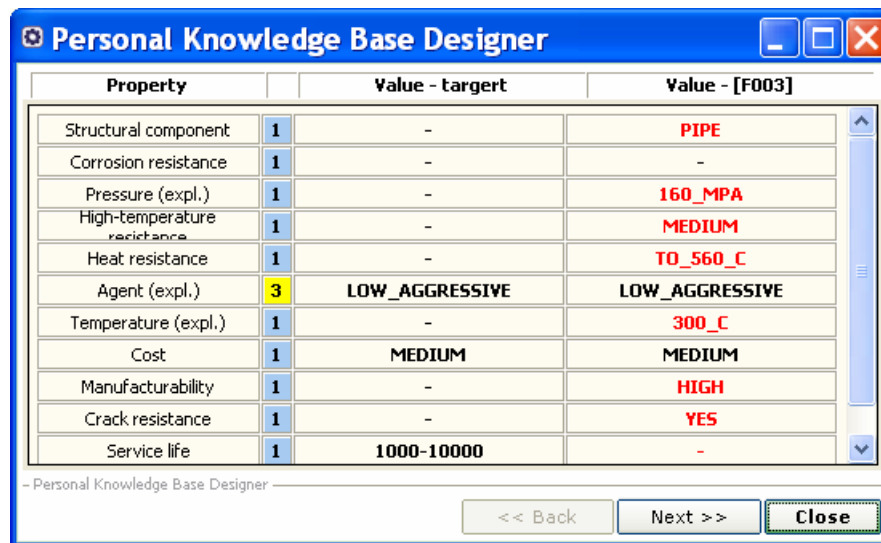


Figure 2.50 – Testing the case-based knowledge base: comparison (comparative preview) of cases

The methods of multi-criteria decision making, in particular, the ARAMIS method (Aggregation and Ranking of Alternatives around Multisign Ideal Situations) are used to prove the correctness of the case retrieval. This method uses the description of the problem situation (query) and the properties of cases to find a solution. The result is also given in tabular form (Fig.2.51).

