T-D11
Guidelines for the adaptation of existing REWERSE specific courses to the industry

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Abstract

This deliverable is the last one of four deliverables, and it is based on its predecessors T-D3, T-D5 and T-D7. It aims at presenting a deep study and evaluation of the available course material developed for the REWERSE project. As the material was originally targeted to an academic audience,specific guidelines for the adaptation of the original courses to an audience from industry are presented, including suggestions for the authors to deal with this kind of audience.

Keyword List

Semantic Web education, Semantic Web industrial courses, industrial training material

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Guidelines for the adaptation of existing REWERSE specific courses to the industry

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06. February 2008

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This deliverable is the last one of four deliverables, and it is based on its predecessors T-D3, T-D5 and T-D7. It aims at presenting a deep study and evaluation of the available course material developed for the REWERSE project. As the material was originally targeted to an academic audience, specific guidelines for the adaptation of the original courses to an audience from industry are presented, including suggestions for the authors to deal with this kind of audience.

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Contents

1 Acknowledge

Special mentioned should be made to the authors of the courses: Norbert E. Fuchs (*Attempto Controlled English: Language, Tools and Applications*), Daniel Olmedilla and Piero A. Bonatti (*Rich Clients Need Rich Interfaces*), Paula-Lavinia Pătrânjan (*Rich Clients Need Rich Interfaces*) and Gerd Wagner and Adrian Giurca (*Rule Modeling and Interchange*).
We would like to thank them for their support and time for maintaining the discussions. Their constructive comments and feedback for the development of the industrial courses guidelines have been very useful for achieving the final goal.
The final deliverable presented has also been reviewed and approved by the authors.

2 Introduction

This deliverable aims at presenting a deep study and evaluation of the available course material developed for the REWERSE project. This is the last one of four deliverables, and is based on its predecessors: T-D3, T-D5 and T-D7. This deliverable identifies the key tips that will facilitate the adaptation of the REWERSE material to the industry. To achieve this target, an evaluation, analysis and selection of the most important courses for the industry have been made as a first step.

Once the courses have been selected, they will be oriented to the industry, highlighting the most important issues for an industrial audience. Thus, theoretical contents will be minimized, presenting just the basics of them to make the audience achieve a general idea. Besides, practical cases, scenarios and examples will be presented, remarking these aspects because they will be the most interesting contents for an industry audience. In case anyone is interested in a further study, the whole courses and references will be presented, allowing the audience to access them online.

In deliverables T-D3 and T-D5, some brief guidelines for the adaptation of educational material addressing industrial needs were offered. In this deliverable, general guidelines as well as individual and more specific ones are offered to adapt the four original selected courses to the industry. Courses chosen are “Attempto Controlled English: Language, Tools and Applications”, “Rich Clients need Rich Interfaces - Query Languages for XML and RDF Access on the Web”, “Semantic Web Policies” and “Rule Modeling and Interchange”.

The first course aims at presenting a controlled natural language (a subset of English) that is human and machine understandable, together with the basics for reasoning with this language. The second course describes query languages based on Semantic Web data, such as XML, RDF and Topic Maps. Semantic Web Policies will also be presented, showing the basics of policy languages and presenting some deployed application scenarios. Finally, an introduction into the state-of-the art of rule modeling and rule interchange is given, presenting two different executable rule languages.

3 Approach

Throughout the activity of the development of courses for the industrial field, it became more and more obvious that the authors would not modify their material for industry needs if it would not offer a strong motivation (for instance, due to an event where they could present their courses to an industry audience). Additionally, the modification of the material is in the hands of the authors. It is understandable that they would rather not have anyone else modifying their material as they want to have control over it.

Consequently, from TTA side only suggestions regarding the modifications can be given, serving as incentives to the authors. However, these comments are not intended to be mandatory, but to be used as suggested modifications over their material.

Consequently, the following procedure has been chosen:

1) The first step is to determine which of the available material in REWERSE has the potential to be adapted to industry audience courses (which includes the suitability of the material as well as the willingness of the authors).

2) Development of specific guidelines for each of the courses to support the authors to adapt their material to the industry audience. These guidelines offered to the researchers serve as suggestions for them to revise the original courses.

3) As a precondition to the revision of the original courses, the authors required a concrete event holding the exposition of the adapted material to an audience from industry. All of the courses have been held already in front of an industry audience. Most of them have been, in fact, tested at presentation possibilities organised by the Technology Transfer and Activity Group (e.g. EBRC, ESTC, I-Semantics, XML Tage). The guidelines now serve as suggestions for further refinements and adaptations of the material to be presented at future events.

4) Upload the adapted material to REASE.

The guidelines presented can be used in the future, serving as a reference on how to develop other guidelines for adapting courses to the industry. Besides, the whole procedure of the development of course material to the industry (as described in this deliverable) can be copied and also realized in other projects.

Moreover, through the upload of adapted material for industry onto the REASE1 portal, sustainability will be reached.

[1] http://rease.semanticweb.org

4 Development of the guidelines

Once the courses have been chosen, some guidelines must be developed. First, general guidelines will be offered, which will be common to every selected course (and every other course to be adapted in the future). Afterwards, individual and more specific guidelines must be developed to help the authors adapt their material to the industry.

These guidelines intend to reduce the theoretical contents of the original courses, since the industry is more interested in the practical uses of those courses. Thus, contents explaining not very relevant information for the industry audience such as characteristics of languages, requirements, etc. will not be presented, focusing on examples, applications and scenarios. Therefore, theoretical contents will be minimized, presenting only a brief overview of them. This will let the audience know the basics, which will help them understand the practical cases for the industry. Since the original sources are available for anyone who is interested, links to that information are offered for a deeper and further study, including the contents that have been removed.

These guidelines are based on the recommendations about how to prepare material for industrial education, detailed in T-D3. Besides, guidelines developed in T-D5 have also been taken into account, as well as the industrial learning structure and conclusions extracted from T-D7.

They will serve as ideas on how to adapt their work and as knowledge on how to reduce theoretical contents, but the authors can follow these ideas as much as they are interested. They will be the ones who will present those contents and then could find more interesting to adapt some slides to their preferences.

It must be remarked that the development of the guidelines could not have been done earlier because research in REWERSE has been very theoretical at the beginning, not being able to offer any practical courses from those contents. Nevertheless, over the last years, research in REWERSE has become less theoretical and more practical, which could be of interest for the industry. Additionally, many Technology Transfer and Awareness industry events usually give room only for shorter presentations and possibility for longer presentations in the form of tutorials mainly emerged in the last year. Some of those tutorials could then serve as the basis for course material for industry, which is commonly designed to endure several hours or days.

