STD-1

Use Cases for a Rule Interchange Format

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Abstract
This document presents the use cases for a rule interchange format, which have been developed by REWERSE members of different Working Groups and submitted as input to the *W3C Rule Interchange Format Working Group*. From the total of 47 use cases submitted by the organizations participating in this W3C Working Group, REWERSE has submitted 7 use cases. One REWERSE use case (out of 7 total) has been accepted for publication in the first deliverable on *Use Cases and Requirements* of the mentioned W3C Working Group. The work presented here has been done within the *Standardization Activity* of REWERSE.

Keyword List
standardization, rule interchange format, rule systems, use cases

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Use Cases for a Rule Interchange Format

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Abstract
This document presents the use cases for a rule interchange format, which have been developed by REWERSE members of different Working Groups and submitted as input to the *W3C Rule Interchange Format Working Group*. From the total of 47 use cases submitted by the organizations participating in this W3C Working Group, REWERSE has submitted 7 use cases. One REWERSE use case (out of 7 total) has been accepted for publication in the first deliverable on *Use Cases and Requirements* of the mentioned W3C Working Group. The work presented here has been done within the *Standardization Activity* of REWERSE.

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Contents

1 Introduction

This document presents the use cases for a rule interchange format, which have been developed by REWERSE members of different Working Groups and submitted to the participants of the W3C Rule Interchange Format Working Group[1] (RIF WG). The work presented here has been done within the *Standardization Activity*[2] (STD) of REWERSE, which has been created in November 2005. The Standardization Activity was perfectly timed with the creation of the W3C RIF WG, which started its work at the beginning of December 2005.

The use cases presented in this document have been developed by the Standardization Task Force (STF) members together with members of Working Group I1, I2, I4, I5, A1, A3; the work has been co-ordinated by the author of this document. Table 2 at the end of the document gives an overview of the use cases and the corresponding Working Groups, which have contributed to them. Still, this document has one single author, namely the REWERSE standardization co-ordinator, since she has gathered the material for the use cases, has written them in the format required by the W3C RIF WG, and guided the whole work during the development of the use cases and towards the publication of the W3C RIF WG *Use Cases and Requirements* (UCR) document.

This report is structured as follows: Section 1.1 gives a light introduction to the W3C RIF WG mission as stated in its charter; though kept short, this section reveals reasons for the active participation of REWERSE within this W3C Working Group. Section 1.2 gives an overview on the work on use cases done within the W3C RIF WG. Section 2 presents the 7 use cases submitted by REWERSE to the W3C RIF WG; they are presented by using the template given by this Working Group. Section 3 concludes this document.

1.1 W3C RIF WG Mission

The W3C RIF WG has the mission of producing a rule interchange format so as to be able to translate rules between rule languages and thus be able to use them on different rule systems. This goal is explicitly stated by the W3C RIF WG Charter[3]. As the interest on rule languages and systems is noticeable in different communities – such as the Business Rules and the Semantic Web communities – the W3C RIF WG tries to find consensus in having a core rule interchange format coming with a set of extensions; this way a large spectrum of application requirements will be covered.

The charter talks about two phases dividing the Working Group's work, phases motivated by the fact that the aimed-at rule interchange format will presumably take the form of a core language having a set of possible, standard and non-standard extensions. This is motivated by the great variety in rule languages and rule engine technologies.

The first phase addresses a simple, useful and extensible interchange format for rules. The deliverables of this phase consist of a *Use Cases and Requirements* document (describing use cases and their analysis with respect to a rule interchange format), a set of *Test Cases* and a *W3C Recommendation* stating the technical specification of the (core) rule interchange format. The first phase runs until the end of year 2007.

The second phase addresses extensions to the core rule interchange format developed as result of the first phase. The deliverables of this phase consist of an updated *Use Cases and*

[1] W3C RIF WG, `http://www.w3.org/2005/rules/wg`
[2] Standardization Activity, `http://rewerse.net/standardization.html`
[3] W3C RIF WG Charter, `http://www.w3.org/2005/rules/wg/charter`

Requirements document, a set of *Test Cases*, and a *W3C Recommendation* stating the technical specification of the extenions to the core rule interchange format. It is expected to extend the working group's work until the mid of year 2009 so as to cover the second phase of the W3C RIF WG's work.

At moment of writing, the W3C RIF WG has 76 participants from 32 organizations plus 3 invited experts, cf. `http://www.w3.org/2005/rules/wg_participants.html`. A number of 6 REWERSE members are participants of the W3C RIF WG.

1.2 W3C RIF WG Work on Use Cases

A considerable number of use cases[4] have been submitted by the W3C RIF WG participants; they represent usage scenarios for a rule interchange format in general. The two phases stated in the Working Group's charter are not considered at this point; each use case poses requirements on the rule interchange format (RIF) to be developed within the W3C efforts – some of them are explicitly stated in the use case description, but some of them are still implicit. At moment of writing, the Working Group works on determining realistic requirements on RIF by taking into account the ones given explicitly in the use cases and discussing the ones implied by them or by other possible use cases. *Note* that Working Group participants can still develop and submit other use cases for RIF; these will be discussed within the group and taken into consideration for future revisions of the UCR document.

