The OO jDREW Engine of Rule Responder: Naf Hornlog RuleML Query Answering Presentation

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RuleML 2007

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Outline

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- Agents
  - Personal
  - Organizational
  - External
- Rule Engines
  - Prova
  - OO jDREW
- Communication Middleware
  - Mule ESB
  - Reaction RuleML messages
- Demo
  - Use Cases

Overview of Rule Responder

- Rule Responder is an intelligent multi-agent system for collaborative teams and virtual communities
- Supports rule-based collaboration between the different members of a virtual organization
- Members of a virtual registration are represented as semi-automated rule-based agents which use rules to describe the behavioral and decision logic
- Uses RuleML subset as its Rule Markup Language, based on logic and XML
  - The member of the RuleML family employed here is Naf Hornlog
- Implemented as a Web-based service architecture

Personal Agents

- A personal agent acts on behalf of a single person of an organization
- The personal agent contains a FOAF* profile with FOAF-extended rules

***The Friend of a Friend (FOAF) project: http://www.foaf-project.org**

Organizational Agents

- Organizational agents are used to represent goals and strategies shared by each person in the collaborative team
- Organizational agents contain rule sets that describe their organizations' policies, regulations, opportunities, etc.

External Agents

- External agents communicate with the virtual organization, exchanging messages that transport queries, answers, or complete rule sets via the public interface of the organizational agents
- HTTP interface to Rule Responder
- Support for multiple unique External Agents (end users) at a single time
- Users can use a web browser to communicate with Rule Responder (currently a test interface)

Rule Engines

- Prova (Prolog + Java)
  - Developed by Adrian Paschke (Germany) and Alex Kozlenkov (United Kingdom)
- OO jDREW (Object Oriented Java Deductive Reasoning Engine for the Web)
  - Developed by Bruce Spencer, Marcel Ball, Benjamin Craig (Canada)

Prova

- Prova is used to implement the organizational agents of Rule Responder
- Prova is also used for some personal agents

OO jDREW

- OO jDREW is used for personal agents in Rule Responder
- Two modes of Rule Execution:
  - Bottom-up (forward reasoning)
  - Top-down (backward reasoning)
- Rule Responder primarily uses top-down
- Supports rules in the following formats:
  - POSL (Positional Slotted presentation syntax)
  - RuleML (XML syntax, can be generated from POSL)

