

RuleML 2013
7th International Rule Challenge

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Grailog KS Viz:
A Grailog
Visualizer for
Datalog RuleML
Using an XSLT
Translator to SVG



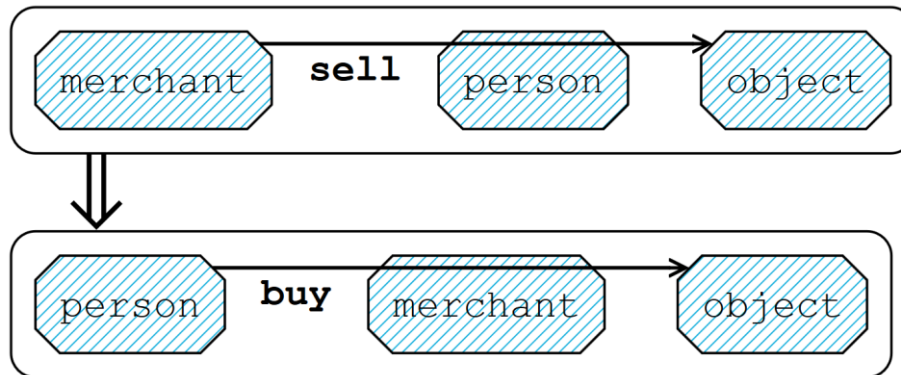
Agenda

- Introduction
 - Graph inscribed logic (Grailog)
 - Approach overview
 - Supported Grailog elements
 - Example
- SVG elements
 - Used elements
- Transformation using XSLT
 - Basic structure of Grailog KS Viz
- Demo
- Conclusion & Future Work

Graph inscribed logic (Grailog)

- Systematic combination of generalized graph constructs for **data & knowledge representation**
- 2-dimensional graph-logic **visualization for humans** in the loop of data & knowledge elicitation, specification, validation and reasoning

Grailog:



- For further information, please see:
<http://wiki.ruleml.org/index.php/Grailog>

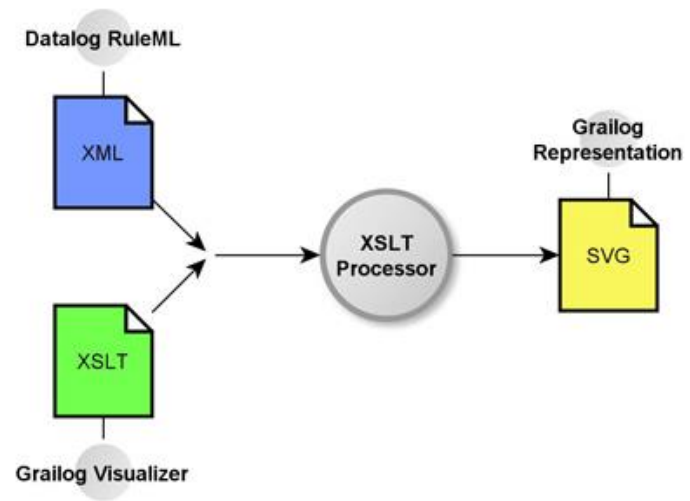
Datalog RuleML:

```

<Implies>
  <Atom>
    <Rel>sell</Rel>
    <Var>merchant</Var>
    <Var>person</Var>
    <Var>object</Var>
  </Atom>
  <Atom>
    <Rel>buy</Rel>
    <Var>person</Var>
    <Var>merchant</Var>
    <Var>object</Var>
  </Atom>
</Implies>
  
```

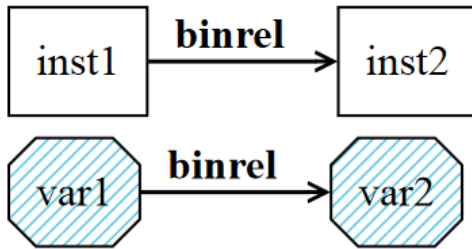
Approach overview

- Initial version of a "Grailog Knowledge-Source Visualizer "
- Mapping from Datalog RuleML/XML, to Scalable Vector Graphics (SVG)/XML:
 - subset to subset
 - target Grailog's "fully node copied " normal form
- Realized by using eXtensible Stylesheet Language Transformations 2.0 (XSLT 2.0)
- **Methodology:**
 - create Grailog representation in SVG
 - create transformation from Datalog RuleML XML to SVG Grailog representation