The almost fifty use cases for RIF show the need for and interest in a format for interchanging rules between rule languages and rule systems. For performing an analysis of these use cases as a base for deciding which ones go into the first deliverable of the W3C RIF WG on *Use Cases and Requirements*, they were classified into 8 categories of use cases[5]. From these categories, 7 use cases have been chosen and refined for their publication as the *RIF Use Cases and Requirements*[6] document (this document contains actually 8 sections, each presenting one use case, but the last one is just a placeholder for a use case on vocabulary mapping for data integration, a use case covering this issue is to be developed soon). The first public working draft of Use Cases and Requirements has been released in March 2006.

REWERSE has submitted a number of 7 use cases for a rule interchange format; this represents a considerable contribution from one single W3C Member organization both in quality and in quantity. The submitted use cases cover most of the main research topics investigated within REWERSE's Working Groups, as we will see in the next section.

Table 1 gives an overview in numbers on the use cases submitted to the W3C RIF WG by the participating organizations and the ones chosen from these for publication in the UCR document; also, it compares the total numbers to the REWERSE contribution. As the given table shows, the work done within the *Standardization Activity* has been a success: REWERSE, as one of the 32 organizations participating within the W3C RIF WG, has one use case out of 7 published in the UCR document.

2 REWERSE Use Cases for a Rule Interchange Format

The use cases submitted by REWERSE were principally tailored to the need for RIF to be able to express different kinds of rules, namely *deduction rules, normative rules, and reactive rules.*

[4] Submitted use cases, `http://www.w3.org/2005/rules/wg/wiki/Use_Cases`

[5] Classes of use cases, `http://www.w3.org/2005/rules/wg/wiki/General_Use_Case_Categories`

[6] RIF Use Cases and Requirements, `http://www.w3.org/2005/rules/wg/ucr/draft-20060323.html`

	Total submissions	REWERSE submissions
Submitted	47	7
Published in UCR document	7	1

Table 1: Total number of use cases: Submitted vs. accepted for publications

Deduction rules are rules stating knowledge that is derived from other knowledge by using inference or mathematical calculation. Deduction rules are also called derivation rules in the business rules community, constructive rules by logicians and views in the database community.

Normative rules are rules that pose constraints e.g. on the business logic of a company. An example of such a rule is `An EU-Rent customer can rent at most one car at a time`, which defines restrictions within the business of the car rental company EU-Rent[7]. Normative rules are also called structural rules in the business rules community and integrity constraints in the database community.

Reactive rules are rules of the form ON Event IF Condition DO Action specifying to automatically execute the Action if Event occurs, provided that Condition holds. Reactive rules are also called Event-Condition-Action rules (or shortly ECA-rules), active rules and dynamic rules.

For a more in-depth discussion on the different types of rules shortly mentioned above, see [3].

Note that the template used in this document for giving the use cases for RIF developed by REWERSE follows closely the one given by the W3C Team for W3C RIF WG participants making a use case submission.

2.1 Automated Trust Establishment for eCommerce

The use case presented in this section has been published in the W3C *Use Cases and Requirements*. The work on developing this usage scenario for a rule interchange format has been done by Piero Bonatti and Daniel Olmedilla with the guidance of the standardization co-ordinator. It shows the need for such a format for enabling negotiations between systems using different rule technologies with the goal of automatically establishing trust within eCommerce applications.

2.1.1 Abstract

A customer (or user) wants to buy a device at an eShop. The customer's and eShop's systems negotiate so as to automatically establish trust with the goal of successfully complete the transaction. The negotiation is based on the policies and the credentials each system has. The customer's and eShop's policies describe who they trust and for what purposes.

2.1.2 Links to Related Use Cases

Policies involved in this use case are, to some extent, similar to those in the use cases Automated Trust Establishment for Accessing Medical Records (presented in the next section),

[7] EU-Rent, `http://www.eurobizrules.org/ebrc2005/eurentcs/eurent.htm`

Refund Policies in E-Commerce[8], and Credit Crad Transaction Authorization[9]. For example, an alternate sequence is given in Refund Policies in E-Commerce where the use case is extended by adding action rules (e.g. for sending notifications as in the case of rule r9 in the use case described here).

2.1.3 Examples of Rule Platforms Supporting this Use Case

Policies such as the ones encountered in this use case can be specified with PeerTrust [7, 8], a policy language to describe trust and security requirements on the Semantic Web. More on PeerTrust can be found at `http://www.l3s.de/peertrust/`.

2.1.4 Benefits of Interchange

Benefit 1 This use case clearly motivates the need for a rule interchange format since rules expressing policies are to be exchanged between parties engaged in negotiations.