5 Industrial courses guidelines

In order to effectively adapt the original courses into industrial ones, some guidelines are offered. For a successful Semantic Web technologies adaptation, they should be applied where they really offer benefits, avoiding using them where they do not. That is, adoption of Semantic Web technologies for the wrong tasks will make the industry audience receive a negative impression about the use of these technologies.

It is very important to disseminate Semantic Web knowledge to industry areas and to provide a real vision on how Semantic Web technologies can contribute to enhance industry issues. Thus, industry will notice how to take advantage of Semantic Web technologies.

The following ideas could be taken into account for a more precise adaptation, serving as orientations for the work to be done:

- **Avoid theoretical information**: Industries are not very interested in technical details, but in how Semantic Web technologies can serve as a solution to some of their problems. Those technical details should only be detailed when necessary or under demand. Besides, details about the research should not either be included, emphasizing only on the conclusions of the research and on the applications of it.

- **Scenarios and examples**: Industry is mostly interested in the practical applications of what it is being shown. Thus, contents should be explained remarking their advantages to the industry, and presenting examples and some scenarios if possible (preferably in the field of the targeted audience). With this approach, attendants will get involved with the explained information, feeling identified with the problem. Moreover, if the course is too long, examples will help the audience to keep their attention.

- **Focus on applications and results**: Experience in previous projects and solutions on Semantic Web technologies would help companies to be aware about the benefits of Semantic Web issues in real use applications. The industry audience could then determine if these issues will provide good results to their particular needs (according to the statistics, cases, experience in other projects, etc., that are presented).

- **Focus on the benefits of Semantic Web technologies**: These technologies should be applied in the fields where they offer the greatest benefits to the industry, avoiding the ones where they do not. Hence, the course should be adapted to the needs and benefits to each particular audience.

- **Take the audience into account**: Courses for the industry should be adapted according to the needs of each audience. Thus, the status of the attendants should be considered, as well as their level of knowledge on the selected courses and on the field of their work.

- **Restriction of time**: In the industry field, time is very important, not being usually able to hold long courses. For this reason, an overview of the courses should be provided to the companies, focusing only on the most important aspects for the industry.

- **Briefness**: Related to the previous point, as time is very important in industry, the presentation should be brief and concise in the explanations, enhancing the advantages and solutions offered in each course.

- **State-of-the-art**: Industrial modules must be up-to-date on Semantic Web technologies. Then, an overview of these technologies should be presented for the companies to choose the technologies which best fit their needs. Besides, there should be a comparison with existent products in the same area.

- **Flexible courses**: Each company is different, and so are their needs and knowledge about the field of the presentation. Therefore, a global index could be offered to the companies, so they can select the most important information for them and the level of knowledge they would need, emphasizing in basic concepts or in more advanced ones (starting technical courses from the point they consider appropriate).

- **Provide further information on demand**: Due to the briefness of industrial courses, the main target is to expose features, advantages and solutions of Semantic Web issues. Nevertheless, deep explanations on technologies should be provided on demand. Besides, the complete course should be provided and available for the audience in case they are interested in further study.

- **Use appropriate vocabulary**: Complex vocabulary or too detailed information must be avoided, especially when the audience is not familiar with these technologies. Thus, appropriate vocabulary, examples, definitions, etc. should be used.

- **Avoid long presentations**: Long presentations do not help the audience to pay attention all the time. It is preferable to present only the important issues in a short presentation than to have a long presentation in which important concepts could get unnoticed. Thus, although the time is in the hands of the authors, it is not recommended to exceed a one-day-tutorial.

5.1 Attempto Controlled English: Language, Tools and Applications

5.1.1 Abstract

The intention of these guidelines is to reduce the theoretical contents on the original ACE courses in order to give them a more practical orientation for the industry. A new index is built up using the slides that compounds the original courses (the name of the correspondent slide is used in this index, referring the file where it is located by means of a number).

This course will be structured in three different sections: the first one is an introduction to ACE in which its functionality and main features are presented. The second one is an approach to ACE itself, in which the way of working with ACE is shown. Finally, the third section aims at presenting how ACE can be used for reasoning. These guidelines are structured in function of these sections, each one of them is widely and individually analysed.

This course has been developed by Norbert E. Fuchs2 and Kaarel Kaljurand3. The original course was presented in December 2006 in an ACE course at the University of Munich. The original course consists of 195 slides plus some exercises related to the courses. In the adapted material, exercises could be included, as well as examples oriented to the industry.

Original sources can are located at: http://attempto.ifi.unizh.ch/site/courses/index.html

[1] Getting Started
[2] The Language ACE
[3] Logical Background
[4] Reasoning in ACE

5.1.2 Introduction

Purpose

The main purpose of this section is to give a first approach to ACE. For an industrial audience, the key point is to understand what ACE is for, and because of this an example illustrating the functioning of this language will be the principal target of this section.

Contents of the section

In order to have a starting point for understanding and using ACE, we need to make the audience understand the nature of the problem. ACE and RACE aim to solve, as well as to give them a first approach to what ACE is. An example set of slides to present these issues is shown next (unless otherwise indicated, these slides are taken from [1]):

- **Getting Started**
- **The Problem**
- **Overview**
- **Attempto Controlled English**
- **An ACE Appertiser**

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[3] Research Assistant at the Department of Informatics of the University of Zurich

- **Using ACE (from [2])**
- **Applications of ACE**
- **Some solutions**
- **Pretty printed example DRS**

This way, an overview to ACE will be presented. The last slide will introduce DRS and the example used further, which will serve as an illustrative way to present this language.

5.1.3 The Language ACE

Purpose

In this second section, we aim at showing the audience how to "speak" in ACE, what are the main elements of the language, the construction rules that allow us to create sentences and the interpretation rules that permit to avoid the ambiguity linked to natural English.