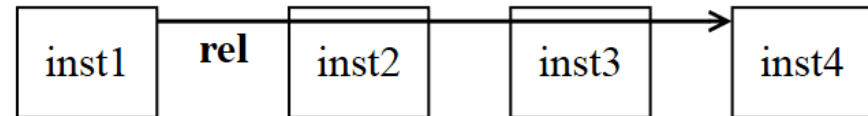


Supported Grailog elements

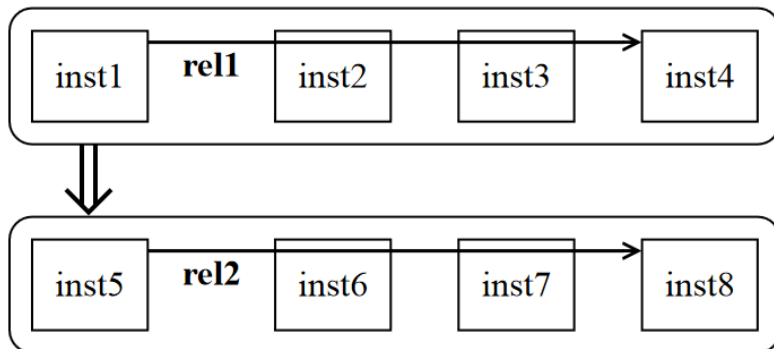
- Binary relations:



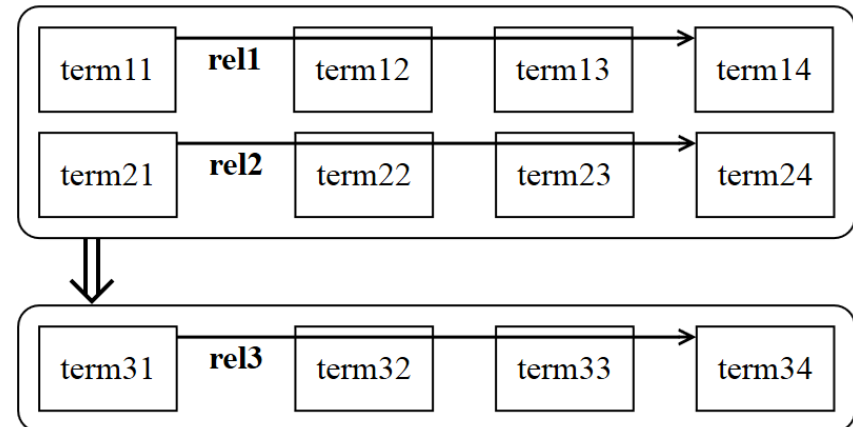
- N-ary relations ($n > 2$):



- Single-premise rules:



- Multi-premise rules:



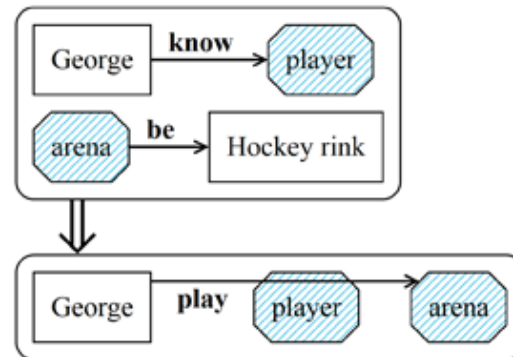
Example

If George knows a player and an arena is a hockey rink, then George plays with the player in the arena.

```

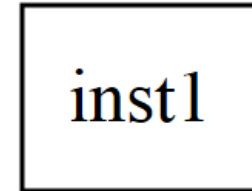
<RuleML>
  <Assert mapClosure="universal">
    <Implies>
      <And>
        <Atom>
          <Rel>know</Rel>
          <Ind>George</Ind>
          <Var>player</Var>
        </Atom>
        <Atom>
          <Rel>be</Rel>
          <Var>arena</Var>
          <Ind>Hockey rink</Ind>
        </Atom>
      </And>
      <Atom>
        <Rel>play</Rel>
        <Ind>George</Ind>
        <Var>player</Var>
        <Var>arena</Var>
      </Atom>
    </Implies>
  </Assert>
</RuleML>

```



Individual constants and variables

- **text**
 - *id, x, y*
- **rect**
 - *id, x, y, rx, ry, height, width, stroke (color, width)*
- **polygon**
 - *id, points, stroke (color, width), style*
- **pattern**
 - *id, patternTransform, x, y, width, height*
- **path**
 - *id, d, stroke (color, width)*
- Lengths of the text elements and positions and scales of the rectangles / polygons were calculated and assigned with JavaScript