2.1.5 Requirements on the RIF

Requirement 1 For negotiation, it should be able to export the policies in a format that can be understood by the other parties engaged in the negotiation.

Requirement 2 Different kinds of rules (deductive, normative, and reactive rules) should be supported.

2.1.6 Breakdown

Actors and their Goals Alice wants to buy an eShop device. She uses a system to determine if eShop is trustworthy or not. eShop offers products for purchase purposes.

2.1.7 Narratives

Alice would like to buy online a new device at an eShop. When she clicks on buy it, the server processes the request and sends back to Alice the relevant policy. When a customer wants to buy such a device, eShop logs the requests (for marketing and statistics purposes) and discloses a policy with the following alternatives:

```
 r1:
   A gold card holder is given a 10% discount on any purchase.

 r2:
   An eShop employee gets 20% discount on devices of this type.

r3:
  Any other buyer must provide to the shop credit card information
  together with delivery information (address, postal code, city, and country).
```

[8] Refund Policies in E-Commerce, `http://www.w3.org/2005/rules/wg/wiki/Refund_Policies_in_E-Commerce`

[9] Credit Card Transaction Authorization, `http://www.w3.org/2005/rules/wg/wiki/Credit_Card_Transaction_Authorization`

```
r4:
  Furthermore, the credit cards accepted are VISA and MasterCard.
```

The policy further states that for buyers providing a valid gold card or who are eShop employees, no further interactions and verifications are needed. The policy also states in case credit card information is disclosed by a buyer, i.e. in the third of the alternatives mentioned above, still the fulfilment of some other conditions might be required and/or still the purchase request might be denied. That is because eShop uses rules such as

```
r5:
  If the client is in the eShop client blacklist then deny
  purchase request;

r6:
  If the client's credit card is revoked then deny purchase request.
```

Once Alice's negotiation system receives the eShop's policy, it checks Alice's credentials that are available (locally or from third parties) and whether some subset of these credentials fulfill the policy. Alice has a credit card but her own policy states that she is not willing to disclose it to everyone. Since Alice has never bought anything from eShop in the past, her system asks eShop to provide a proof of its membership to the Better Business Bureau (BBB), Alice's most trusted source of information on online shops. (The Better Business Bureau could be the root authority for a Public Key Infrastructures hierarchy, which can be used to establish domains of trust. E.g. Visa International could be the root authority for such a hierarchy devoted to Visa cards.) eShop has such a credential and its policy is to release it to any potential purchaser. Hence, it does so to Alice's negotiation system on its request. Alice's negotiation system is now ready to disclose her credit card information to eShop but it still must check whether disclosing all the information does not break Alice's denial constraints. Alice has stated two constraints stating

```
 r7:
   To never disclose two different credit cards to the same
   online shop; and

r8:
  For anonymity reasons never to provide both her birth date
  and postal code (indeed, they are a quasi-identifier).
```

For this purchase, anonymity is no issue and only information on one credit card is requested. Thus, Alice's constraints are respected. Alice's negotiation system therefore provides Alice's credit card information to eShop. eShop checks that Alice is not in its client black list, then confirms the purchase transaction, generates an email notification to the Alice giving information about the purchase, and notifies eShops's delivery department (r9).

2.1.8 Commentary

Automated trust establishment is possible when policies for every credential and every service can be codified; so as to minimize user intervention, the codified policies should be checked automatically whenever possible. Note that the notion of policies refers to access control policies, privacy policies, business rules, etc.

Taking into consideration the proposed classification of rules, a possible classification of the rules occurring in the given use case is:

- normative rules (r3,r4,r7,r8)
- deductive rules (r1,r2)
- reactive rules (r5,r6,r9)

However, one might argue that rules r3 and r4 are not normative but deductive rules. The above given classification is not the only possible one since the proposed classification of rules is un-sharp.

2.2 Automated Trust Establishment for Accessing Medical Records

2.2.1 Abstract

A user is at a hospital's Web site to access medical records. The user's and hospital's systems negotiate so as to automatically establish trust with the goal of retrieving medical records. The negotiation is based on the policies and the credentials each system has. The user's and hospital's policies describe who they trust and for what purposes.

2.2.2 Links to Related Use Cases

Policies involved are, to some extent, similar to those in the use cases Automated Trust Establishment for eCommerce (presented in the previous section), Refund Policies in E-Commerce[10], and Credit Card Transaction Authorization[11].

2.2.3 Examples of Rule Platforms Supporting this Use Case

Just like for the previous use case, PeerTrust is an example of a platform supporting this use case.

2.2.4 Benefits of Interchange

Benefit 1 This use case clearly motivates the need for a rule interchange format since rules expressing policies are to be exchanged between parties engaged in negotiations.

[10] Refund Policies in E-Commerce, `http://www.w3.org/2005/rules/wg/wiki/Refund_Policies_in_E-Commerce`

[11] Credit Card Transaction Authorization, `http://www.w3.org/2005/rules/wg/wiki/Credit_Card_Transaction_Authorization`

2.2.5 Requirements on the RIF

Requirement 1 For negotiation, it should be able to export the policies in a format that can be understood by the other parties engaged in the negotiation.