Contents of the section

The contents of the section will go in line with the aforementioned purpose. We will begin by showing the vocabulary we can handle with ACE, introducing the morphological level of the language. After this, the construction rules for such vocabulary, showing the grammatical level of the language, and for ending, the interpretation rules that give us a first approach to semantic taste in ACE. An example set of slides to present these issues is shown next (all these slides are taken from [2]):

- **The Language ACE + Learning ACE**
- **Vocabulary**
  - Content words and their semantics (1 or 2 slides)
    - Adverbs and Adjectives
    - Nouns
    - Verbs
  - Function Words
- **Construction Rules**
  - Noun Phrases (1 or 2 slides)
  - Verb phrases (1 or 2 slides)
  - ACE Texts
    - Simple Sentences
    - Composite Sentences and Coordination
      - Quantification
      - Negation and Interrogative
      - Subordination (2 or 3 slides)

- **Interpretation Rules**
  - Ambiguity (1 or 2 slides)
  - Lexical Ambiguity
  - Anaphoric References
  - Pronominal References
  - Variables

As said before, we need to keep the interest of the audience by means of referring the different issues shown here with examples located in the scenario chosen for the

introduction. In order to give a feeling of cohesion to the course, all the examples should be seen as pieces of a big puzzle in which they all take part.

After this section, the audience will know what can be said using ACE and how to say it. A set of exercises can be done when this section is finished in order to get more familiarized with ACE. These exercises can, as well, be distributed along the whole presentation. The exercises will be related with the scenario around which the tutorial is formed.

5.1.4 Reasoning in ACE

Purpose

The goal of the last part of the tutorial is to show the real computational potential of ACE. We could have an idea so far about the interest of this language, as it can be understood as a comprehensive way for human-computer communication, however, the main interest of the language will be connected with its computability, for this reason, we will show in the final phase of the tutorial how to reason with ACE, and what is its reasoning potential in the field of ontologies, logic and DRS representation. RACE is introduced as an ACE reasoner.

Contents of the section

In order to give an initial overview to this topic, we will first take a look to ACE comparing it with the different ways we had so far for reasoning in computer sciences, specifically, we will focus on reasoning in the web. Once this approach is done, we will take a look to the ACE reasoner, RACE, exploring it from the functional point of view, what it can do, but also giving an idea of why it can do what it does.

An example set of slides to present these issues is shown next, unless otherwise indicated, these slides are taken from [4].

From ACE to First-Order Logic (from [1])
Example DRS Representation (from [1])
ACE as Ontology Language (from [3])
RACE
- Requirements for ACE Reasoner RACE
- Structure of RACE
- RACE Detects Entailments
- RACE Answers Questions
- RACE Detects Inconsistencies

In this final phase of the tutorial, we will make the circle closed by reasoning over the different sentences that has been developed so far. Again we keep working on the same scenario we chose as a beginning point.
The audience will use the online tools available for reasoning with RACE in order to check the potential of the language by themselves. This will be proposed as a practical experience with ACE and RACE, the audience will not just try the sentences appearing all along the tutorial, but also any other one they could have developed by themselves in the previous section.

5.1.5 Conclusions

Once the contents of this course are presented, this section will be used to introduce future work and more information about what it has been shown. To achieve this objective, two more slides will be added, both from [1]:

Current & Future Research
Attempto Website

The last slide will serve as a link to people interested in further study of ACE, RACE and work related to this course.

5.2 Rich Clients Need Rich Interfaces

5.2.1 Abstract

The intention of these guidelines is similar to the one exposed in the course described before. Theoretical contents of the original “Rich Clients need Rich Interfaces – Query Languages for XML and RDF Access on the Web” courses must be minimized, in order to give it a more practical orientation for the industry. A new index is built up using the slides that compounds the original courses. Again, to accomplish this target, the name of the correspondent slide is used in this index, jointly with the slide number in parentheses, to make it easier to search and identify.

The contents of “Rich Clients need Rich Interfaces - Query Languages for XML and RDF Access on the Web” can be classified in different technical areas, depending on the technologies presented to enrich the content of an interface. These guidelines propose several approaches to present this to an industrial audience, always keeping in mind that the main interest of the audience in the courses is the practical application of its contents in order to get an added-value for their products.

These guidelines present an introductory section in which the different approaches for the course are analysed. Then, each chapter to be developed is individually analyzed given an index for it, that is composed from the slides of the original tutorial by James Bailey[4], François Bry[5], Tim Furche[6], Benedikt Linse[7], Paula-Lavinia Pătrânjan[8] and Sebastian Schaffert[9], and a set of targets and concepts to be reached or developed in the course. The original material was presented at the “XML-Tage” in Berlin in 2006, and was a 3-hour-duration course, consisting of 111 slides.

The publication of this original course is available at:

http://rewerse.net/publications/download/REWERSE-RP-2006-045.pdf

Structure of the original course will be maintained, so that it can be divided into different sections:

1. Introduction
2. Preliminaries
3. XML Query Languages
4. RDF Query Language Families
5. Topic Maps Query Languages
6. Rules and Web Querying
7. Versatile Web Query Languages
8. Conclusions

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[8] REWERSE project's standardization coordinator
[9] Senior Researcher at Salzburg Research and Scientific Director of Salzburg NewMediaLab

5.2.2 Introduction

Purpose

The main purpose of this section is to provide a general idea about what it is going to be explained in this industrial course. Thus, main characteristics of Web and Semantic Web data will be treated in this introduction. Besides, data representation formalisms will be mentioned in this section.

Contents of the section

Before explaining with details the main contents of this course, Web data and Semantic Web data will be introduced, explaining its main characteristics. Besides, the main purpose of this course is the need of advanced interfaces for rich clients. That is why some general aspects of this kind of interfaces are shown.

Slides used in this section will be:

Rich Clients need Rich Interfaces (slide number 1)
Contents (2)
Access to (or querying) Web and Semantic Web data (3)
Focus of this tutorial (4)

The last slide is important because it introduces the three data formalisms to be explained in this course. Moreover, it shows references for further study. These references should also be offered to the audience at the end of the course, so they could access this information if they are interested.

Slide presenting the contents will be included but should be modified. In case the orator would like every section and subsection to be included, subsections in Preliminaries should be reordered. First of all, there will be an introduction to XML, RDF/S and Topic Maps. Afterwards, the running example, and finally, the sample queries. We think this is more visual to the audience and the sample queries could also serve as an explanation of the running example.