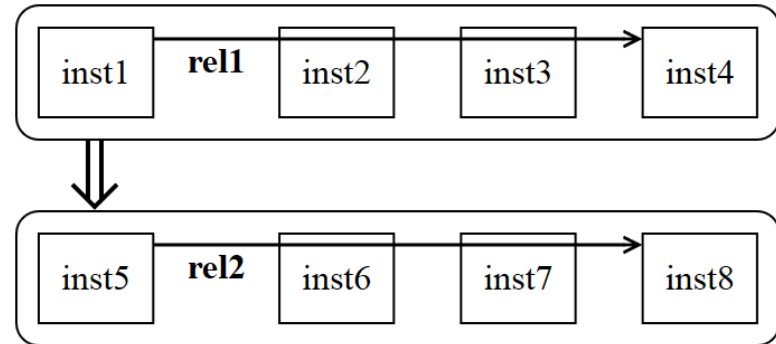


Arrows, double-arrows and rectangles with rounded corners

- **marker**

- *id, markerWidth, markerHeight*

- The arrow is an SVG path element with an arrow head, which is created with a marker element and another path-element, on top
- The double-arrow is created with a path on a particular track
- Positions and scales of these elements were also calculated and assigned with JavaScript



Basic structure of Grailog KS Viz (1)

- Start the SVG file:
 - definitions (id, version, namespace, marker, pattern)
- **Differentiate** between **rules and facts**:
 - searching for <Implies> , <And> and <Atom>
 - using parent and child relationships and positions for determining the type of the considered atom
 - fact
 - single-premise rule: head, single premise
 - multi-premise rule: head, multi premise
- **Differentiate** between **binary and n-ary (n>2)**:
 - using the number of children of an atom
 - used for determining if a simple arrow or an (intermediate-node-cutting) hyperarc arrow is needed

Basic structure of Grailog KS Viz (2)

- **Create unique variable names** for the used JavaScript code:
 - concatenation of the type and the position in the XML tree
- **Create** the needed **SVG elements**:
 - text (with its value from the source file), rect, polygon, path
- **Create** the needed **JavaScript code**:
 - using `<xsl:if>` for alternating the code
 - keeping track of the maximum height and width of the viewBox of the resulting SVG file
- End the SVG file

Demo

Conclusion

- Successful implementation of a **reliable, fast and easy-to-use** tool for transforming Datalog RuleML/XML rules and facts into their corresponding SVG/XML Grailog visualization(s)

Future Work

- **Merging** of the individual SVG elements of rules and facts to one graph
 - ✓ User could directly see connectivity
 - High computational complexity could lead to response-time issues
- **Support** of:
 - unary relations, (positional-)slotted variants and typed variants
 - Grailog visualizers for other rule and ontology languages
- Realization of **inverse translators** parsing Grailog SVG/XML diagrams into RuleML/XML trees
 - ✓ Authoring tool that allows users to visually design rule bases in the graphically rendered SVG representation
 - ✓ Could ultimately lead to a complete Grailog IDE

- (1) Boley, H.: **Grailog 1.0: Graph-Logic Visualization of Ontologies and Rules. Preprint:** <http://www.cs.unb.ca/~boley/papers/GrailogVisOntoRules.pdf>, visited on May 9th, 2013. To appear: Proc. RuleML 2013, Springer LNCS 8035, July 2013
- (2) Boley, H.: **Grailog**. <http://wiki.ruleml.org/index.php/Grailog>, visited on May 24th, 2013
- (3) Boley, H., T. Athan: **RuleML Primer**, August 2012. <http://ruleml.org/papers/Primer/RuleMLPrimer2012-08-09/RuleMLPrimer-p0-2012-08-09.html>, visited on October 19th, 2012
- (4) Boley, H., Athan, T., Paschke, A., Tabet, S., Grosz, B., Bassiliades, N., Governatori, G., Olken, F., Hirtle, D.: **Schema Specification of Deliberation RuleML Version 1.0**. <http://ruleml.org/1.0/>, visited on October 19th, 2012
- (5) Dahlstroem, E., Dengler, P., Grasso, A., Lilley, C., McCormack, C., Schepers, D., Watt, J., Ferraiolo, J., Fujisawa, J., Jackson, D.: **Scalable Vector Graphics (SVG) 1.1 (Second Edition) - W3C Recommendation**, August 2011. <http://www.w3.org/TR/2011/REC-SVG11-20110816/>, visited on October 19th, 2012
- (6) Kay, M.: **XSL Transformations (XSLT) Version 2.0 - W3C Recommendation**, January 2007. <http://www.w3.org/TR/2007/REC-xslt20-20070123/>, visited on October 19th, 2012
- (7) RuleML: The Rule Markup Initiative - Library of Datalog Examples. <http://www.ruleml.org/1.0/exa/Datalog>, visited on June 12th, 2013

Thank you!



