VARIOUS ASPECTS OF SIMULATION'S USAGE TO CREATE REAL SOLUTIONS WITH „DARSIR" CONCEPTION AS AN EXAMPLE

Vadim Zuravlyov[1], Eleonora Latisheva[2]

Riga Technical University
[1] Pernavas 1-2, Riga, LV-1012, Latvia
Phone: +371 28346517. E-mail: zuravlyov@yahoo.com
[2] Meza 1/3, Riga, LV-1048, Latvia
Phone: +371 7089576. E-mail: elat@inbox.lv

Nowadays concepts of designing data management systems and technologies exist, and they can be used to create new real solutions without using typical programming. In this work authors present one of the ways to create real solutions – the usage of simulations.

Different technologies can be used to enable necessary functionality, but the authors have chosen Radio Frequency Identification (RFID), as the most perspective direction nowadays.

One of their concepts of designing data management systems, that authors want to present, is a "Data-And-Rules-Save-In-Resource" ("DARSIR") [1] conception, that can be used with RFID technology. Main case of this concept is to achieve universality, flexibility, not using other sources (such as database) to accept the decision that the information (attributes and rules) is saved in RFID tag.

In this work authors present various aspects of simulation's usage to create a solution. Authors also present the main steps from simulation creation to real solution.

Keywords: "*DARSIR" conception, Radio Frequency Identification, XML, Resource Physical Mark-up Language, simulation*

1. Introduction

Nowadays one of the most important tasks that many specialists are trying to decide in information technologies is founding an easy way for creating new real solutions. Various concepts of designing data management systems and technologies exist, and they can be used to create new real solutions without using typical programming. In this work authors present one of the ways to create real solution – usage of simulations.

Different technologies can be used to enable necessary functionality, but authors have chosen Radio Frequency Identification (RFID), as the most perspective direction nowadays. This technology is chosen in [1]. RFID is an automatic identification method, which relies on storing and remote data retrieving with the use of devices called RFID tags. RFID tag is possible to place in physical object, embedding in physical object or to construct interaction with other physical objects (for example sensors). The approach gives a variety of architectural solutions.

One of their concepts of designing data management systems, that authors want to present, is a "Data-And-Rules-Save-In-Resource" ("DARSIR") [1] conception, that can be used with RFID technology. Main case of this concept is to achieve universality, flexibility, not using other sources (such as database) to accept the decision that the information (attributes and rules) is saved in RFID tag. This concept data storage type provides relieve transformation from simulation scheme to real solutions.

In this work authors present various aspects of simulation's usage to create a solution Authors present their opinion for main steps from simulation creation to real solution. In this paper the main elements of "DARSIR" conception, data storage type, attributes, rules etc. are described, working principles of the real solution and simulation are shown. For better understanding of practical usage, last step is the description of a concrete problem: it is necessary to organize regulation of temperature inside. Authors are describing aspects of simulation's creation of this task, as well as the real solution of it in RPML, which is a final result.

2. Description of the Conception

The first step of simulation's usage for solution creation is defining key elements of conception. The key elements of the "DARSIR" concept are resources. A resource is any object of the living or lifeless nature, which is involved in working process of information system. The information of a concrete resource and its interrelationship with other objects (or types of objects) must be stored in this resource.

Different technologies can be used to enable necessary functionality, but authors have chosen Radio Frequency Identification (RFID), as this technology is chosen in [1].

RFID (see more in [2]) is an automatic identification method, relying on storing and remotely retrieving data using devices the so-called tags. Basic element of this technology is a tag, it is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. It is possible to store up to 1 Mb data in each tag. Such size of data allows uniting the list of attributes (data) with functionality (rules) in resource.

3. Working Principles of the Real Solution and Simulation

Next step of our process is defining working principles of conception and ways of simulation usage in creation of new real solution. The "DARSIR" concept working process key element is RFID reader. RFID reader has a built-in embedded system that loads to and carries out rules from RFID tags. To load rules from RFID tags, they must be located in RFID reader working zone. If RFID readers are connected in network of RFID readers, that RFID readers realize RFID tag information (attributes and rules) exchange.

Resources (RFID tags) are important for real solution and simulation, because for creation of working process is necessary to change information (attributes and rules) only in resources (in RFID tags). Other elements of working process (such as RFID reader) usually do not need any modifications.