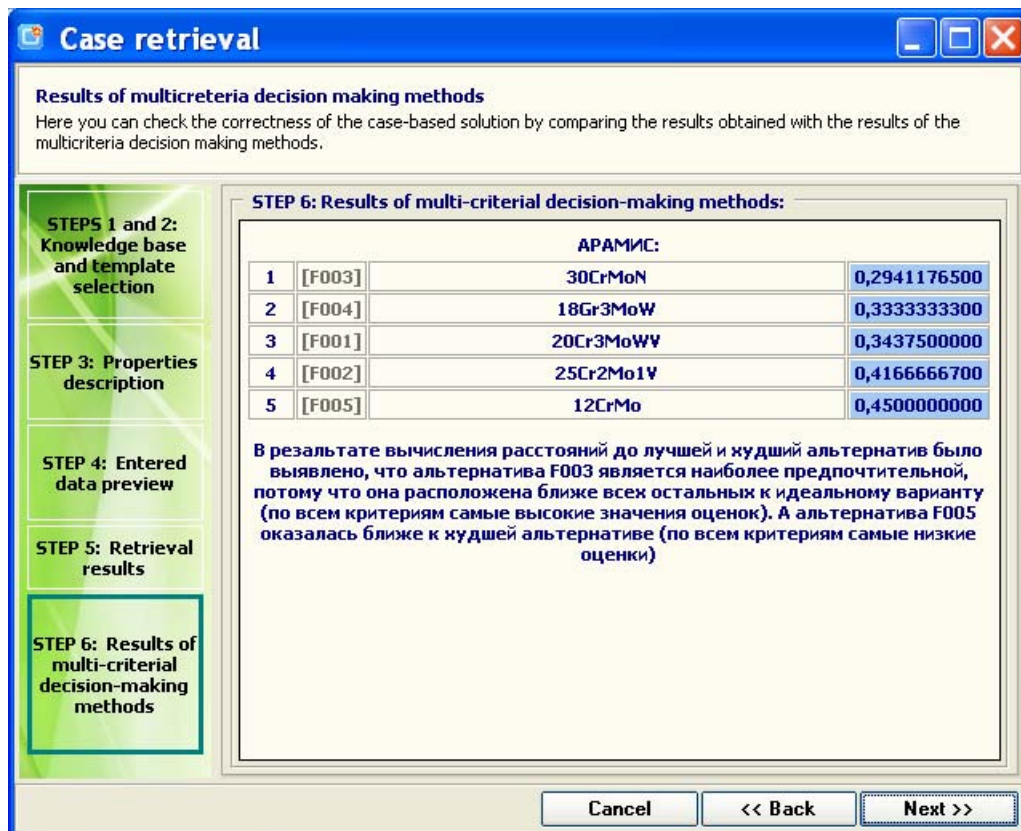


Figure 2.51 – Testing the case-based knowledge base: previewing the results of a multi-criteria decision making

The search (validation) results will be added to the Explorer in the tasks section (Fig.2.52).

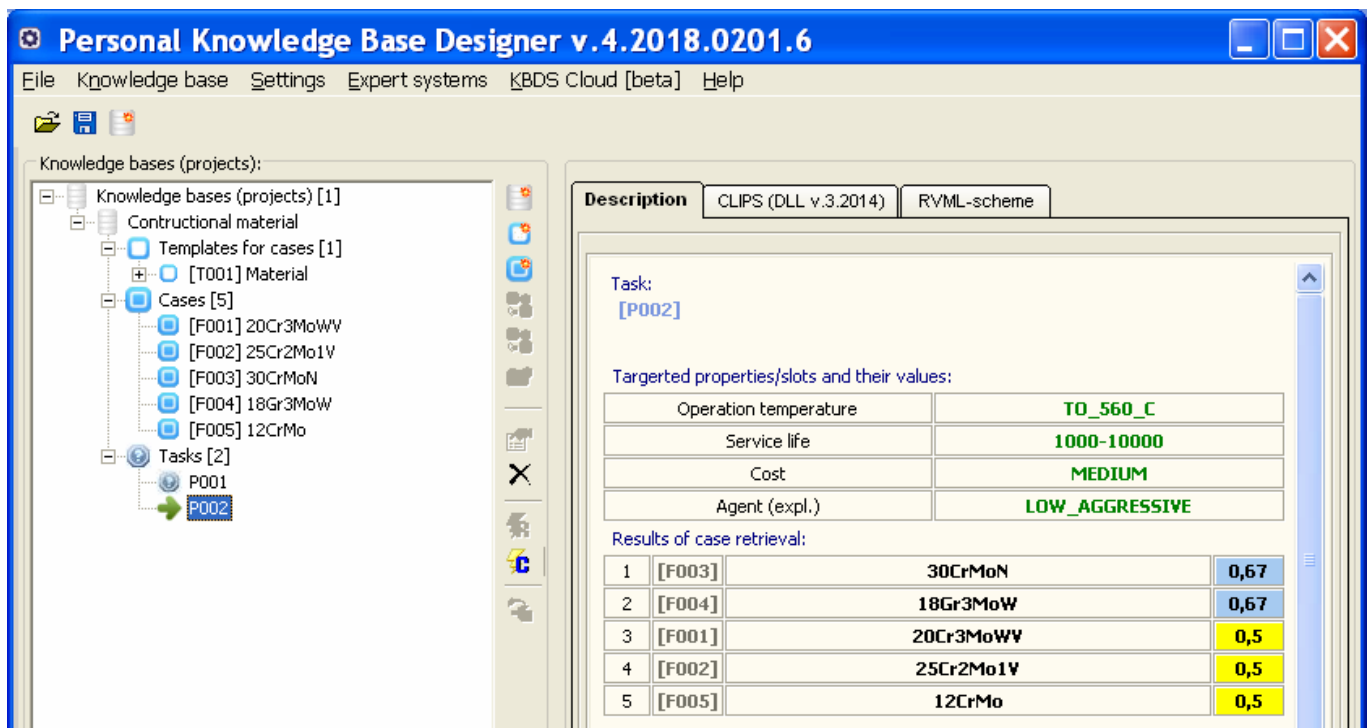


Figure 2.52 – Task preview (knowledge base testing results)



2.2.7 Import

The program provides the ability to import knowledge base elements from CLIPS (.clp), CMapTools (.cxl), Protégé (.owl), StarUML (.mdj, .xml), XMind (.xmind) and IBM Rational Rose (.mdl) files. Access to this function is provided from the Main menu, the «File» item.