Requirement 2 Different kinds of rules (deductive, normative, and reactive rules) should be supported.

2.2.6 Breakdown

Actors and their Goals Alice wants to access the medical record of her brother. She uses a system to determine if a party is trustworthy or not. Bob is Alice's brother; he is under treatment at two different hospitals. The hospital system stores data such as medical reports and has its own policies for records' retrieval.

2.2.7 Narratives

Alice is at the hospital Web site and tries to retrieve the medical record of her brother Bob. A negotiation between Alice's system and the hospital's system begins with Alice's read request over the Web. Alice receives a policy stating that

```
r1:
  She must be a medical employee at the hospital for reading
  medical records;

r2:
  If she is employed at the general medicine department she
  can retrieve all data of the hospital's medical records;

r3:
  If she belongs to other department, she is allowed to
  retrieve only a subset of the data according to her discipline. For
  determining this data subset, the hospital's system uses deductive
  rules (r4).

r5:
  Anyone can retrieve his or her own records after disclosure
  of an id to prove identity.
```

There exist two more policies at the hospital which are not released to Alice but which apply to her request:

```
r6:
  Because Bob has been under psychiatric treatment at another
  hospital for some years, his psychiatric consultant at that hospital
  can also access his current records. Since this information would
```

```
  already tell any requester (e.g. Alice) that Bob is under
  psychiatric treatment, the policy is kept private and only disclosed
  to medical employees of the hospital (after disclosure of the
  appropriate credential);

r7:
  Stated by law, the hospital includes a policy stating that
  patient records can be accessed by police officers with a request
  signed by a judge.
```

In case Alice has credentials stating that she is a police officer having such a signed request, upon her read request a notification is sent to the manager of the hospital (r8). If the hospital manager accepts the request, then access is granted.

It is important to note that the two above policies are applicable even if they are not publicly advertised. That means that Bob's psychiatric consultant can send his employee credential together with the request and receive the data without problem.

Finally, apart of the above hospital's policies, there exist a monitoring constraint which states that information about VIP patients (e.g., the president of the government) is never provided online (r9).

2.2.8 Commentary

Automated trust establishment is possible when policies for every credential and every service can be codified; so as to minimize user intervention, the codified policies should be checked automatically whenever possible. Note that the notion of policies refers to access control policies, privacy policies, business rules, etc.

Taking into consideration the proposed classification of rules, a possible classification of the rules occurring in the given use case is:

- normative rules (r1,r5,r6,r7,r9)
- deductive rules (r2,r3,r4)
- reactive rules (r8)

However, one might argue that rules r5, r6, and r7 are not normative but deductive rules. The above given classification is not the only possible one since the proposed classification of rules is un-sharp.

2.3 Organizing a Vacation with Friends

2.3.1 Abstract

A couple of friends want to spend their vacation together and use a Web-based travel service for recommending restaurants and out of ordinary places and for making the necessary travel arrangements. For this purposes, the travel service uses the profiles of the persons taking part at the trip.

2.3.2 Links to Related Use Cases

Part of persons' profiles in the use case described here could be specified as in Ben's personal interests, friends, etc. in use case RIF RuleML FOAF[12].

2.3.3 Examples of Rule Platforms Supporting this Use Case

The reactive language XChange [4, 1, 6, 9] developed within REWERSE WG I5 may be employed for implementing this use case.

2.3.4 Benefits of Interchange

Benefit 1 Data and rules making up the persons' profiles need to be interchanged between systems (e.g. travel service and more specialized services such as hotel booking services).

Benefit 2 Data and rules of different profiles need to be combined so as to find a trip fitting most of the persons' expectations. Also, it might be the case that the travel service's business rules (e.g. for offering discounts) need to be also considered in the process of arranging a trip.

2.3.5 Requirements on the RIF

Requirement 1 Different kinds of rules (deductive, normative, and reactive rules) should be supported.

2.3.6 Breakdown

Actors and their Goals Group of friends, each person having its own profile. Travel service plans trips by combining different services and using the profiles of the persons taking part at the trips.

2.3.7 Narratives

A couple of friends living now in different European countries want to spend their vacation together. They use a Web-based travel service for recommending restaurants and out of ordinary places and for making the necessary travel arrangements. The service combines a couple of specific services, for example hotel reservation services and transportation services.

Each friend has its own (personalized) profile, that is a set of rules defining the person's likes and dislikes, interests, constraints (such as time and finances), etc. and data about previously made trips, hotels' rating, etc. Profiles are the result of monitoring activities (e.g. visiting online museums or buying books online), filling in online registration forms, dialogue with travel office employees, or combinations of these. Of course, the group of friends authorized the travel service to use and share their profiles.