4. The Structure of Stored Information

Further it will be necessary to define the structure of stored information in simulation. From the previous chapters it is known, that all information that can be changed, is stored in resources (RFID tags). And all information that is needed in real solution customer must edit in simulation scheme. It is not possible to create finished real solution if this condition is not executed

Next step is to describe format of storing information in conception. In the "DARSIR" conception information is stored in resource in PML (Physical Mark-up Language) – the format modification of XML. PML is described in [3] as "a simple, general language for describing physical objects for use in monitoring and control of a physical environment – particularly through the Internet. Applications include inventory tracking, automatic transaction, supply chain management, machine control and object-to-object communication."

In the "DARSIR" concept description article [1] is represents a new modification of PML, that is been developed for this concept, that calls is RPML (Resource Physical Mark-up Language). Further in this document the authors gives examples in the language RPML, but the places, where syntax coincides with the official version of the language PML, will not be separately described (it is possible to find them on official page [3]).

To create real solution it is necessary to create RPML document for each element from the finished simulation model and load it in appropriate RFID tag. RPML documents have the attributes and rules, main types for them and kinds of stored information will be defined in the following chapters.

4.1. Attributes

Each resource has own unique features, but it is possible to emphasize some standard kinds of such features:

- Physical – any resource possesses physical properties, it is possible to fix from what material the resource is made, the length of the resource, etc.
- Sensors – the resource can have built-in sensor (such as thermometer, hydrometer) or many sensors; the current value of sensor is stored in resource as attribute.
- Entity – the resource can have its owner (it can be the person, the organization, the country, etc.), so here such parameters, as a name of the owner, the name of the organization, the address, etc., are registered.
- Location – the coordinates of a resource concerning the reading out device, it can be in 2D (X and Y), also in 3D (X, Y and Z) coordinates.
- Configuration – resource can consist of another resources (e.g. pallet shipment), here the unique numbers of other resources can be listed.
- History – parameters of any kind, that has timing component, when these parameters have been fixed. It is very important to remember, that memory of a resource is limited and consequently it is necessary to limit final number of possible records
- Variables – any program can be stored in a resource, and for its work variables are necessary. There are standard types of variables (such as Integer, String, Date, etc.), and also non-standard such as arrays (defined in PML).

So far the authors have described the basic kinds of features, but there are also other, not listed kinds of features. All of this depends on defined tasks and on variants of their solution. It would also be desirable to note, that exist tags that communicate with the carrier. The typical example of such tag is sensors. For example, the thermal sensor control can write down a current condition of temperature in the tag. Also any mechanism (being carrier of tags) can write down on it the information. For example, the printer can write down on the tags the working condition of itself (such as printing, on, off, waiting, error etc.).

Some standard kinds are possible to use in simulation as static data, such as: physical, entity. But some standard kinds are possible to change in simulation process, such as: sensors, location, configuration, history and variables.

4.2. Rules

In simulation, rules can be created by simulation's languages. In this chapter authors are defining format, how simulation rules must to be converted for creation of real solution.

The ideology is similar to usual programming languages, and analogical examples in programming language C ++ are specified for better understanding of the chapter. In a resource the rules are presented as the program, in the form of XML.

The executable block of the program, called "task", can be defined as procedure. The very first executable task in a resource is called "main". In the own task there is an opportunity to apply some kinds of operations:

1. Executable – actions which can execute resources. Typical actions: to include, to switch off, to start, etc.
2. Boolean – the Boolean operators, consisting of condition and task that will be executed (or on the contrary not to be executed) if condition is true.
3. Predefined – the built in operators who are predetermined by the system (for example, for definition of distance between two resources, operation "Locate" is used).

The syntax of the task:

```
<task label = "procedure" variable="value">
    ..
    <return type = "variable">value</return>
</task>
```

By the tag "task" it is defined the working block, where the name of the task (procedure) is required to be defined. Then the names of variables with their values are listed. The authors want to emphasize that it is necessary to define those variables which are transferred into "task". Inside of the procedure there are operations. If it is necessary to return any values, then the type of procedure (type) or the name (variable) or the returned value (value) are defined. If this task is used as a condition in verifying operation, then the last value in the last tag "return" is considered.