When calling the function, you must select the file via the standard dialog (Fig.2.53). Next, you must select a knowledge base to place the imported items (Fig.2.54, 1) and select them (Fig.2.54, 2) from the list formed by the results of the analysis of the file specified earlier.



Figure 2.53 – Selecting a file to import knowledge base items

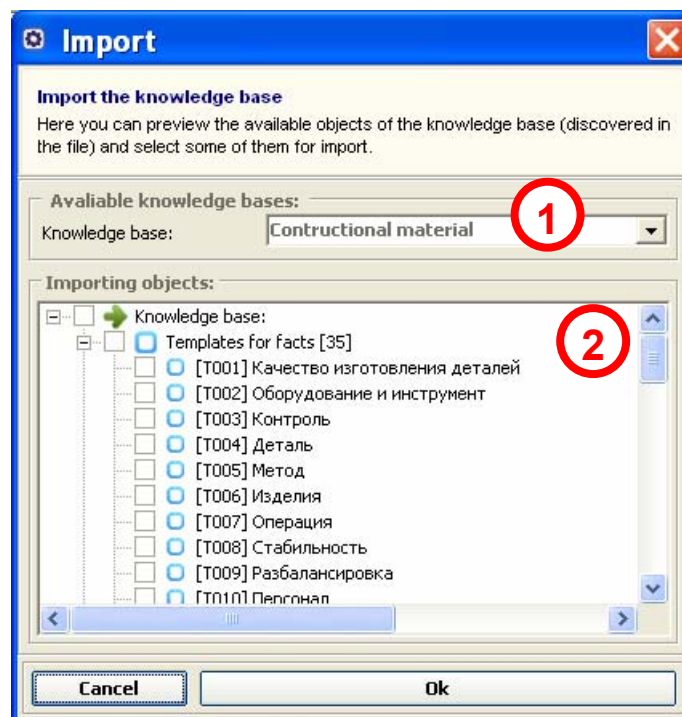


Figure 2.54 –Selecting the elements of knowledge bases to import



2.2.8 Export

The knowledge bases developed with the aid of the program can be exported to the CLIPS (.clp), CMapTools (.xtm), Protégé (.owl), StarUML (.xml) and IBM Rational Rose (.mdl) files. This function is accessed from the Main menu, the «File» item.

When you call the function, you have to select the knowledge base items to export (Fig.2.55) and specify a file to save.

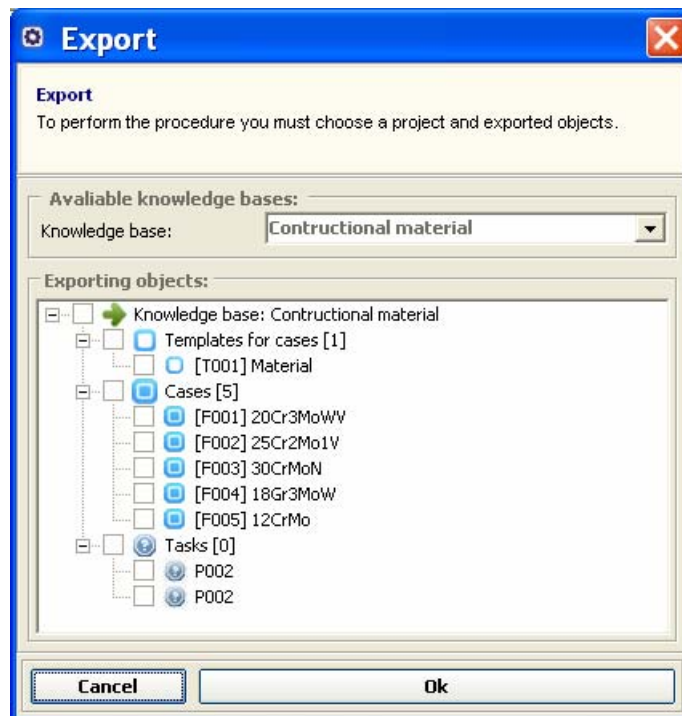


Figure 2.55 – Selecting the elements of knowledge bases to export

2.2.9 Report building

The program provides the ability to generate a report in the .doc (MS Word) format with a description of knowledge base elements in the form of a list of tables and text descriptions. Access to this function is carried out from the Main menu, the «Knowledge Base» item.