So as to arrange a trip and make recommendations that suit (most of) friends' expectations and constraints, the travel service needs to 'combine' the profiles of the persons taking part at the trip. Rules regarding particular issues (such as dietary requirements or activities of interest) are to be interchanged between services making the corresponding booking of and/or recommendations for the trip. Moreover, each such service has its own rules for determining suitable proposals and recommendations for the planned travel.

[12]RIF RuleML FOAF,`http://www.w3.org/2005/rules/wg/wiki/RIF_RuleML_FOAF`

2.3.8 Commentary

The following rules and data exemplify part of George's profile that is used by the travel service:

```
1:
 George prefers cheap restaurants, but no Indian ones.

2:
 George prefers to travel away from expensive, over-developed
  resort areas.

3:
 George prefers locations full of history.

4:
 George visited the following places: ... .
```

The travel service uses deductive rules for inferring data on-demand. For example statement (3) could be inferred based on the places George has visited before by using a rule such as

```
Rule 5:
      IF Person visited at least three locations full of history
      THEN Person prefers locations full of history
```

For determining the locations full of history, views (specified by deductive rules) over a city and region database are used. For example, such a view could contain Rome and Athens as locations full of history.

Normative rules (or integrity constraints) are used for example for posing constraints regarding dietary requirements or finances:

```
Rule 6:
      IF restaurant R is recommended for person P
      THEN R has vegetable dishes OR R has fish dishes
```

Reactive rules are used for monitoring activities (e.g. visiting online museums or buying books online) and updating profiles:

```
Rule 7:
      IF person P orders online a tennis racket
      THEN add tennis to P's activities of interest
```

2.4 Rule-Based Intelligent Guiding

2.4.1 Abstract

Location-based systems can be employed for intelligent guiding of passengers at the airport. There are many use cases within such a scenario where intelligent guiding is desirable or necessary. This use case concentrates on guiding a passenger at her/his stopover so as to perform a list of tasks.

2.4.2 Links to Related Use Cases

This use cases has several common points with the use case Situation Assessment and Adaptation[13]: The task of rule-based guiding is employed within two domains. The need to automatically react (e.g. by proposing alternate routes) to changes (in Situation Assessment and Adaptation, situation assessment is dynamically updated as new data or rules come in).

2.4.3 Examples of Rule Platforms Supporting this Use Case

The use case can be implemented by employing (not necessarily rule-based) systems (such as for automated guiding) and rule-based systems for realizing the reactive behavior. For the latter, the reactive language XChange developed as a research project at the Institute for Informatics, University of Munich could be used (more on XChange).

2.4.4 Benefits of Interchange

Benefit 1 This use case is more about interchanging data than interchanging rules.

2.4.5 Requirements on the RIF

Requirement 1 Different kinds of rules (deductive, normative, and reactive rules) should be supported.

2.4.6 Breakdown

Actors and their Goals Alice wants to do some shopping, have a coffee and call a colleague while she is changing planes; she uses her Personal Digital Assistant (PDA) to connect to the airport's information system. Airport's information system provides a number of services, including automated guiding, directory services and other.

2.4.7 Narratives

Alice is traveling by plane to a conference in Boston via Paris. Since she has enough time at her stopover, she decides to do some shopping, have a coffee and call a colleague while she is changing planes.

On arrival in Paris, she uses her Personal Digital Assistant (PDA) to connect to the airport's information system, which provides a number of services, including automated guiding, directory services and other. From the directory she chooses what stores to visit and which

[13]Situation Assessment and Adaptation,`http://www.w3.org/2005/rules/wg/wiki/Situation_Assessment_and_Adaptation`

cafe to go to, while the guiding service generates the shortest route in order to connect these different locations on her way from the arrival gate to the departure gate. At the same time, the guiding service calculates the approximate time necessary for the planned route and gives a warning message if the remaining time before boarding is too short.

During Alice's stay at the airport the PDA as well as the airport's systems make sure that she receives updates about her journey (such as changes of the departure gate or delays). Likewise, if she is held up at any point along her route through the airport or whenever she deviates too far from the recommended route, she receives a message on her PDA (which provides positioning by means of Wireless LAN, IndoorGPS or similar mechanisms). In such cases she has several alternatives, which include calculating a new route or changing intermediate destinations. If for example her duty-free shopping took too much time, she has the possibility to skip having coffee and instead requesting new guiding information which lead directly to the departure gate.

2.4.8 Commentary

Both Alice's personal organizer and the airport's guiding system use different types of rules for implementing their services; these rule types are exemplified next.

The airport's guiding system uses normative rules for excluding airport areas such as closed ones from the possible route parts to recommend. E.g.

```
IF route R is recommended
THEN R passes through transit areas OR R passes through open areas
```

The possible transit areas and the current open areas can be determined by means of deductive rules defining views over one or more airport's areas databases.