The syntax of the checking operation:

```
<if label = "name" condition="condition">
    <true>..</true>
    <false>..</false>
</if>
```

By means of tag "if" it is possible to define a condition. Conditions of comparison are set by an alphabetic combination: EQ (=), GT (>), LT (<), GE (=>), LE (<=), NE (<>). If the condition is true, then the working block, that is located in the tag "true", is to be executed. Otherwise, the block of the tag "false" must be executed. Verification operation has a name on which it is possible to identify verification operation (name). If the tags "true" and "false" don't exist, tag "true" will be considered.

5. The Simulation Creation from Real Solution

Sometimes customers have situations, when they have real solution ready and need to do some changes for this solution with simulation usage. For this functionality with simulation usage it is possible to have the following situations and possible decisions:

- Real solution is created by "DARSIR" conception – the best way in this situation, is possible to transfer all attributes and rules from resources to simulation scheme;
- Real solution with all elements with built-in RFID tags – in this situation it is possible to load some part of attributes in simulation scheme, as physical (if present RFID identification owner type description), sensors (if present), entity (if present in RFID tag), location (possible define by RFID readers), configuration (possible define by RFID readers), etc.;
- Real solution all elements without built-in RFID tags – in this situation first step is built-in RFID readers, it is possible to load some part of attributes in simulation scheme (but usually less than in previous situation), as physical (if present RFID identification owner type description), sensors (if present), location (possible define by RFID readers), configuration (possible define by RFID readers), etc.

6. The Example

So far, the theoretical basis of the various aspects of simulation's usage for creation of real solution with "DARSIR" conception was briefly described in this document. For better understanding of the practical usage of the simulation for creating real solution with "DARSIR" concept authors described a concrete problem, and its solution in RPML with remarks of simulation creation.

Condition of the problem: it is necessary to organize regulation of temperature inside. Initial data are the conditioner (downturn of temperature), a heater (rise of temperature) and thermo sensor (capable to take temperature).

First of all the authors need to define attributes that can be used to solve the problem. In thermo sensor there is already been one parameter "Temperature", that changes on demand of attributes from the environment. There are also 2 parameters: "Min" (admissible minimum) and "Max" (admissible maximum).

Example:

```
<mat label = "thermosensor">
    <extrude type = "Temperature"> 0 </extrude>
    <integer label = "Min"> 20 </integer>
    <integer label = "Max"> 21 </integer>
</mat>
```

Simulation creation process is dependent on simulation language. It is reason why authors can only define attributes, which must be used in simulation. There is defined one sensor type attribute and two attributes of variable type.

The next step is definition of accessible executable operations. The conditioner and a heater have two executable operations "On" and "Off" that allow switching on and off these devices.

There will be a control block (or in other words – working algorithm) in thermo sensor:

1. If value of the parameter "Temperature" is greater then value of the parameter "Max", then switch off the heater and switch on the conditioner.
2. If value of the parameter "Temperature" is less then value of the parameter "Min", then switch off the conditioner and switch on the heater.

In RPML it looks as:

```
<task label = "main">
    <if label = "Hot" condition = "Temperature GT Max">
            <msr label = "Heater.Off"></msr>
            <msr label = "Conditioner.On"></msr>
    </if>
    <if label = "Cold" condition = "Temperature LT Min">
            <msr label = "Conditioner.Off"></msr>
            <msr label = "Heater.On"></msr>
    </if>
</task>
```

In simulation it is important to define the correct executable actions, so they can execute resources they need. If simulation have some errors in names that mean that in transformation process from simulation to real solution this error must be fixed. After that it is necessary to realize mechanism for name correction checking.

7. Conclusions

Various aspects of simulation's usage for creation of real solutions of "DARSIR" conception as example are described in this article. It is one of the possible easy ways for creating new solutions without using typical programming.

Authors have chosen one of the concepts of designing data management systems. The choice is "Data-And-Rules-Save-In-Resource" ("DARSIR") [1] conception, that can be used with RFID technology. This concept data storage type provides relieve transformation from simulation scheme to real solutions.

In this article authors present their opinion for main steps from simulation creation to real solution. Main elements of "DARSIR" conception, data storage type, attributes, rules etc. are described here. Working principles of the real solution and simulation are shown. For better understanding of practical usage, last step is described as concrete problem: it is necessary to organize regulation of temperature inside.

Various aspects discussed in this article can be used as a practical guide for the implementation of "Data-And-Rules-Save-In-Resource" as the easy way of creation new real solution. Such simulation task can be easily created with user-friendly graphical interface.

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