In case subsections are not expected to be included in contents, but only in its corresponding section, structure of this slide will be as it was shown before:

1. Introduction
2. Preliminaries
3. XML Query Languages
4. RDF Query Language Families
5. Topic Maps Query Languages
6. Rules and Web Querying
7. Versatile Web Query Languages
8. Conclusions

5.2.3 Preliminaries

Purpose

This section presents an introduction to some data representation formalisms (XML, RDF and Topic Maps). Although they will be explained with more details in next sections, it is important to offer the audience a brief outline of each of them, so that the main characteristics, analogies and differences between them will be presented. Besides, some query examples will help the audience to understand how these query languages work.

Contents of the section

It would be interesting to explain the highlights of XML, RDF and Topic Maps before presenting an example and an explanation of it. The audience should have an idea about what it is going to be presented. That is why slides of each query language are presented first. The target of this course is not teaching the audience about data codes or complex functioning, that is why just the principles of query languages will be shown. They will be presented in a unique slide for each query language. Therefore, the selected slides would be:

Introduction to XML (8)
Introduction to RDF (10)
Introduction to topic maps (14)

After these preliminaries about query languages, an example could be presented, explaining the main relations existing between classes, resources, etc. Another slide will serve as an explanation of this example. In the original document, four slides are used to illustrate sample queries. It is proposed to summarize these four into only one. This slide could also mention some aspects such as inheritance explained in slide number 7, but these aspects would rather be explained while presenting the running example, indicating relations and brief explanations to introduce these ideas.

Running example (6)
Sample queries (one slide as a summary of slides from 16 to 19. Some aspect of slide number 7 (semantics) could also be included)

This last slide could be named “sample queries” and present two or three examples, with no need of any introduction or written explanation (e.g. “Select all data items with any relation to the book titled ‘Bellum Civile’”, “Return the last year in which an author with name ‘Julius Caesar’ published something”, and “Return the co-author relation between two persons that stand in author relationships with the same book.”).

5.2.4 XML Query and Transformation Languages

Purpose

This section presents some query and transformation languages working on XML data and their main characteristics. The target is to show the audience the principles of these languages, in order to make them understand and know the coincidences and differences between these languages and the other ones presented in this course, which does not work on XML data.

Contents of the section

The main characteristics of XML have been introduced in the previous section. The target now is to explain the main languages working on XML data, their functioning and characteristics. However, this is a course oriented to the industry, so not very relevant information oriented to this target audience should be avoided. Thus, a brief introduction to query and transformation languages should be presented, explaining the categories working on XML data. However, information about the history of these languages is not very relevant for the audience. Besides, some other information which is important for the industry (such as standards, tools or specifications) should be briefly added, which is to be applied to every query language presented.

Slide presenting XML Query Languages is the following:

> **XML Query and Transformation Languages (20)**

However, just the first half of this slide should be explained, presenting the main categories. Points dealing with “This presentation does not consider” should not be included. The orator could consider explaining a very brief history of XML or languages which have had influence on it, but it is not very important, so no slide has been selected for this industrial course.

Data codes and names of expressions or variables used are not the target of this course, because it is not expected that the audience will learn them during the presentation. Hence, the principles of each language will be presented. An example could be attached if the orator believes it could help the audience to understand the concepts, but too much time would be required to explain each sample query for each language. The profit the audience will receive by explaining each sample query would be very small, comparing to the time spent.

For the first category, slides selected are:

> **The Navigational Approach: W3C's Query Languages (22)**
> **W3C's Query Languages: The Navigational Approach (23)**
> **XPath (24)**
> **XPath — Node Tests and Predicates (26)**
> **XPath — Comparison with Generalized Path Expressions (27-28)**
> **The Transformation Language XSLT (33)**
> **XSLT — Templates and Recursion (34)**
> **The Query Language XQuery (41)**
> **XQuery — Principles (42)**

Following the same criteria, the second category (the positional approach) would consist on these slides:

> **The Positional Approach: Research Prototypes (52)**
> **Xcerpt (53)**
> **Xcerpt — Principles (54)**

5.2.5 RDF Query Language Families

Purpose

This section will explain the basics of RDF Query Language Families. It will be divided into three main subsections, which concerns Relational Query Languages (explaining the ones considered more important), Query Languages with Reactive Abilities, and Navigational Access Query Languages (in which *Versa* will be introduced). The target is to show the audience the principles of query languages working on RDF data, in order to make them understand and know the coincidences and differences between these languages and the other ones presented in this course.

Contents of the section

The principles of RDF have already been introduced in the Preliminaries section. However, it needs further explaining. The target now is to explain its functioning and characteristics with more details. RDF Query Languages are divided intro four families, each of them will be explained in a different subsection. The first one will deal with Relational Query Languages, the second one is about Query Languages with Reactive Abilities, and finally, Navigational Access Query Languages. An index should be included to guide the audience over the presentation. Then, index used in the original document would be reused, but erasing the first point, which shows a chronological overview, not very relevant for this study.

RDF Query Language Families – Index (63)
Relational Query Languages – Main points (65)

The first section is about Relational Query Languages, where four query languages will be included: SPARQL, RQL, TRIPLE and Xcerpt. In each of them, a brief introduction will explain its characteristics. Information about the variables, optional fields, etc., should be avoided. A sample query could be introduced to clarify some concepts, but we should not abuse of complex or very long data codes or examples, because the target is to show the audience the principles of these languages, instead of making them big experts of them. In case anyone is interested in a further study, the whole course will be linked, together with more bibliography.

Slides used for SPARQL will be:

SPARQL – The Family (66)
SPARQL – Basic Constructs and Syntax (67)
SPARQL – Sample queries (70-71)
SPARQL - Synopsis (74)

RQL will then be explained. Selected slides are:

RQL – The Family (75)
RQL – Overview (76)
RQL – Synopsis (81)

The third query language included in this section is TRIPLE. Two slides have been selected:

TRIPLE (82)
TRIPLE - Limitations and Critique (85)

The fourth one, as it was introduced, is Xcerpt. Slides for this language are:

Xcerpt (86)
Xcerpt—Limitations and Critique (90)

After explaining Relational Query Languages, the other two families of RDF Query Languages will be presented. Slides used for both of them are the following ones:

Query Languages with Reactive Abilities (91)
Versa: Navigational Access (92)
Versa—Higher-order Functions (94)
Versa—Limitations and Critique (95)

Slide 94 will serve as an example to show the general structure of Versa. However, the orator should not spend too much time explaining it, just to show how a basic query would be implemented.

5.2.6 Topic Maps Query Languages

Purpose

This section will explain the basics of query languages based on Topic Maps. The target is to show the audience the principles of these query languages, in order to make them understand and know the coincidences and differences between these languages and the other ones presented in this course.