Reactive rules are employed for reacting to situations such as deviations from the recommended route that trigger the sending of warning messages to Alice's personal organizer.

```
ON deviation greater than a threshold value
DO send warning message
```

2.5 Rule-Based Email Manipulation

2.5.1 Abstract

In many email client/server systems, a user can define her own rules so as to automatically process incoming and outgoing messages. When a user switches to another email system it would be desirable to be able to interchange the rules between these systems using a rule interchange format.

2.5.2 Links to Related Use Cases

The main idea of the use case described here is portability of rules, same as in use case Portability[14].

[14] Portability, http://www.w3.org/2005/rules/wg/wiki/Portability

2.5.3 Examples of Rule Platforms Supporting this Use Case

Rules needed for automated message processing can be specified by using the rule module of Microsoft Outlook. Though, functionalities that go beyond Microsoft Outlook are desirable (see Requirements on the RIF). What is really missing for realizing this use case is the RIF.

2.5.4 Benefits of Interchange

Benefit 1 This use case clearly motivates the need for a rule interchange format since rules expressing policies are to be exchanged between parties engaged in negotiations.

2.5.5 Requirements on the RIF

Requirement 1 Different kinds of rules (deductive, normative, and reactive rules) should be supported.

Requirement 2 Functionalities that go beyond Microsoft Outlook are desirable:

- user-defined functions for conditions, e.g. for deleting emails which are recognized as spam (by some user-defined, external function) with a probability; an important role would play procedural attachments for e.g. information retrieval services
- user-defined actions that need to be interchanged between systems
- conflict resolution, e.g. one rule matching for sender containing string 'Paula' and another matching domain '@ifi.lmu.de', each with different actions; how to react to an incoming message from 'Paula.Patranjan@ifi.lmu.de'?
- access to persistent data, e.g. vacation calendars.

2.5.6 Breakdown

Actors and their Goals Person using an email client and having rules for a personalized manipulation of incoming and outcoming messages.

2.5.7 Narratives

In Microsoft Outlook, for example, rules are used for automated message processing. The rule module is called 'Rule Wizard'. A Microsoft Outlook rule can be specified for incoming or for outgoing messages. It consists of a set of conditions referring to the message and its parameters, and of a set of actions. The specified conditions determine the messages the rule applies to. Negative conditions are called "exceptions".

The specified actions may do something with a qualifying message, such as moving it to a specific folder or deleting or printing it, or they may do things like playing a specific sound, starting a specific application or sending a reply message.

So, there are two basic event types, i.e. incoming message (Inmsg) and outgoing message (Outmsg) and many action types.

A condition is a conjunction of atomic and negated ('except') atomic conditions, where an atomic condition is a substring relation or a string equality involving string constants and the parameters of a message (such as ?To, ?From, ?Cc, ?Body). Thus, Outlook rules are reactive (or Event-Condition-Action) rules, having one of the following forms:

```
r1:
  ON Inmsg(?To, ?From, ?Cc, ?Body)
  IF some condition involving ?To, ?From, ?Cc, ?Body holds
  DO some action

r2:
  ON Outmsg(?To, ?Cc, ?Body)
  IF some condition involving ?To, ?Cc, ?Body holds
  DO some action
```

To ease the use of rules, Microsoft Outlook provides a natural language template interface for specifying rules.

2.5.8 Commentary

Both rules, r1 and r2, can be implemented as reactive rules.

2.6 Rule-Based Reactive Organizer

2.6.1 Abstract

A rule-based reactive organizer is used for planning trips and for automatically react to changes affecting already made plans for its owner.

2.6.2 Links to Related Use Cases

Reactive behavior is also needed in the use case Rule-Based Intelligent Guiding.

2.6.3 Examples of Rule Platforms Supporting this Use Case

The rules involved here can be implemented by using the reactive language XChange, which has been developed as a research project at the Institute for Informatics, University of Munich (more on XChange).

2.6.4 Benefits of Interchange

Benefit 1 Business rules need to be interchanged between companies and the personal organizers of their employees.

Benefit 2 Personal organizer's rules need to be migrated to other systems (e.g. in case of changing the system).

2.6.5 Requirements on the RIF

Requirement 1 Different kinds of rules (deductive, normative, and reactive rules) should be supported.

Requirement 2 Rules require access to data contained both in events and stored persistently.

2.6.6 Breakdown

Actors and their Goals Ken has a personal organizer that plans his trips and as several reactive rules in place to automatically react to events affecting his itinerary. The company Ken is working for has its own business rules (e.g. for travel expenses).

2.6.7 Narratives

Ken is on a business trip attending a conference in Seattle. He uses a personal organizer for planning his trips: the organizer is notified about changes affecting his itinerary (told by the airline, bus, or railway companies) and has rules to automatically react appropriately. While packing, Ken's organizer receives a notification stating that his fight back home is canceled due to rain and he is instead booked for the next day. Fortunately Ken's organizer has (reactive) rules in place to react to this event.

Ken's organizer automatically tries to extend Ken's stay in the hotel. Since for the next night no single rooms are available, Ken is being placed in a more expensive double room. Before the booking is made, the new price is checked against the rules for business trip expenses of Ken's company.