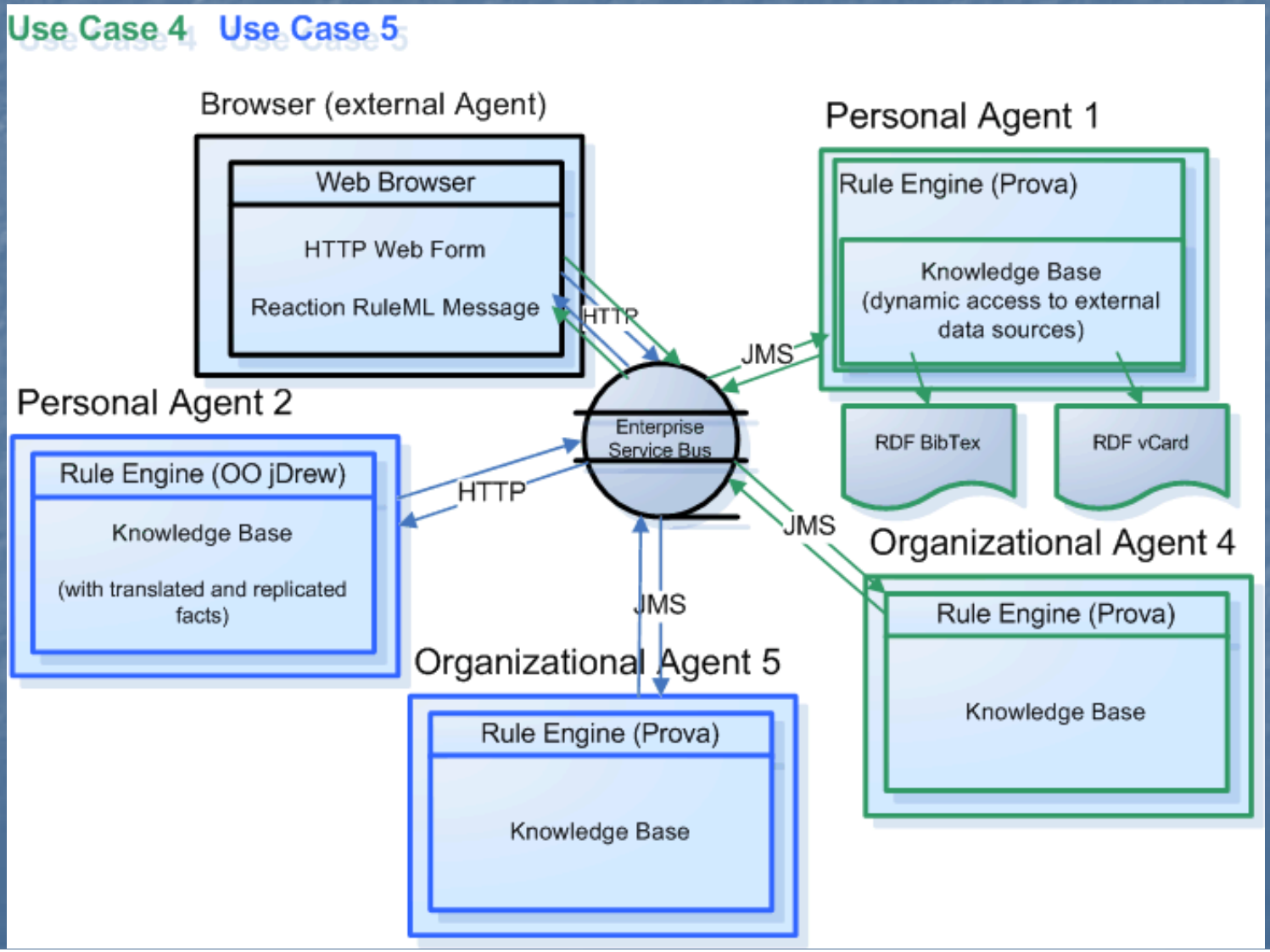
Communication Middleware

- **Mule** Enterprise Service Bus (ESB)
  - Mule is used to create communication end points at each personal and organizational agent of Rule Responder
  - Mule supports various transport protocols (i.e. http, jms, soap)
  - Rule Responder uses http and jms as transport protocols

Reaction RuleML

- Reaction RuleML is a branch of the RuleML family that supports actions and events
- When two agents need to communicate, each others' Reaction RuleML messages are sent through the ESB

Architecture - Overview



Use Case

- RuleML-2007 Symposium
  - One Organizational Agent that acts as the single point of entry to the conference
    - Assists with planning, preparing, and running the Symposium
  - Personal Agents represent Chairs of the Symposium

Online Demo

- http://responder.ruleml.org/
- Use Case Demo Link:
- http://ibis.in.tum.de/projects/paw/ruleml-2007/