Contents of the section

As it has been explained before, just the main principles and contents should be presented to the audience, avoiding information not concerning practical cases for this audience. First of all, an overview of this query language will be presented, as well as some basic concepts of it. Slides used of the original archive are the following:

Topic Maps Query Languages – Overview (96)
Topic Maps Query Languages - tolog -- Concepts (97)
Topic Maps Query Languages - tolog -- Example/Demo/API (98)

In the last slide there is a demo link to *Omnigator*. It would be very interesting to make a small demo during the presentation, so that the audience could know how this language really works. Nevertheless, although just one demonstrator is included, the author could insert any other one if he/she considers it appropriate.

The audience might not be interested in the content of each language or how it works internally, but how they should introduce a query, how the results are presented, the percentage of coincidence, etc. Besides, the demo link(s) should be attached, so that the audience could practice after the presentation with this material.

5.2.7 Rules and Web Querying, Versatile Web Query Languages and Conclusions

Purpose

Due to its least importance in this presentation and that slides used are very few compared to the rest of the query languages, the rest of the sections will be explained in this point. However, in the presentation, the original format can be maintained. Rules, Web Querying and Versatile Web Query Languages will be explained in this section. The coincidences and differences between languages working on Topic Maps, RDF and XML data will also be expressed in a table. To summarize what it has been explained in this presentation, there will also be a slide of conclusions.

Contents of the section

The first point will be explaining Rules and Web Querying. To achieve that, a simple slide has been selected:

Rules and Web Querying (99)

The next step is explaining the functioning of Versatile Web Query Languages. A comparative table of Query Languages explained in the previous sections is attached. Besides, the advantages and disadvantages of this language will be here presented, together with Xcerpt:

Versatile Web Query Languages (103)
Versatile Web Query Languages: The Syntactic Web Approach (108)
Versatile Web Query Languages: Xcerpt (109)

To finish with this presentation, there must be some conclusions of this study. Slide of conclusions used in the original document will be maintained, summarizing the main idea of this document.

Conclusions (110)
Acknowledgments (111)

5.3 Semantic Web Policies

5.3.1 Abstract

The intention of these guidelines is to reduce the theoretical contents of the original "Semantic Web Policies" courses, in order to give it a more practical orientation for the industry. A new presentation of contents is built up using the slides that compounds the original course. To accomplish this target, the name of the correspondent slide is used in this index, jointly with the slide number in parentheses, to make it easier to search and identify. The original course was developed by Daniel Olmedilla[10] and Piero A. Bonatti[11], and it was presented in the 3rd European Semantic Web Conference 2006 in Budva, Montenegro. Its duration was 3 hours and is composed of 194 slides. The tutorial is part of a REWERSE deliverable available at:

http://rewerse.net/deliverables/m30/i2-d8.pdf

These guidelines are oriented to an industrial audience. Consequently, it must be kept in mind that the main interest of the audience in the courses is the practical application of its contents in order to get an added-value for their products. Thus, theoretical contents not providing any information for practical cases should be avoided.

These guidelines present an introductory section in which the different approaches for the course are analysed. Then, each chapter to be developed is individually analyzed given an index for it, composed from the slides of the original tutorial and a set of targets and concepts to be reached or developed in the course. The original tutorial can also be found at:

http://www.l3s.de/~olmedilla/events/2006/ESWC06/ESWC06_Tutorial.html
The contents of "Semantic Web Policies" will be firstly introduced, giving an outline about what will be presented. Several policy languages are treated in this course in order to present a brief state-of-the-art to the audience and let them know the basics of each of them and what they are used for. Afterwards, some practical scenarios will be shown, so that all this information can be oriented to practical cases. Finally, a future work and some conclusions will also be explained. Then, structure of the original course will be maintained, so that it can be divided into different sections:

1. Introduction
2. Where are we?
3. Deployed Application Scenarios
4. What is still missing?
5. Conclusions

[10] Researcher at the L3S Research Center and Hannover University
[11] Full Professor at the University of Federico II in Naples

5.3.2 Introduction

Purpose

The main purpose of this section is to provide a general idea about what it is going to be explained in this industrial course. Thus, main characteristics of policies will be treated in this introduction, emphasizing its practical uses, problems and challenges. Besides, other aspects as requirements, authentication methods and some examples will be briefly explained.

Contents of the section

This section will serve as an overall introduction to contents and languages explained in next sections. Introduction will be divided in four subsections. Thus, index will be as it follows:

1. Introduction
    a. Semantic Web Policies
    b. From security and trust to knowledge and reasoning
    c. Expressiveness requirements
    d. User awareness and control
2. Where are we?
3. Deployed Application Scenarios
4. What is still missing?
5. Conclusions

The first subsection, Semantic Web Policies, specifies why this tutorial is important and what it is intended to provide, highlighting the main problems and challenges of Semantic Web Policies. Moreover, some specific examples of the use of these policies will be briefly detailed. Thus, slides used in this subsection are:

Semantic Web Policies (1)
Outline (2)
About this tutorial (5)
Warning or clarification (8)
Policies are everywhere (10)
Warming up: Problems (9-11-12)
Warming up: Challenges (13)

The next subsection is called “From security and trust to knowledge and reasoning”. The main point is to explain the authentication in open systems. Slides dealing with this objective in the original archive are very intuitive and easy to understand from the audience. That is why all of them are attached in this new version of the tutorial. Other aspects explained in this subsection are security and trust management, negotiations and expressiveness and privacy issues. All these contents will give the audience a good theoretical base, although the most intuitive and practical point will be the authentication and scenarios where it is used. Slides selected for this subsection are:

From security and trust to knowledge and reasoning (14)
From security to KR&R (15)
From trust management to SW (19)
Authentication in Open Systems (20-21-22-23-24-25-26-27)

Beyond authentification (28)
Privacy issues (29)
Negotiations (30)
Expressiveness issues (31-32-33)
Therefore policies are (37)
Relevance to SW community (38)

Expressiveness requirements are the third subsection of this introduction. Here, other uses apart from passive objects will be shown, as well as examples of policies and privacy and security possible scenarios:

Expressiveness requirements (39)
A broader notion of Policy (40)
Examples of policies (41)
Context-sensitive privacy & security policies (42)
Policies are not (only) passive objects (43)

To finish with this introduction, some basics of user awareness and control will be presented. From the original archive, two subsections have been fused into this one. It is not recommended to have different sections with only a couple of slides in each of them. That is why they have been combined into this one, because contents were very similar. Thus, slides selected are:

User awareness and control (46)
User awareness and control – General challenges (57)
Widespread security (47-48)
Cooperative policy enforcement (50)
Many policies, one framework (54)

Experiment in "Widespread security" is very visual and important, allowing the audience to know how important personalized policies are.