Further the organizer recognizes that Ken's coming home one day late affects its business and private plans. The organizer requests rescheduling of Ken's business meetings on the next day by notifying his business associates. Finally, the organizer reminds Ken to call his girlfriend, Barbie, to postpone their date. 10. Commentary

Ken's organizer has several reactive rules in place to automatically react to events affecting his itinerary. For example in the event of a rescheduling of Ken's flight, the following rule extends his overnight stay. Note that the rule requires access to data contained both in events (e.g., flight number, duration of delay) and stored persistently (e.g., the name of the hotel where Ken is staying).

```
r1:
  ON rescheduling of flight by X days
  IF on business trip
  DO extend overnight stay by X nights
```

The decision that Ken can stay in a double room is governed by several deductive and normative rules. These rules state restrictions on business trip expenses of Ken's company.

```
r2:
  IF traveling alone AND single room available
  THEN not double room

r3:
  IF NOT single room available
  THEN allow double room

r4:
  IF business trip in city C
  THEN hotel price less then limit for C OR hotel provided by conference
```

The price limit for hotel expenses is determined by deductive rules, such as the following ones. Note that the price table may be represented as an XML document or a table in a relational database.

```
r5:
  IF city C in Germany
  THEN hotel price limit = 10 * lg(population(C)) + 50 Euro

r6:
  IF city C in country L and L different than Germany
  THEN hotel price limit = entry for C and L in price table
```

Further reactive rules take care of rescheduling Ken's business meetings and remind him of calling his girlfriend, Barbie:

```
r7:
  ON delay
  DO request rescheduling of business meetings

r8:
  ON delay
  DO remind Ken to call Barbie
```

Note that the above reactive rules react to any kind of delay events. Hence deductive rules for events such as the following are needed:

```
r9:
  ON flight delay OR flight rescheduling OR train delay
  DO delay
```

Taking into consideration the proposed classification of rules, a possible classification of the rules occurring in the given use case is:

- normative rules (r2, r3, r4)
- deductive rules (r5, r6, r9)
- reactive rules (r1, r7, r8)

2.7 Rule-Based Combined Access to XML and RDF Data

2.7.1 Abstract

Rules referring to both, a Computer Science publication server and Computer Science taxonomy or ontology, are used for determining in which area the co-authors of a certain author have published.

2.7.2 Links to Related Use Cases

The use case described here is similar to the use case Enterprise Information Integration[15], as both stress the integration of heterogeneous data.

2.7.3 Examples of Rule Platforms Supporting this Use Case

This use can be implemented in Xcerpt [2, 5, 11, 10], the Web and Semantic Web query language developed within REWERSE WG I4.

2.7.4 Benefits of Interchange

Benefit 1 Querying tasks realized by using rule-based query languages need access to heterogeneous data sources.

2.7.5 Requirements on the RIF

Requirement 1 Rule-based combined access to both XML and RDF data is needed.

2.7.6 Breakdown

Typically, the publication server will have its data in XML. Indeed, publications are naturally grouped after the proceedings, journal issue, or book they appeared in. In contrast, a taxonomy of research fields is naturally expressed in RDF.

The following rules are views accessing both, the XML data of the Computer Science publication server DBLP and an (hypothetical) Computer Science taxonomy in the spirit of SKOS, the Simple Knowledge Organisation System. 8.1.1. Constructs

Like RDF data, XML documents are accessed by Datalog-like queries with the following constructs.

`a[ b[], c[] ]` is a query retrieving XML documents of the form

```
<a>
   <b/>
   <c/>
</a>
```

`a[[ b[] ]]` is a query retrieving XML documents of the form

```
<a>
   ...
   <b/>
   ...
</a>
```

where ... stands for any content, i.e. the query is an incomplete specification of XML documents to retrieve.

`a{ b, c }` is a query retrieving XML documents of one of the forms

[15] Enterprise Information Integration, `http://www.w3.org/2005/rules/wg/wiki/Enterprise_Information_Integration`

```
<a>
   <b/>
   <c/>
</a>

<a>
   <c/>
   <b/>
</a>
```

`a{{ b, c }}` is a query retrieving XML documents of one of the forms

```
<a>
   ...
   <b/>
   ...
   <c/>
   ...
</a>

<a>
   ...
   <c/>
   ...
   <b/>
   ...
</a>
```

`a[ desc b ]`, `a[[ desc b ]]`, `a{ desc b }`, and `a {{ desc b }}` are queries retrieving a rooted XML documents having a b element at any possible depth.

In other words, an XML document on the Web is seen as a fact.

Each of the following rule is given an intutive reading in English. Each rule body is a conjunctive query to an XML document, or to both, an XML document and an RDF specification. Each rule's head is a RDF triple (the syntax of which can be rephrased as one wishes).

Query In which areas have my co-authors published?