Bonn-Rhein-Sieg University
of Applied Sciences

Project website: <http://www2.unb.ca/~mkoch/cs6795swt/index.html>

(The project website provides detailed documentation of the project, concrete examples, the Grailog KS Viz tool to download and further links and information to all related topics)

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Appendix

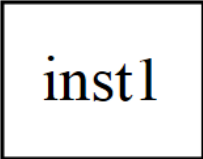
SVG

- Features of SVG used to create the Grailog elements:
 - static graphics
 - text and vector graphic shapes as graphical objects
 - assigning styles and transformations
- All described in XML

JavaScript

- Was essential...
 - to get the lengths of the different texts
 - to scale the elements
 - to position the elements
 - to assign other dynamic features
- The importance of JavaScript was not obvious in the first considerations of the project

Example: individual constant



inst1

```
<svg version="1.1" xmlns="http://www.w3.org/2000/svg">
```

```
<text id="text1" x="50" y="50">inst1</text>
```

```
<rect id="rect1" style="stroke:#000000; fill: none; stroke-width:1;"/>
```

```
<script>
```

```
document.getElementById("rect1").setAttribute("width",  
parseFloat(document.getElementById("text1").getComputedTextLength()  
+ 20);
```

```
document.getElementById("rect1").setAttribute("height",40);
```

```
document.getElementById("rect1").setAttribute("x",  
parseFloat(document.getElementById("text1").getAttribute("x")) - 10);
```

```
document.getElementById("rect1").setAttribute("y",  
parseFloat(document.getElementById("text1").getAttribute("y")) - 25);
```

```
</script>
```

```
</svg>
```

XSLT

- Features of XSLT used to create the SVG Grailog representation:
 - XSLT Elements
 - stylesheet, output
 - apply-templates, template
 - value-of, for-each
 - variable, if, text
 - XSLT Functions
 - current()
 - concat(string, string, ...)
 - not(arg)
 - count(*item, item, ...*)
 - position()
 - last()

Example: individual constant

inst1

```

<xsl:if test="parent::r:Assert">
  <xsl:variable name="countRelations" select="count(preceding-sibling::*) + 1"/>
  <xsl:for-each select="/*">
    <xsl:if test="position()=2"> <!-- First term -->
      <xsl:if test="(ancestor-or-self::r:Ind) or (ancestor-or-self::r:Data)">
        <xsl:element name="rect">
          <xsl:attribute name="id">
            <xsl:value-of select="concat('rect','Relation', $countRelations, position())"/>
          </xsl:attribute>
          <xsl:attribute name="style">
            stroke:#000000; fill: none; stroke-width:1;
          </xsl:attribute>
        </xsl:element>
        <xsl:element name="text">
          <xsl:attribute name="id">
            <xsl:value-of select="concat('text','Relation', $countRelations, position())"/>
          </xsl:attribute>
          <xsl:value-of select="."/>
        </xsl:element>
        <script type="text/javascript" language="JavaScript">
          ... (relevant JavaScript code with adjusted variable names etc.) ...
        </script>
        ... (second term, next terms, last term; each for „Ind“, „Data“, „Var“ and „Rel“) ...
      </xsl:if>
    </xsl:for-each>
  </xsl:if>

```

Difficulties and their solutions

- Support of two different source document versions:
 - Datalog RuleML file without and with RuleML namespace and schema
- Support of all recent major webbrowsers:
 - two different methods for computing the length of the text elements
 - needed for determining the width and position of the graphical elements
 - normal version of the Grailog Visualizer
 - uses *getComputedTextLength()*
 - does not work in Firefox
 - monospaced font version of the Grailog Visualizer
 - uses *XMLSerializer()* and *serializeToString()*
 - does work in Firefox, but not in Safari or Chrome

Supported Web Browsers

- Supported (green) and unsupported (red) Web browsers of the normal version of Grailog KS Viz :

Representation in Browser	Firefox (16.0.2)	Google Chrome (23.0.1271.64 m)	Internet Explorer (9.0.8112.16421)	Opera (12.10)	Safari (5.1.7)
After on-the-fly transformation	not supported	not supported	supported	supported	supported
Retrospectively saved as SVG	supported	supported	supported	supported	supported

- Supported (green) and unsupported (red) Web browsers of the monospaced font version of Grailog KS Viz :

Representation in Browser	Firefox (16.0.2)	Google Chrome (23.0.1271.64 m)	Internet Explorer (9.0.8112.16421)	Opera (12.10)	Safari (5.1.7)
After on-the-fly transformation	supported	not supported	supported	supported	not supported
Retrospectively saved as SVG	supported	not supported	supported	supported	not supported