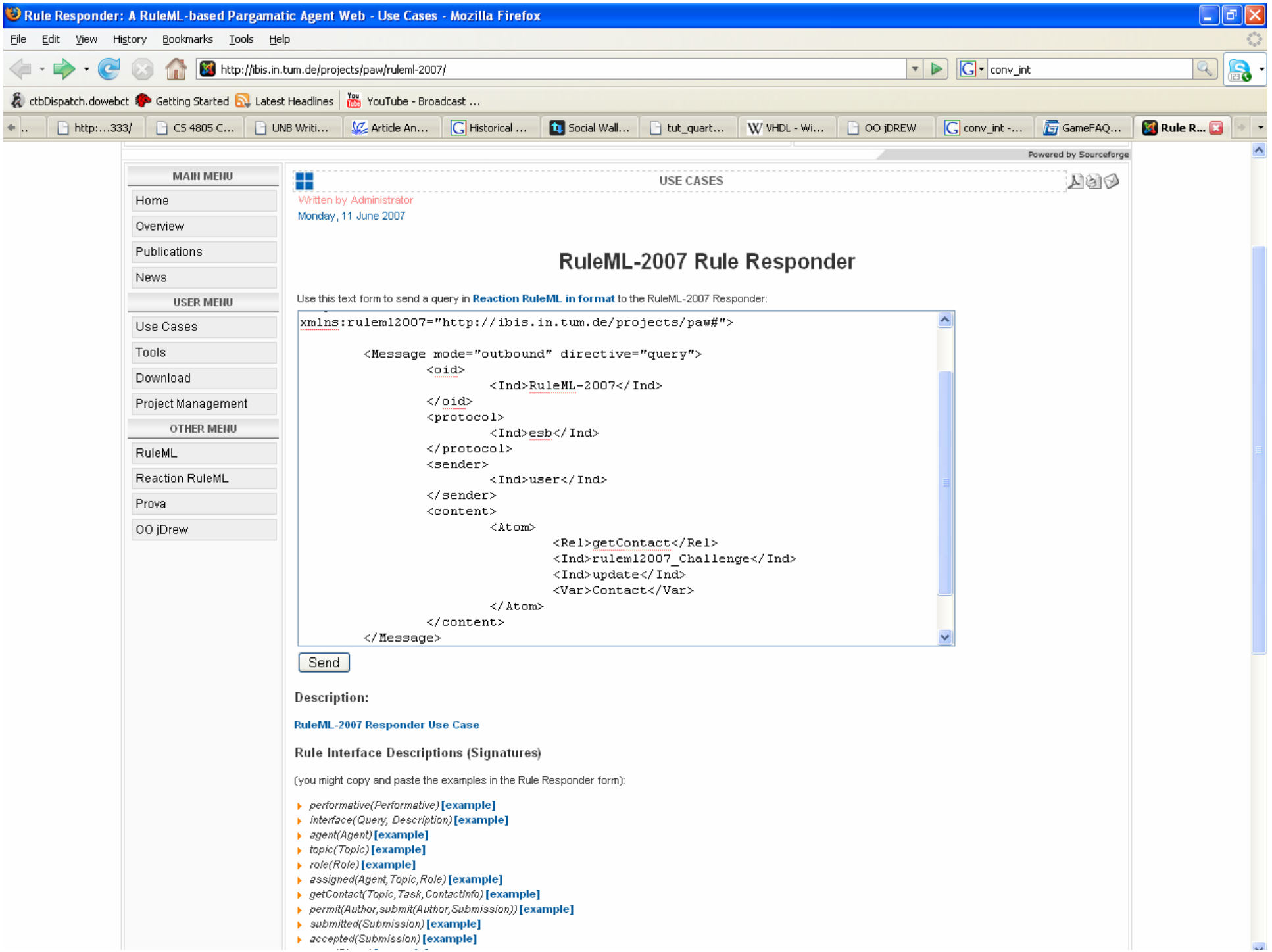
Ex. Personal Agent's knowledge base

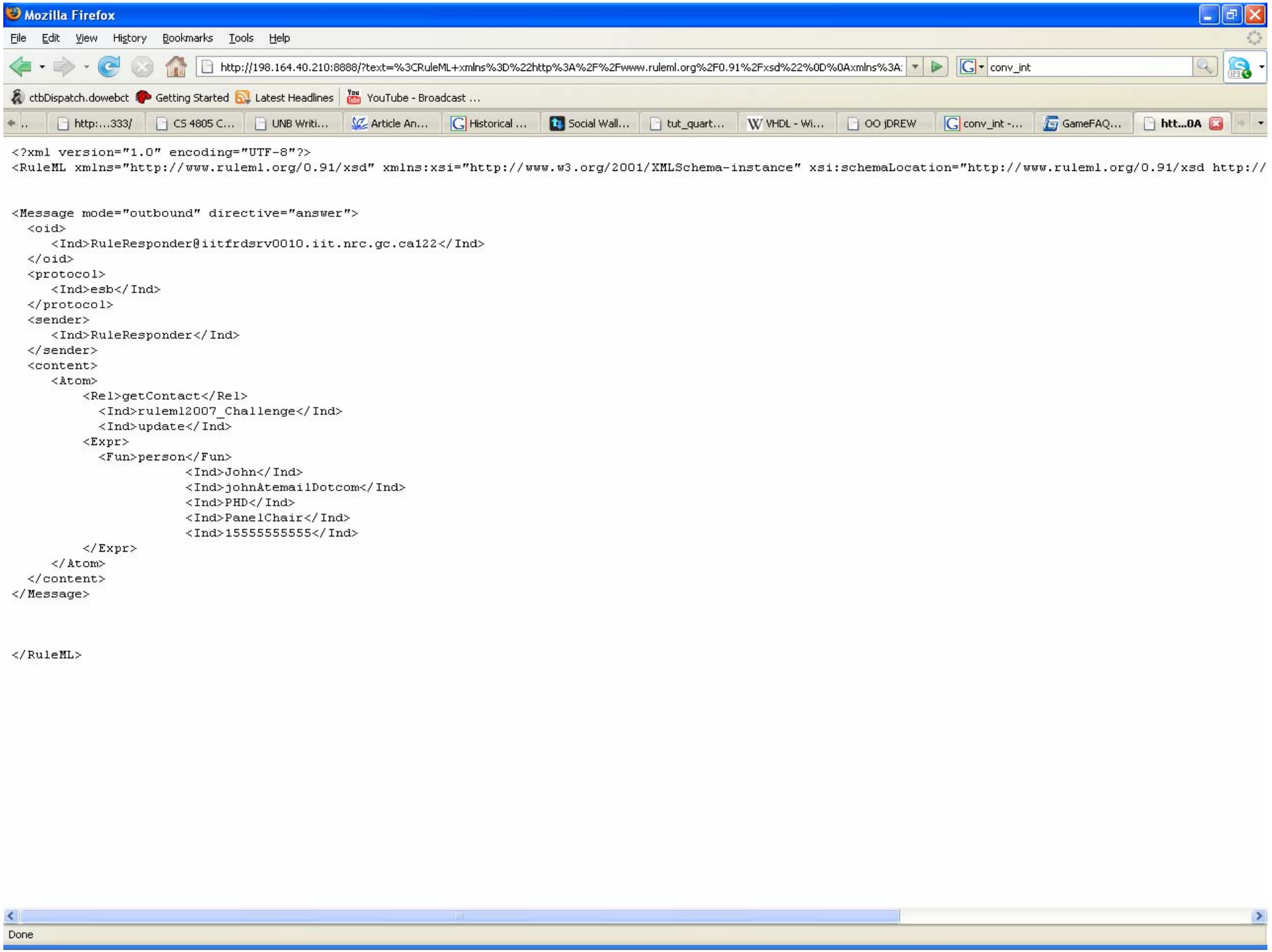
```
% Sample rule POSL syntax
person(?person,?role, ?title, ?email, ?telephone):-
    contact(?person,?email,?telephone),
    role(?person,?role),
    title(?person,?title).
% Sample facts that match the previous rule
contact(John, john@email.com, 1-555-555-5555).
role(John,Panel Chair).
title(John, Doctor).
```