!! *To generate a report, you need to have MS Office installed.*



3 An example

Let us consider an example of the application of the program for the development of a static prognostic expert system knowledge base for prognosis of the flood hazard (a fragment, used in an educational process) .

The main subject domain concepts are the following:

- Atmospheric condensation;
- River;
- Flood hazard;
- Risk;
- Conclusion.

The following relationships can be defined:

- Atmospheric condensation and River determine Flood hazard and Risk degree;
- Flood hazard and Risk determine the Conclusion.

These concepts and relationships form a model of the subject domain, which can be described using a UML classes diagram (Fig.3.1). The described classes represent a prototype of templates for the formation of facts in the knowledge base, and relationships are rule templates.

It is proposed to use this model for automation of knowledge base engineering.

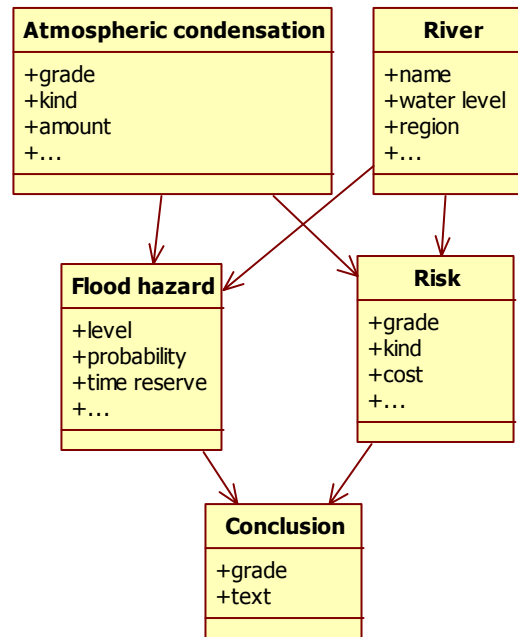


Figure 3.1 - The class diagram describing the basic concepts and relationships in the flood hazard

Next, a new knowledge base of the rule-based type is created (Fig.3.2), the StarUML model import module is called (Fig.3.3), the imported elements are selected (Fig.3.4). If necessary, the fact templates are changed (Fig.3.5) and rules (Fig.3.6), rules are created (Fig.3.7).