This query can be separated in three tasks:

1. Find the co-authors of a person.
2. Find the papers published by these co-authors.
3. Find the areas that these papers are associated with.

```
area-of-coauthors[var Person, var AreaLabel] :-
   in "http://dblp.uni-trier.de/xml/dblp.xml"
     dblp {{
```

```
      desc article {{ desc author [ var Person ], desc author [ var Co-author ] }},
      desc article (id = var PaperID) {{
        desc author [ var Co-author ]
        without desc author [ var Person ]
      }}
    }}
  AND
  in "http://example.com/cs-ontology.rdf"
    (var Paper ID, skos:related, var Area)
    AND
    (var Area, skos:prefLable, var AreaLabel)
```

Salient features:

- The rule mixes access to XML and RDF.
- Co-author is defined as sibling author elements somewhere in the document. This definition easily covers all publications covered in DBLP and requires a search at indefinite depth (the pattern is incomplete in depth).
- The pattern matching the dblp root element is incomplete in breadth allowing for many more than just the two specified sub-elements.
- Other papers also authored by the co-author are also descendants of the dblp root element.
- The 'without' expression is a simple form of "scoped negation as failure" avoiding an author being considered a co-author of him/herself.

Query For which areas, exist papers that cite one of my papers?
Again the query can be divided in three parts:

1. Find the papers authored by a person.
2. Find the papers citing these papers.
3. Find the areas of computer science these papers are related to.

```
citing-area[var Person, var Area] :-
    author-of-paper[var Person, var Paper]
    AND
    citing-papers[var CitingPaper, var Paper]
    AND
    area-of-paper[var CitingPaper, var Area]

citing-paper[var Paper, var CitedPaper] :-
   in "http://dblp.uni-trier.de/xml/dblp.xml"
     dblp {{
       desc article (id = var Paper) {{
          desc cite(idref=var CitedPaper){{}} }},
```

```
  }}
}}
OR
dblp {{
  desc article (id = var Paper) {{
     desc a(href=concat('#',var CitedPaper)){{}} }},
  }}
}}
```

One might also consider indirect citation, i.e., a transitive closure over the citing-paper predicate.

Query In which areas have papers been published on my last conference?

I want to write the call for papers for the third iteration of a conference. I would like the list of topics on which papers are solicited for to reflect the list of topics from papers published on the conference in previous years.

```
area-of-conference[var ConferenceName, var Area] :-
  paper-at-conference[var Paper, var ConferenceName]
  AND
  area-of-paper[var Paper, var Area]

paper-at-conference[var Paper, var ConferenceName] :-
  in "http://dblp.uni-trier.de/xml/dblp.xml"
    dblp {{
      desc article (id = var Paper) {{
         in (idref=var ConferenceID){{ }}
      }},
      desc conference(id=var ConferenceID){{
             title{{ var ConferenceName }}
          }}
    }}
```

2.7.7 Commentary

Combining a taxonomy of research fields as metadata with the XML data of DBLP is a foundation for applications such as community based classification and analysis of bibliographic information using interrelations between researchers and research fields.

3 Conclusion

This report has presented the REWERSE contribution to the work on use cases done within the W3C Rule Interchange Format Working Group. The 7 use cases for a rule interchange format submitted by REWERSE have been developed as part of the project's *Standardization Activity*. This report aims at documenting that this *Activity*, though just recently started, has already obtained promising results towards REWERSE's contribution to standards. The success of REWERSE's involvement within the W3C work has different dimensions:

WG(s)	Use case	Note
STD, I2	Automated Trust Establishment for eCommerce	Part of the W3C RIF UCR deliverable
STD, I2	Automated Trust Establishment for Accessing Medical Records	
STD, I5, A3	Organizing a Vacation with Friends	
STD, I5, A1	Rule-Based Intelligent Guiding	
STD, I1	Rule-Based Email Manipulation	
STD, I5	Rule-Based Reactive Organizer	
STD, I4	Rule-Based Combined Access to XML and RDF Data	

Table 2: REWERSE use cases for a rule interchange format

1. The submission of 7 use cases from the project's research areas represents an important first contribution both in quality and in quantity.

2. The W3C *Use Cases and Requirements* document contains one REWERSE use case; it has been developed by Piero Bonatti and Daniel Olmedilla with the guidance of the standardization co-ordinator. This use case (of Section 2.1) shows the need for a rule interchange format for enabling negotiations between systems using different rule technologies with the goal of automatically establishing trust within eCommerce applications. Also, it shows that co-ordinated work within the *Standardization Activity* has been rewarded.

3. Last but not least, REWERSE standardization efforts (guided by its Standardization Task Force and its standardization co-ordinator) are means to strengthen the integration and cooperation between REWERSE members of different Working Groups, as shown also in Table 2. The WG I3 has not contributed yet to the REWERSE input to W3C RIF WG because of the high-level nature of the submitted use cases; though, the WG I3 will surely have the opportunity to contribute to future revisions of the use cases, as e.g. the issues related to typing rules are explicitly stated in the W3C RIF WG charter.

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