Example Message to the Organizational Agent

```
<RuleML xmlns="http://www.ruleml.org/0.91/xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.ruleml.org/0.91/xsd
http://ibis.in.tum.de/research/ReactionRuleML/0.2/rr.xsd"
xmlns:ruleml2007="http://ibis.in.tum.de/projects/paw#">

        <Message mode="outbound" directive="query">
                <oid>
                        <Ind>RuleML-2007</Ind>
                </oid>
                <protocol>
                        <Ind>esb</Ind>
                </protocol>
                <sender>
                        <Ind>user</Ind>
                </sender>
                <content>
                        <Atom>
                                <Rel>getContact</Rel>
                                <Ind>ruleml2007_Challenge</Ind>
                                <Ind>update</Ind>
                                <Var>Contact</Var>
                        </Atom>
                </content>
        </Message>
</RuleML>
```


Rule Responder: A RuleML-based Pargamatic Agent Web - Use Cases - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://ibis.in.tum.de/projects/paw/ruleml-2007/
conv_int
ctbDispatch.dowebct Getting Started Latest Headlines YouTube - Broadcast ...
Powered by Sourceforge
MAIN MENU
Home
Overview
Publications
News
USER MENU
Use Cases
Tools
Download
Project Management
OTHER MENU
RuleML
Reaction RuleML
Prova
OO jDrew
USE CASES
Written by Administrator
Monday, 11 June 2007
RuleML-2007 Rule Responder
Use this text form to send a query in Reaction RuleML in format to the RuleML-2007 Responder:
xmlns:ruleml2007="http://ibis.in.tum.de/projects/paw#">
<Message mode="outbound" directive="query">
<oid>
<Ind>RuleML-2007</Ind>
</oid>
<protocol>
<Ind>esb</Ind>
</protocol>
<sender>
<Ind>user</Ind>
</sender>
<content>
<Atom>
<Rel>getContact</Rel>
<Ind>ruleml2007_Challenge</Ind>
<Ind>update</Ind>
<Var>Contact</Var>
</Atom>
</content>
</Message>
Send
Description:
RuleML-2007 Responder Use Case
Rule Interface Descriptions (Signatures)
(you might copy and paste the examples in the Rule Responder form):
performative(Performative) [example]
interface(Query, Description) [example]
agent(Agent) [example]
topic(Topic) [example]
role(Role) [example]
assigned(Agent,Topic,Role) [example]
getContact(Topic,Task,ContactInfo) [example]
permit(Author,submit(Author,Submission)) [example]
submitted(Submission) [example]
accepted(Submission) [example]


Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://198.164.40.210:8888/?text=%3CRuleML+xmlns%3D%22http%3A%2F%2Fwww.ruleml.org%2F0.91%2Fxsd%22%0D%0Axmlns%3A
conv_int
ctbDispatch.dowebct Getting Started Latest Headlines YouTube - Broadcast ...
http:...333/ CS 4805 C... UNB Writi... Article An... Historical ... Social Wall... tut_quart... VHDL - Wi... OO jDREW conv_int -... GameFAQ... htt...0A
<?xml version="1.0" encoding="UTF-8"?>
<RuleML xmlns="http://www.ruleml.org/0.91/xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.ruleml.org/0.91/xsd http://
<Message mode="outbound" directive="answer">
<oid>
<Ind>RuleResponder@iitfrdsrv0010.iit.nrc.gc.ca122</Ind>
</oid>
<protocol>
<Ind>esb</Ind>
</protocol>
<sender>
<Ind>RuleResponder</Ind>
</sender>
<content>
<Atom>
<Rel>getContact</Rel>
<Ind>ruleml2007_Challenge</Ind>
<Ind>update</Ind>
<Expr>
<Fun>person</Fun>
<Ind>John</Ind>
<Ind>johnAtemailDotcom</Ind>
<Ind>PHD</Ind>
<Ind>PanelChair</Ind>
<Ind>15555555555</Ind>
</Expr>
</Atom>
</content>
</Message>
</RuleML>
Done