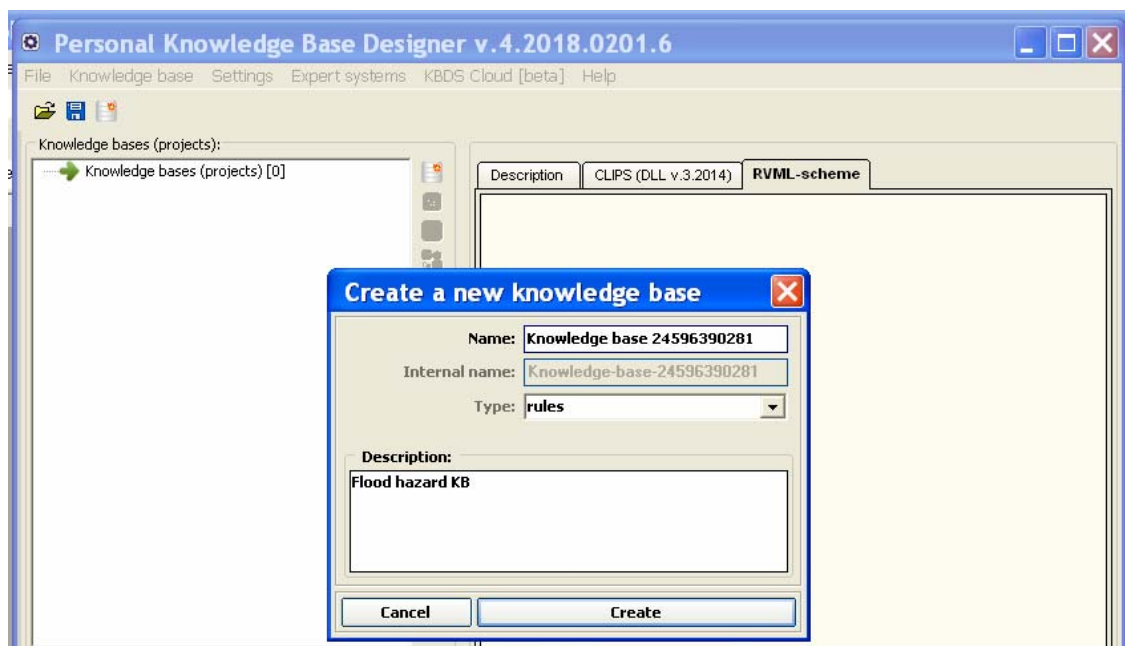


Figure 3.2 - Creating a project in Personal Knowledge Base Designer to work with rules