5.3.3 Where are we?

Purpose

This section deals with policy languages and their main requirements. As an introduction to those languages, the main requirements both for policy languages and for policy frameworks will be presented. Afterwards, the basics of some of the languages will be taught, together with some examples to clarify their ideas.

Contents of the section

This section, as every one in this industrial course, will begin with an outline. It is important to let the audience know what it is being presented and the exact point of the presentation where they are at. This section is divided in two main subsections, where the first one introduces the requirements of the second subsection. Structure will be as it follows:

1. Introduction
2. Where are we?
    a. Main requirements for policy languages
    b. Policy language / Framework state of the art
3. Deployed Application Scenarios
4. What is still missing?
5. Conclusions

In the first subsection, the main requirements for policy languages will be explained. Just the most important slides have been selected because the goal is not detailing every requirement but giving a general vision of policy languages, their requirements and characteristics. Hence, slides selected are:

Outline (60)
Main Requirements for policy languages (61)
Well-defined semantics → Slides 63 and 64 should be fused into a unique slide
Type of evaluation (66)
Operations/Combinations (68)
Management of Attribute Credentials (69)
External functions / Execution of actions (72)
Extensibility (76)
Lightweight vs. Strong Evidence (77)
Conflict resolution (83)

Conflict resolution has been introduced into the first subsection because it also delas with requirements and it is not recommended to make another subsection just to present one slide. The second subsection presents the main characteristics of the most important policy languages. Again, it is not interesting to spend a lot of time explaining theoretical aspects of those languages, such as detailing every requirement of each language. Thus, just a couple of slides for each language should be enough:

Policy Language / Framework State of the Art (87)
Classification (88)
XACML – Overview (89)
XACML – Data flow diagram (91)
P3P – Overview (96)
P3P – You are probably already using it (100)
Kaos – Overview (104)
Kaos – Reasoning (106)
Kaos – Policy conflicts (107)
REI 2.0 – Overview (111-112)
REI 2.0 – Metapolicies (113)
RT – Overview (118)
RT – RT_1 credentials (119)
RT – Example (120)
PeerTrust – Overview (125)

In slide 125, the first point of (124) should also be included: “Based on guarded distributed logic programs”. That is because in (124) the most interesting information are the first two points, but the second one is already included in (125).
The same idea will be made with slide 130. It should be wholly included, together with the first line of (131), the one which stands “Based on logic program ĄL1,…,Ln”.

Categories of predicates are not very interesting, so that only the first idea of this slide should be attached in the previous one:

Protune – Specification (130)
PeerAccess – Overview (139-140)
PeerAccess – Example (141)
Other policy languages (145)

Finally, some other policy languages will be introduced, in case the audience is interested in some further study.

5.3.4 Deployed application scenarios

Purpose

This section presents the most practical part of this industrial course. It introduces the audience to some real applications where policies are used.

Contents of the section

This section is also divided into two subsections, according to contents that will be provided:

1. Introduction
2. Where are we?
3. Deployed Application Scenarios
    a. Application Scenarios
    b. Other implemented features
4. What is still missing?
5. Conclusions

This section is the most important one of this industrial course because it presents some application scenarios that are used in the practice. This is the main target and the most interesting part for the audience, and that is why most of slides from the original archive have been included. Those are:

Outline (146)
Application scenarios (147)
Negotiating on the web (148)
P3P and Policy Enforcement with REI (149)
Policy protecting e-mail (150)
Policy Matchmaking for Semantic Web Services (151)
Automatic Credential Fetching on Grids (152-153-154)

The second subsection is about other implemented features, such as loop detection and other explanations. This section will finish with a demo of an explanation method:

Other implemented features (155)
Loop detection: online sharing pictures (156)
Loop detection: CIA agents (157)

Inference web answer explanation (159)
Why-not demo (165-166-167)

5.3.5 What is still missing?

Purpose
In this section, problems obtained in policies, together with future work will be treated. Hence, weak points will be here presented, as an introduction to the research which is going to be made.

Contents of the section
This section will start with the outline of where it is located in the presentation. It will continue with the main problems with policies nowadays, jointly with news in SW scenarios and future work. It will finish with a couple of slides introducing the concept of record linkage:

Outline (168)
Widely recognized problems (169)
Some problems we couldn't deal with not SW-specific (170)
What's new in SW scenarios (171)
Policies are still sensitive (172)
Servers may release credentials (174)
Inference on sensitive information (177-178)
Record linkage (179-180)

5.3.6 Conclusions

Purpose
The target of this section is to include a review of what it has been presented during this industrial tutorial of Semantic Web Policies. Conclusions are very important because those are the main ideas and information the audience is going to remember.

Contents of the section
As it has been said, conclusions must express the principal ideas of this industrial course. That is why every slide has been attached because it is important to mention every interesting aspect that has been treated during the presentation.

Outline (181)
Conclusions (182-183-184)
Questions (185)
References (186)*

It is important to mention that slide 186 should include the location where the full tutorial is, together with the location of the full list of references. Those references will not be included here because they will be necessary several slides to include the whole bibliography. In case the audience wants to know a specific reference, they could access to the link and look for all of them, instead of writing down every single reference during the presentation.

Thus, slide for references will include this information. Besides, the link to the full tutorial (the original one before being adapted to the industry) is offered:

Tutorial is available from: **(from slide 7)**
http://www.l3s.de/~olmedilla/events/2006/ESWC06/ESWC06_Tutorial.html

Full list of references can be found at:
http://www.L3S.de/~olmedilla/policy/policyPapers.html **(from 186)**

5.4 Rule Modeling and Interchange

5.4.1 Abstract

These guidelines aim at adapting the available "Rule Modeling and Interchange" material to an industrial audience. In this case, the original material was a tutorial, and was freely available on the Web. Thus, it was oriented accessible to anyone interested in this course with an Internet connection. These guidelines serve as adaptation to a new format (a presentation), but share other characteristics with the previous guidelines, such as having to reduce theoretical contents and emphasizing the most practical ones.