Example Message 2

```
<content>
  <Atom>
        <Rel>sponsor</Rel>
        <Expr>
          <Fun>contact</Fun>
          <Ind>ben</Ind>
          <Ind>nrc</Ind>
        </Expr>
        <Ind type="integer">500</Ind>
        <Expr>
          <Fun>results</Fun>
          <Var>Level</Var>
          <Var>Benefits</Var>
          <Var>DeadlineResults</Var>
        </Expr>
        <Expr>
          <Fun>performative</Fun>
          <Var>Action</Var>
        </Expr>
  </Atom>
  </content>
```

Mozilla Firefox

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CS 4805 C... | UNB Writi... | Article An... | Historical ... | Social Wall... | tut_quart... | VHDL - Wi... | OO jDREW | conv_int -... | GameFAQ... | htt...++ | OO jDREW

```
<?xml version="1.0" encoding="UTF-8"?>
<RuleML xmlns="http://www.ruleml.org/0.91/xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.ruleml.org/0.91/xsd http:


<Message mode="outbound" directive="answer">
  <oid>
     <Ind>RuleResponder@iitfrdsrv0010.iit.nrc.gc.ca134</Ind>
  </oid>
  <protocol>
     <Ind>esb</Ind>
  </protocol>
  <sender>
     <Ind>RuleResponder</Ind>
  </sender>
  <content>
     <Atom>
         <Rel>sponsor</Rel>
         <Expr>
           <Fun>contact</Fun>
                     <Ind>ben</Ind>
                     <Ind>nrc</Ind>
         </Expr>
           <Ind type="integer">500</Ind>
         <Expr>
           <Fun>results</Fun>
                     <Ind>bronze</Ind>
                   <Expr>
             <Fun>benefits</Fun>
                       <Expr>
               <Fun>logo</Fun>
                           <Expr>
                 <Fun>on</Fun>
                                 <Ind>site</Ind>
               </Expr>
             </Expr>
                       <Expr>
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                           <Expr>
                 <Fun>in</Fun>
                                 <Ind>proceedings</Ind>
               </Expr>
             </Expr>
           </Expr>
                   <Expr>
             <Fun>passed</Fun>
                         <Ind>deadline</Ind>
           </Expr>
         </Expr>
         <Expr>
           <Fun>performative</Fun>
                     <Ind>email</Ind>
         </Expr>
     </Atom>
  </content>
</Message>
```
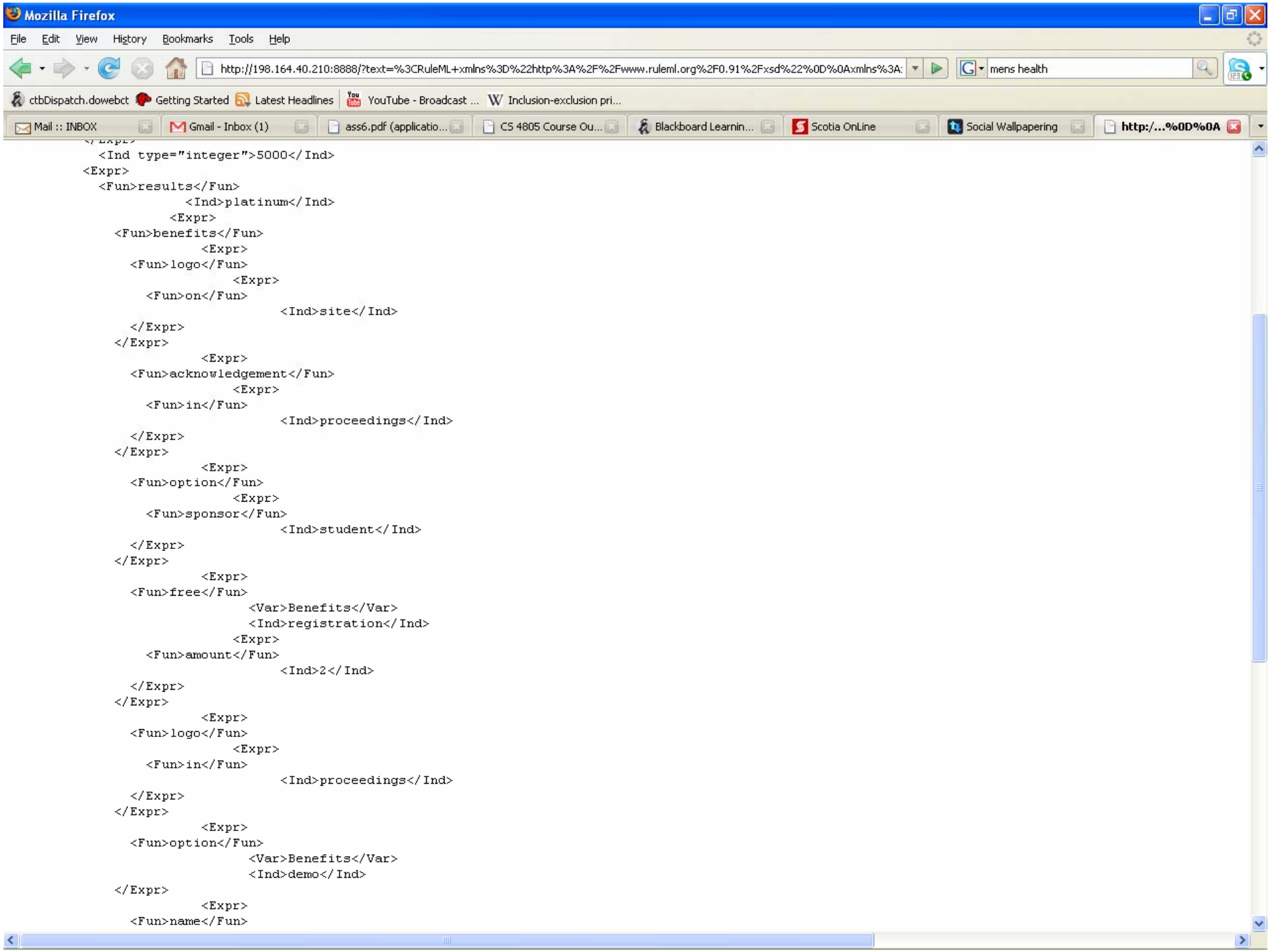