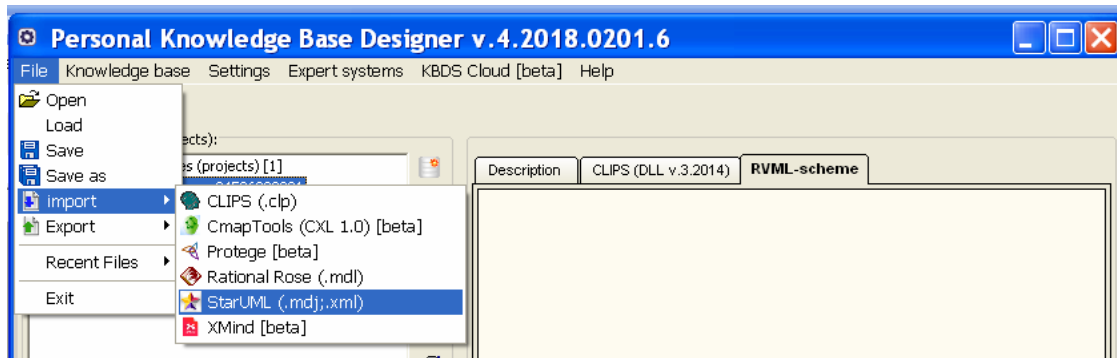


Figure 3.3 - StarUML import call

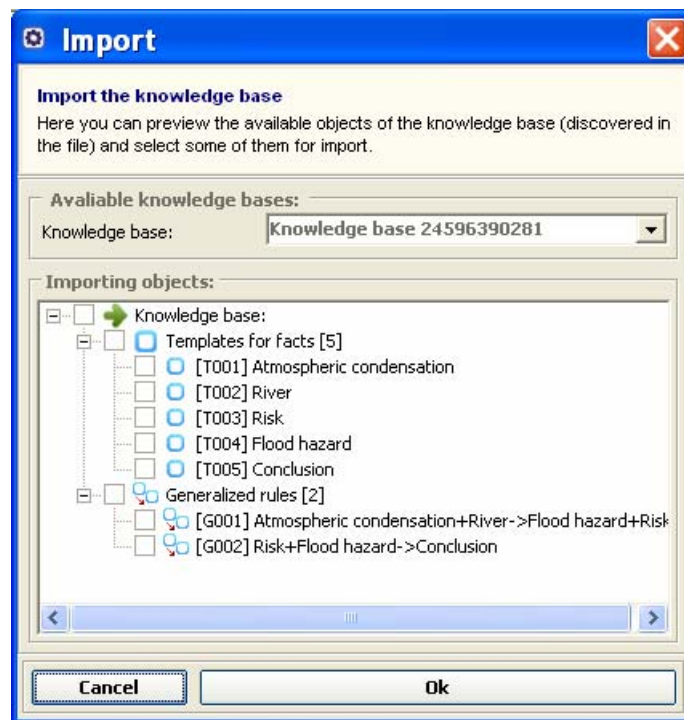


Figure 3.4 - Selecting items to import from StarUML file

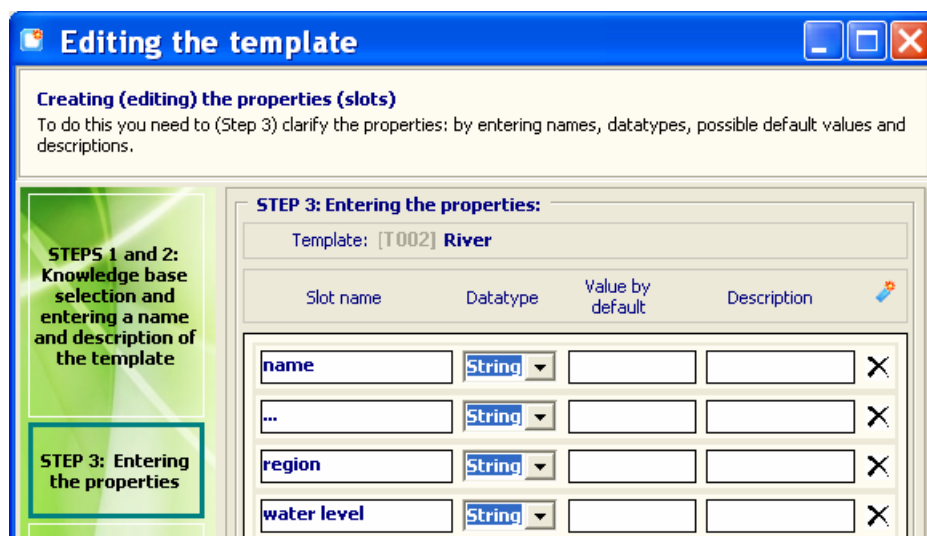


Figure 3.5 - Changing the fact template