The original material was developed by Gerd Wagner[12] and Adrian Giurca[13] and has been presented so far in two different acts: the 1st European Semantic Technology Conference (ESTC 2007) in Vienna, as a half-day tutorial, and the 6th European Business Rules Conference (EBRC 2007), in Dusseldorf, being 1h30 long. It can be accessed at:
http://hydrogen.informatik.tu-cottbus.de/moodle/course/view.php?id=24

It is composed of 136 steps (plus exercises and further links). If the full original tutorial (with no exercises) was intended to be adapted to a presentation, supposing an average of 1.5-2 slides per step, from 204 to 272 slides would be needed. Thus, the original course should be shortened. The main purpose is to present fewer contents (but trying to make the audience have a general idea of what it is being presented), instead of showing the whole course, not dedicating enough time to each content. Hence, as it is freely accessed on the Web, anyone who is interested could complete the full tutorial, having at their disposal further links, examples and exercises.

This tutorial is based on the activities of the Working Group I1 within the EU FP6 Network of Excellence REWERSE. The main goal of this tutorial is to give an introduction into the state-of-the-art of rule modeling and rule interchange. Starting from the basics of rule languages and the Semantic Web, the tutorial discusses the various issues of rule interchange, and then presents the approaches of the REWERSE Working Group to rule modeling and rule interchange.

The general index will be maintained, so that it will follow this structure:

1. Overview of Rule Languages
2. REWERSE I1 Rules Framework
3. (Semantic Web) Rule Engineering
4. What is Rule Interchange?

[12] Professor of Internet Technology at the Brandenburg University of Technology of Cottbus
13 Postdoctoral Researcher at the Brandenburg University of Technology at Cottbus

5.4.2 Overview of Rule Languages

Purpose

The main purpose of this section is to serve as an introduction to a number of important rule languages (such as F-Logic, RuleML, SWRL, JenaRules, N3 Notation, etc.). They come from AI Community, Semantic Web Community and Software Engineering Community.

Contents of the section

Since the original material is a tutorial, all references to the word "tutorial" should be erased and include "course", "presentation"… instead. Another common indication is that links, sources, references, etc. should be extracted from each slide and exposed at the end of the presentation, in sections oriented to those purposes. Besides, steps of the tutorial need to be re-shaped and adapted to a slide format. Thus, they must be more structured (presenting the information preferably with points), and containing basic information (the orator would present add-value commentaries if he/she considers it is appropriate). Every slide should have approximately the same size (i.e. slides with many contents followed by others with very few contents should be avoided). The ideal size would contain 7-8 points/lines per slide, not exceeding 10 lines unless it is necessary.

Since this is the first section of the presentation, a cover slide should be added, as web as an index slide. This is extensible to every other section, which should include an index or a slide indicating which section of the tutorial is going to be presented.
Bearing in mind all these comments, slides proposed to be used are the following:

> **In this tutorial you will learn...**
> **Where to use business rules?**
> **Different rules for different business purposes**
> **When to use business rules? (I and II)**
> **Business Rules and Vocabularies**
> **Software Engineering Community uses UML**
> **Business Rules Community uses SBVR**

The second slide is very interesting for the industrial field and, depending on the audience, applications oriented to their specific field could be emphasized. This comment also applies to the third one.

On the other hand, although "The logical formulation of the rule" is not included due to its excessive length, some of the ideas could be very briefly introduced by the orator in the "Keywords and phrases for logical formulation" slide:

> **Keywords and phrases for logical formulation**
> **Semantic Web Community uses RDF/RDFS**

From the previous slide only the first five points should be included. The rest of the contents could be explained in next slides where code is introduced. Slides "rdfs:Class - Describing Classes" and "rdf:Property - Defining Properties" could be summarized in a single point, such as "Each class/property is identified by an URI". This point would be included in an existing slide as an extra point.
The representation of rules with logic could also be included but, in that case, just a very brief explanation would be sufficient.

> **Logic Represents Rules too**

Object Oriented Rule Languages, Object Constraint Language – OCL, Oracle Business Rules, JBoss Rules

The previous four slides could be presented in a single one, simply keeping the structure of “Object Oriented Rule Languages” and adding a couple of lines explaining each point.

Finally, Semantic Web Rule Languages would also be included. However, a single slide would better be included for each language of those languages, detailing its main characteristics in a structured way.

Semantic Web Rule Languages
One slide for **N3 Notation**
One slide for **RuleML**
One slide for **SWRL**
One slide for **F-Logic**
One slide for **JenaRules**

5.4.3 REWERSE I1 Rules Framework

Purpose

This section aims at presenting the REWERSE I1 Working Group Framework which supports two main scenarios: modeling rules and their deployment to execution platforms and rule interchange via R2ML between different rule platforms.

Contents of the section

In this section it will be presented how rules can be interchanged using R2ML (REWERSE I1 Rule Markup Language). The structure will be maintained from the original material:

1. Overview of Rule Languages
2. REWERSE I1 Rules Framework
   - 2.1. UML-based Rule Modeling Language
   - 2.2. REWERSE I1 Rule Markup Language, R2ML
     - 2.2.1. What is R2ML?
     - 2.2.2. Vocabulary
     - 2.2.3. The Language
     - 2.2.4. Actions and Events
     - 2.2.5. Rules
   - 2.3. Tools and services
     - 2.3.1. Strelka - A Visual Rule Modeling Tool
     - 2.3.2. R2ML Services: Rule Translators, Rule publishing and Rule Verbalization
3. (Semantic Web) Rule Engineering
4. What is Rule Interchange?

