WellnessRules2: Supporting Social Semantic Wellness Communities with Rule Responder

Harold Boley, Taylor Osmun, Derek Smith
Institute for Information Technology, National Research Council, Canada
Fredericton, NB, Canada

2nd Atlantic Workshop on Semantics and Services (AWoSS 2)
Moncton, NB, Canada, Nov. 10, 2010
WellnessRules – Idea and Implementations

The **Social Web** (Web 2.0) meets
the **Semantic Web** (ontologies and *rules*)
in a **Social Semantic Web** (Web 3.0):

People advertise their **semantic** profiles
to **socialize** with others in wellness groups

Implemented in [WellnessRules](#) & [WellnessRules2](#)
WellnessRules Overview

- WellnessRules supports a wellness community that is **online-interactive** and **rule-supported**. Each participant of this community has the ability to:
  - **Create profiles about themselves**, containing their preferences for activities and nutrition, their event times, and their fitness levels
  - **Compare and collaborate with others** in the community, to track progress and schedule group events

- Rules about wellness opportunities are
  - **authored** in rule languages such as POSL and N3
  - **interoperated** within the community using RuleML/XML
Global Knowledge Base

- Contains knowledge relevant to everyone in the WellnessRules community

- Knowledge Areas:
  - **Season**
    - Defines timeframe of the seasons
  - **Forecast**
    - Describes the weather forecast within timeframes
  - **Meetup**
    - Contains activity meetup locations for maps

Global Knowledge Base is available in POSL and N3
Local Knowledge Bases

- Contains local knowledge specific to each participant in the WellnessRules community

Knowledge Areas:

- Calendar
  - Used for event planning. Allows for sharing of calendars between profiles

- Map
  - Links to meetup locations. Allows for sharing of maps between profiles

- Fitness
  - Defines expected fitness level for a specific period of time (scale of 1-10)

- Event
  - Possible/Planned/Performing/Past

- MyActivity
  - Derive participants’ individual activity preferences
Local MyActivity Sample Rule (in POSL) — Centered on Participant p0001 as First Argument

myActivity(p0001,Running,out,?MinRSVP,?MaxRSVP,?StartTime,?EndTime,?Place,?Duration,?Level) :-
  calendar(p0001,?Calendar),
  event(?Calendar,?:Running,possible,?StartTime,?EndTime),
  participation(p0001,run,out,?MinRSVP,?MaxRSVP),
  season(?StartTime,summer),
  forecast(?StartTime,sky,?Weather),
  notEqual(?Weather,raining),
  map(p0001,?Map),
  meetup(?Map,run,out,?Place),
  level(p0001,run,out,?Place,?Duration,?Level),
  fitness(p0001,?StartTime,?ExpectedFitness),
  greaterThanOrEqual(?ExpectedFitness,?Level),
  goodDuration(?Duration,?StartTime,?EndTime).

Based on this rule the following are p0001’s preferences for Running outdoors:

- The number of participants must be within the minimum and maximum
- The season must be summer
- It must not be raining outside
- p0001’s fitness level is greater than or equal to the required fitness level
The WellnessRules taxonomy is broken into two topics: Activity and Nutrition
Each of these contains multiple subtopics (e.g., Walking and Running)
Both representations use `rdf:type`, `rdfs:Class` and `rdfs:subClassOf`
Taxonomy classes act as user-defined types to restrict rule variables