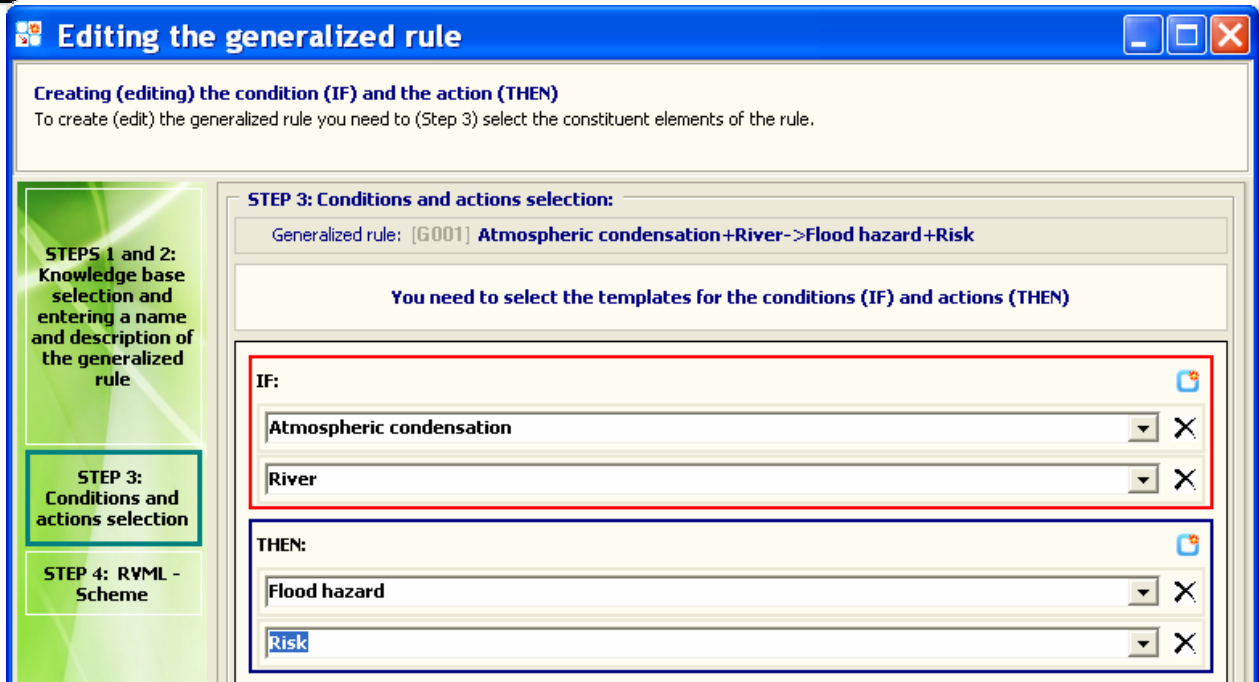


Figure 3.6 - Changing the rule template

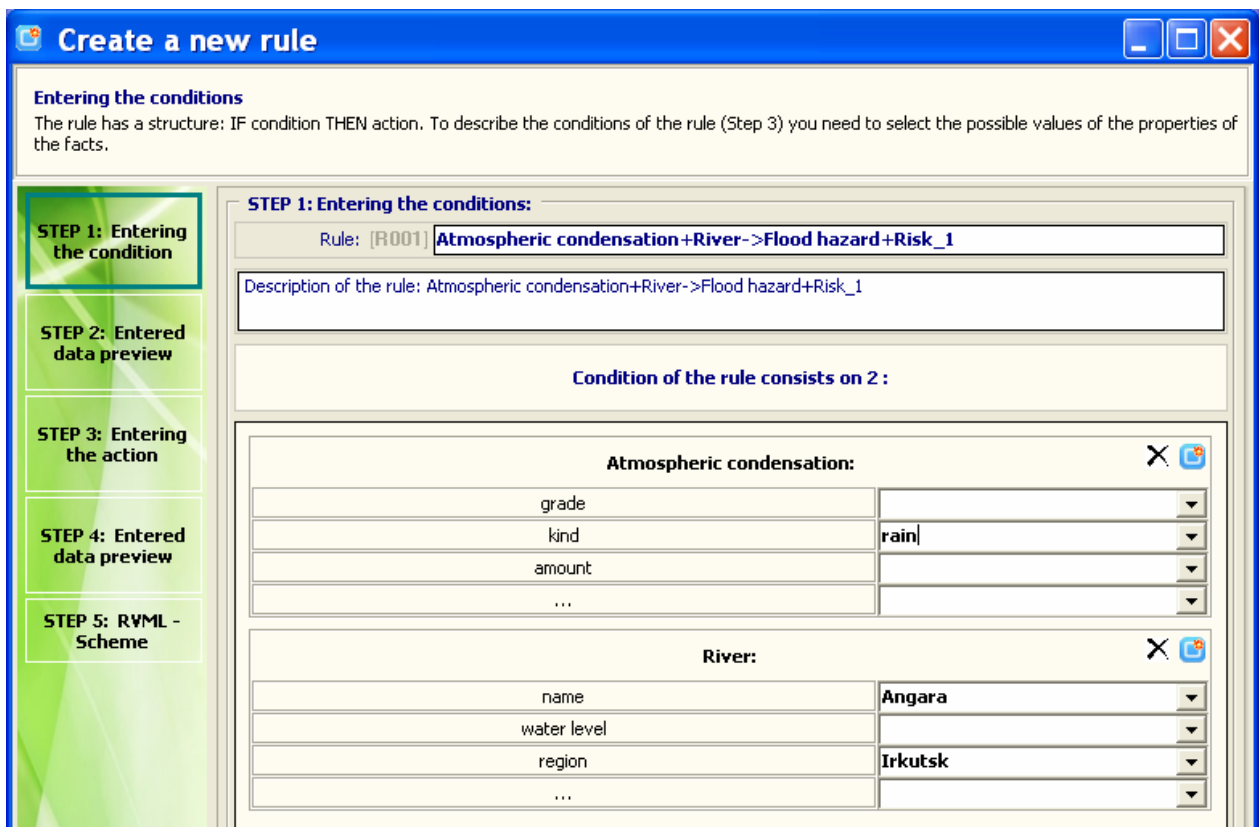


Figure 3.7 - Creating rules on the basis on templates

Next, the knowledge base can be exported to the CLIPS format, or tested in the program.