As it can be observed, it is divided into three different subsections. For the first one, some notions about URML will be presented, which is a UML-based visual language for rule modeling concerning the Strelka modeling tool. A general approach to URML will be obtained using the following slides:

Design principals
Advantages of URML
Visual Symbols

Visual Notation: Conditions/
Visual Notation: Variables, Filter Expressions and Property-Value Statements
Visual Notation: Actions and Events
Visual Notation: Rules

Related to the Visual Notion, the four slides have been kept from the original tutorial. Nevertheless, the contents should be presented with shorter sentences, just presenting the most important information in a more structured way. Finally, a single slide presenting a rule example should be utilized. It would be the last one, which summarizes the previous steps:

Visual Rule: "If car is between 5 and 10 years old, then increase premium by $250"

The second subsection deals with R2ML, the REWERSE I1 Rule Markup Language. In order to introduce what R2ML is, the following slides could be used:

Statements and Goals
The REWERSE I1 Rule Markup Language
Basic Content Vocabulary

The vocabulary would be presented in the last slide, showing a brief overview of this aspect.
In order to explain the language, structure of slide “R2ML terms” could be used. Thus, the definition and characteristics of each term could be located in different slides, jointly with the diagram (i.e. one slide for Object terms, another one for Data terms and a different one for generic terms):

Object terms
Data terms
Generic terms
General formulae

Afterwards, two slides could be presented for “Atoms”: the one that presents the diagram and also one point or line for each type of atom (object classification, data classification, property, and equality/inequality):

Atoms
Atoms (types) New slide serving as summary (one point per type)
Quantifier-free formulae

Related to actions and events, the two slides of that part could be re-used, considering that the code should be erased (only maintaining the explanations and diagrams), and the contents should be summarized (e.g. only one or two lines for each event type)

Action
Events

To conclude with the explanation of R2ML language, the four slides dealing with “Rules” would better take part of a single one. The diagrams could also be erased, maintaining only the four types with their explanations in one slide.

The third subsection of REWERSE I1 Rules Framework is “Tools and Services”. It is a very important section, since many translators are introduced. Thus, a single slide should be inserted for each for each translator. Nevertheless, links and online

resources should be deleted. In case the orator wants to attach them, it could be done at the end of the presentation, adding some slides with that purpose.

Strelka - A Visual Rule Modeling Tool - Overview
R2ML to F-Logic
R2ML to Jess
R2ML to JenaRules
R2ML to SWRL
R2ML to OCL
R2ML to JBoss Rules

After presenting these translators, some other ones could be introduced, showing brief outlines of each one.

Other translators
R2ML Rule Publishing on the Web

Again, online resources should be erased. On the other hand, slide **"**R2ML Rule verbalization" could also be included. Since it is too short, it could be attached to an existing one (e.g. in the previous one).

5.4.4 (Semantic Web) Rule Engineering

Purpose

This section aims at presenting Semantic Web Rule Engineering and how to build rulebased applications. In particular, JBoss Rules and Jena Rules will be treated in detail.

Contents of the section

Translators from R2ML to JBoss Rules and Jena Rules were already treated in the previous section. The target is now to explain these languages with greater detail, as it was already done in the original material. The structure to be followed is (it could be part of one slide to make the audience know the exact point of the presentation and what it is going to be explained):

1. Overview of Rule Languages
2. REWERSE I1 Rules Framework
3. (Semantic Web) Rule Engineering
   3.1. UServ Product Derby 2005 Use Case
   3.2. Engineering within JBossRules
   3.3. Engineering within JenaRules
4. What is Rule Interchange?

For the first subsection, UServ Product Derby 2005 Use Case, slide "The application" should not be included, although its link should be offered at the end of the presentation in a section containing external links.

As for the other two slides, introduction could be included as it is in the original material. Nevertheless, in the second slide there should only be one line for each business rule. Every type should be included with the presented examples or with the explanation.

Introduction
UServ Business Rules Model

Engineering within JBossRules will be then treated in this section. Slides to be used would be:

What is JBoss Rules?
Use Strelka to visually model the rules
JBoss Vocabulary are Java beans

As for the first one, it could be divided into two different slides: one containing the characteristics and the second one the example.

To finish with this section, a similar study will be realized for JenaRules. The most important slides for an industrial audience are the following:

Introduction to JenaRules
Mapping UML vocabularies to RDFS (I)
Example: If the driver is male and is under the age of 25, then young driver

Once the main contents are introduced, the example will help the audience understand what it has been explained. The author could also consider the presentation of an example oriented to the attendants (i.e. instead of presenting an example with cars or drivers, the author should better change the examples for others dealing with each audience, considering the industry fields of the audience, among others).

5.4.5 What is Rule Interchange?

Purpose

This is the last section and aims at introducing what rule interchange is and the interchange between different rule systems. Besides, the interchanging rules will be centred in JenaRules and JBoss Rules.

Contents of the section

This section was originally too long, and contents should be minimized. Slides proposed for the industry audience are the following:

The RIF Interchange Principle
G1 Consistency with W3C Specifications
G2-3. Exchange of Rules, Widescale Adoption
R2ML and RIF requirements
R2ML Interchange Principle
The JBoss Rule
Example: The Driver class
The R2ML rule Template
The final picture

As for R2ML and RIF requirements, the four slides presented in the original material could be included, but more schematic.
To finish with this course, some conclusions should be included, oriented basically to the industry field. Moreover, external links, references and further study should be also presented.

6 Conclusions

In this deliverable, a deep study, evaluation and analysis of the available course material for the REWERSE project is presented in order to select the most appropriate courses for the industry. After this selection, the courses have been oriented to the industry, emphasizing the most important contents for the industry and avoiding theoretical contents which do not give a practical vision. Thus, just the basics of theoretical contents have been presented, to let the audience have a global vision of the state-of-the-art of languages and tools of each course. Additionally, irrelevant contents for the industry audience have been deleted, highlighting scenarios, practical cases and examples of each of them. Besides, some suggestions about interesting information to the industrial field have been presented.

Guidelines for the adaptation of original academic courses into industrial ones have been offered, providing general guidelines common to every single course as well as individual and more specific ones, in which a selection of the most important material to the industry has been developed.

This deliverable is the last one of four deliverables, and has been based on its predecessors: T-D3, T-D5 and T-D7. It has presented the development of the guidelines, identifying the key tips that have facilitated the adaptation of the material to the industry.

It has shown how the deliverables have been developed, emphasizing aspects as the minimum modification of the original material. It is due to the lack of time from authors to modify their own contents and that they would not want anyone else modifying their material, because they are the experts and the ones who are going to present those courses. That is why only suggestions have been given.

Four courses oriented to the industry have been presented. The first one was “Attempto Controlled English: Language, Tools and Applications”, which basically presents the language ACE, its applications and Reasoning with ACE. The second one was “Rich Clients need Rich Interfaces - Query Languages for XML and RDF Access on the Web”, which presents the main query languages based on semantic web data (XML, RDF and Topic Maps). “Semantic Web Policies” shows, among others, the basics of policies and some deployed scenarios where they are used, whereas the last one, “Rule Modeling and Interchange” presents an introduction into the state-of-the art of rule modeling and rule interchange, jointly with two different executable rule languages.