Example Message 3

```
<content>
  <Atom>
        <Rel>sponsor</Rel>
        <Expr>
          <Fun>contact</Fun>
          <Ind>ben</Ind>
          <Ind>nrc</Ind>
        </Expr>
        <Ind type="integer">5000</Ind>
        <Expr>
          <Fun>results</Fun>
          <Var>Level</Var>
          <Var>Benefits</Var>
          <Var>DeadlineResults</Var>
        </Expr>
        <Expr>
          <Fun>performative</Fun>
          <Var>Action</Var>
        </Expr>
  </Atom>
  </content>
```


Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://198.164.40.210:8888/?text=%3CRuleML+xmlns%3D%22http%3A%2F%2Fwww.ruleml.org%2F0.91%2Fxsd%22%0D%0Axmlns%3A
mens health
ctbDispatch.dowebct
Getting Started
Latest Headlines
YouTube - Broadcast ...
Inclusion-exclusion pri...
Mail :: INBOX
Gmail - Inbox (1)
ass6.pdf (applicatio...
CS 4805 Course Ou...
Blackboard Learnin...
Scotia OnLine
Social Wallpapering
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<Ind>site</Ind>
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</Expr>
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</Expr>
</Expr>
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</Expr>
</Expr>
<Expr>
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<Fun>amount</Fun>
<Ind>2</Ind>
</Expr>
</Expr>
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<Fun>option</Fun>
<Var>Benefits</Var>
<Ind>demo</Ind>
</Expr>
<Expr>
<Fun>name</Fun>

Conclusion

- Rule Responder can be used to implement a wide range of use cases that require an intelligent, semi-automated decision layer
- The middleware of Rule Responder allows deployment of multiple running use cases concurrently