RDF (used by POSL)

```xml
@prefix : <wellnessRules#>.
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>.

:Wellness rdf:type rdfs:Class.
:Activity rdf:type rdfs:Class;
  rdfs:subClassOf :Wellness.
:Walking rdf:type rdfs:Class;
  rdfs:subClassOf :Activity.
...
WellnessRules as a Rule Responder

- Rule Responder is an intelligent multi-agent infrastructure for collaborative teams and virtual communities.

- Rule Responder uses three kinds of agents:
  - Organizational Agent (OA)
  - Personal Agents (PAs)
    - PAs extended to select relevant profiles of participants
  - External Agents (EAs)

- The WellnessRules instantiation of Rule Responder employs the OA, PAs, and EAs for communication and query delegation to support an online-interactive wellness community.

  Similar to SymposiumPlanner
WellnessRules Architecture

Legend:
- Data transfer via Mule
- Data transfer from file
- Possible data transfer from file

WellnessRules Website (EA)

Prova Rulebase & Engine (OA)

Activity Group 1 (PA)

Activity Group M (PA)

Nutrition Group 1 (PA)

Nutrition Group N (PA)

Profile Responsibility Matrix

p0001 (Wellness Profile)
p0002 (Wellness Profile)
p0003 (Wellness Profile)
p0004 (Wellness Profile)
p0005 (Wellness Profile)

...
Rule Responder Agents (OA, PAs, EAs)

- External Agent (EA):
  - The WellnessRules website (shown later)

- Organizational Agent (OA):
  - Contains a Prova knowledge base which is used for incoming queries: directs them to appropriate PAs via the Group Responsibility Matrix

- Personal Agent with Profiles (PA):
  - Consists of a Java servlet and – using the two embedded engines, OO jDREW and Euler – forwards the query to POSL and N3 profile knowledge bases, respectively
  - It only has access to profiles which contain relevant information for its responsible activity by using the Profile Responsibility Matrix
Group and Profile Responsibility Matrix

- Role assignment on two levels: Group Responsibility Matrix (GRM) and Profile Responsibility Matrix (PRM).

- The **GRM** contains information about PA wellness responsibility, written as an OWL light ontology. It defines which PA is best suited for different kinds of queries.

- The **PRM** contains information about PA profile responsibility and the format of each profile knowledge base:

  ```xml
  <Activity>
    <Walking>
      <ResponsibleProfile name="p0001" format="posl"/>
      <ResponsibleProfile name="p0002" format="n3"/>
      <ResponsibleProfile name="p0003" format="posl"/>
    </Walking>
    ...
  </Activity>
  ```

PAWalking:
EA used to issue queries to the WellnessRules OA

Query is placed in the text box, in RuleML format

The Send Message will issue the query to the OA

A new screen containing a list of answers in RuleML will be presented

Query examples are provided with their subsequent English descriptions. Can be modified to suit your query

Online Demo: http://www.ruleml.org/WellnessRules/RuleResponder

Sources Used by WellnessRules:
Activity Scenario: Structured English

Introduction:

- In this scenario a participant of WellnessRules (Peter) uses the system to find one or more partners for Running some time in the near future.

Query 1:

- Peter first asks the community if anyone at all is interested in running with 2 to 6 people. Assessing the answer to this, he finds that there are far too many candidates on the list, and decides to narrow down his question.

Query 2:

- He feels that he will continue to have a fitness level of 5 for Running, and so asks a refined question wanting only Level-5 activities. In the answer list he notices p0001 (John), who is someone he has previously performed cycling with. (He finds John's fitness level of 5 for running surprising, as he did not realize he was also a good Runner.)

Query 3:

- Now he wishes to run with John (perhaps in a race?) and so targets p0001, and that he prefers Joe's Gym as the location. Peter now receives a single, final answer on the list, from which he takes the type of running, time, and duration, to contact John for scheduling this event.
Example Query 1

Peter would like to go for a run at some point in time. He poses the following question:

Is anyone interested in general Running (indoors or outdoors), with 2 to 6 people, for any (start and end) time, location, duration, and fitness level?

English Description:

Example Query 1

Peter would like to go for a run at some point in time. He poses the following question:

Is anyone interested in general Running (indoors or outdoors), with 2 to 6 people, for any (start and end) time, location, duration, and fitness level?
Example Query 1 – POSL & N3

**RuleML**

```xml
...<Atom>
  <Rel>myActivity</Rel>
  <Var>ProfileID</Var>
  <Ind>Running</Ind>
  <Var>InOut</Var>
  <Ind type="integer">2</Ind>
  <Ind type="integer">6</Ind>
  <Var>StartTime</Var>
  <Var>EndTime</Var>
  <Var>Location</Var>
  <Var>Duration</Var>
  <Var>FitnessLevel</Var>
</Atom>
...
```

**N3**

```n3
_:myActivity
  rdf:type :MyActivity;
  :profileID ?ProfileID;
  :activity :Running;
  :inOut ?InOut;
  :minRSVP 2;
  :maxRSVP 6;
  :startTime ?StartTime;
  :endTime ?EndTime;
  :location ?Location;
  :duration ?Duration;
  :fitnessLevel ?FitnessLevel.
```

**POSL**

```sql
myActivity(?ProfileID,Running,?InOut,?Duration,?FitnessLevel).  
```
Example Query 2

Peter feels that he will continue to have a fitness level of 5 for Running. He poses the following question:

Is anyone interested in general Running (indoors or outdoors), with 2 to 6 people, for any (start and end) time, location, and duration, at a fitness level of 5?
Example Query 3

Now he wishes to run with John, and so addresses p0001, and that he prefers Joe's Gym as the location. He poses the following question:

- **English Description:**

  Is p0001 interested in general Running (indoors or outdoors), with 2 to 6 people, for any (start and end) time, at Joe's Gym, for any duration, at a fitness level of 5?
WellnessRules will return the answer seen below. This gives Peter all of the information he needs to contact John about scheduling this event.

```xml
<Atom>
  <Rel>myActivity</Rel>
  <Ind>p0001</Ind>
  <Ind>Running</Ind>
  <Ind>in</Ind>
  <Ind type="integer">2</Ind>
  <Ind type="integer">6</Ind>
  <Ind>2009-06-15T10:15:00</Ind>
  <Ind>2009-06-15T11:15:00</Ind>
  <Ind>joesGym</Ind>
  <Ind>P60M</Ind>
  <Ind type="integer">5</Ind>
</Atom>
```

English Description:

p0001 is interested in Running Indoors, with 2 to 6 people, between 10:15AM and 11:15AM on June 15th, 2009, at Joe's Gym, for 60 minutes, at a fitness level of 5.
Google provides a GUI result when you query weather via a Google search. However, an XML API format is also available.

We will use Thursday, October 14th, 2010 as an example:

Google Weather – GUI & XML

GUI

Google

Web Images Videos Maps News Books Gmail more▼

Everything

More

The web
Pages from Canada

More search tools

Weather for Fredericton, NB - Add to iGoogle

About 2,810,000 results (0.27 seconds)

Weather Forecast: Fredericton, New Brunswick - The Weather Network

Get the most updated weather conditions and forecasts for Fredericton, Canada.

weather: fredericton, new brunswick

Weather for Fredericton, NB - 7 Day Weather Forecast - 16 Sep 2010

The Climate and Weather of Fredericton, New Brunswick

The Climate and Weather of Fredericton, New Brunswick - Average D.

Used in the taxonomy of weather conditions

Google Weather In XML for Fredericton, NB:

http://www.google.com/ig/api?weather=Fredericton,NB

<forecast_conditions>
  <day_of_week data="Thu"/>
  <low data="42"/>
  <high data="59"/>
  <icon data="/ig/images/weather/partly_cloudy.gif"/>
  <condition data="Partly Cloudy"/>
</forecast_conditions>
WellnessRules2 takes this XML representation, converting it to POSL and N3, with similar interoperation methods as seen previously.

**XML**

```
...<forecast_conditions>
    <day_of_week data="Thu"/>
    <low data="42"/>
    <high data="59"/>
    <icon data="/ig/images/weather/partly_cloudy.gif"/>
    <condition data="Partly Cloudy"/>
</forecast_conditions>
...```

**POSL**

```
:forecast_109
    rdf:type :Forecast;
    :location "Fredericton, NB";
    :dateTime [rdf:type :DateTime;
        :year 2010;
        :month 10;
        :day 14;
        :hour ?Hour;
        :minute ?Minute];
    :lowTemp 5;
    :highTemp 15;
    :avgTemp 10;
    :conditions :PartlyCloudy.
```

**N3**

```
forecast("Fredericton,NB",
    dateTime[2010:integer,10:integer,14:integer,?
        ?Hour:integer,?Minute:integer],
    5:integer,15:integer,10:integer,?:PartlyCloudy).
```
Current Project will provide an extension to WellnessRules2, which: automatically imports participants’ events from their Google Calendar and synchronizes event facts with the rest of their profiles

Methodology

Increment 1: Servlet to retrieve participants’ Google Calendar event information and display this information

Increment 2: Translator that maps event information to the N3 and POSL formats

Increment 3: Editor to update a participant’s profile
Conclusion

- The WellnessRules case study:
  - Uses a global as well as distributed local *knowledge bases* to support profile interoperation and querying
  - Demonstrates *profile interoperation* between *logic-relational* (e.g., POSL) and *graph-networked* (e.g., N3) knowledge representations
  - Introduces an *extended* Rule Responder *architecture*, adding the *profile level* underneath the PAs
  - Supports *online-interactive wellness communities* via the online WellnessRules/WellnessRules2 ActivityPlanners in Rule Responder
  - This system, described here, was also complemented by a NutritionPlanner and by a PatientSupporter
  - More instantiations upcoming, e.g. a Personal Learning Responder