A Novel SVG Application In UML System Modelling

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Outline

- Introduction
- Motivations
- Aim
- Design and Methods
- Analyses and Evaluations
- Conclusion and Future Works
- Biography
Introduction

- New dimension for collaborative software system development in the face of globalization.
- Software processes outsourcing
  - Reduce escalating software costs
  - Tap into global talent pools
- How can software developers who are geographically distributed get together and collaborate on a software project?
  - Needs a new software tool or development environment
Introduction (cont.)

- **Presentation:** eEEL
  - A thin-client Web-based collaborative CASE tool
  - Supports collaborative software modelling
  - Allows developers to create, discuss, and archive software artifacts in a centralized repository
  - Provides automated rendering of high-quality, resolution-independent graphics of UML visual models in asynchronous mode.
  - Generates only Class, Sequence, and Use Case Diagrams
Motivations

- Two significant factors
  1. The importance of the requirements specification in systems development
  2. The importance of the Use Case Narrative over the Use Case Diagram in UML Use Case modelling.
Motivation #1

The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult as establishing the detailed technical requirements, including all the interfaces to people, to machines, and to other software systems. No other work so cripples the resulting system if done wrong. No other part is more difficult to rectify later.

Brooks, F.P., “No Silver Bullet”, Mythical Man-Month
Motivation #2

- UML experts (e.g., Martin Fowler and Alistair Cockburn) place greater emphasis on Use Case Narrative over Use Case Diagram
  - the sole purpose of Use Case Diagram is to provide a succinct visual context diagram for a system, illustrating external actors and the ways they interact with the system.
Aim

- If more time should be dedicated to writing the Use Case Narrative and less time to drawing the Use Case Diagram, why not devise a mechanism in such a way that the time dedicated to drawing the Use Case Diagram manually is eliminated?
Design and Methods

- Overview of eEEL
- UML Building Block
- Automated Rendering (AR) Mechanism
- Triplet Positioning Algorithm (TPA)
Overview of eEEL

- A pure thin-client Web-based CASE tool that supports collaborative software modelling for geographically distributed software teams.
- A shared, centralized repository system for authorized users to access the contents in eEEL via the Web browser.
- eEEL comes from the aim of the tool as an Online Collaborative CASE Tool.
Overview of eEEL (cont.)

- Functionality in eEEL (8 managements)
  - Access Authorization
  - Activity Notifications
  - UML Diagrams
  - Use Case Narratives
  - Glossary Terms
  - User Comments
  - User Accounts
  - Administration
UML Building Block

- The combination of two identity elements and a binding element – a “triplet”.
- Different UML diagrams have different set of identity and binding elements.
- Some identity and binding elements are unique to particular UML diagrams while some may be shared across many diagrams.
UML Building Block (cont.)

- Each UML diagram is made up of a finite number of identity and binding elements
  - A combination of “triplet” is also finite
  - It is possible to deconstruct any UML diagram and list the corresponding triplets that provide the visual information
  - eEEL use the reversal of the above – the construction of a set of “triplet” to systematically “draw” a UML diagram
AR Mechanism

- 16 processes logically group into 4 categories
  - Preliminary
  - SVG document authoring
  - HTML document authoring
  - Database update
AR Mechanism (cont.)

- Preliminary (User and System)
  1. Create a pool of identity and binding elements (User)
  2. Create a pool of triplets (User)
  3. Create a virtual canvas (User)
  4. Insert triplets into the virtual canvas (User)
  5. Update the virtual canvas version (System)
  6. Generate a unique filename for SVG and HTML documents (System)
AR Mechanism (cont.)

- SVG Document Authoring (System)
  1. Create a SVG document using the unique filename
  2. Write into the SVG document the SVG starting framework (`<svg xmlns ...>`)
  3. Write into the SVG document the definitions of objects and elements (`<defs>...</defs>`)  
  4. Write into the SVG document the positions of objects and elements (`<use xlink:href ... />`)
  5. Write into the SVG document the SVG closing framework (`</svg>`)

- AR Mechanism (cont.)

  ![Image 36x36 to 576x756]
AR Mechanism (cont.)

- HTML Document Authoring (System)
  1. Create a HTML document using the unique filename
  2. Write into the HTML document the HTML starting framework ( <html><body> )
  3. Embed the HTML document into the HTML document ( <embed src ... /> )
  4. Write into the HTML document the SVG closing framework ( </body></html> )
TPA (Class Diagram)

Figure 1. A compendium of four relationships for an itemized class.
Figure 2. An example of UML Sequence Diagram generated from the automated rendering of the UML diagrams.
TPA (Use Case Diagram)

Figure 3. “Virtual” canvas division for the Use Case Diagram in the automated rendering of the UML diagram.
Analyses and Evaluations

- File Size Comparison
- Cross Web Browser Compatibility
- Triplet Positioning Algorithm (TPA) Limitations
### File Size Comparison

<table>
<thead>
<tr>
<th>Graphic Format</th>
<th>Size (KB)</th>
<th>Loss of Colour Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVG</td>
<td>10.2</td>
<td>No</td>
</tr>
<tr>
<td>GIF</td>
<td>14.9</td>
<td>Yes</td>
</tr>
<tr>
<td>PNG</td>
<td>30.8</td>
<td>No</td>
</tr>
<tr>
<td>JPEG</td>
<td>48.9</td>
<td>No</td>
</tr>
<tr>
<td>TIFF</td>
<td>66.2</td>
<td>No</td>
</tr>
<tr>
<td>Monochrome BMP</td>
<td>109</td>
<td>Yes</td>
</tr>
<tr>
<td>16-Colour BMP</td>
<td>434</td>
<td>Yes</td>
</tr>
<tr>
<td>256-Colour BMP</td>
<td>870</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 4. File size comparison for images of different graphics standards for the generated UML Sequence Diagram in Figure 2.
Cross Web Browser Compatibility

- Cross Web browser compatibility experiment
  - XP and Vista platforms
  - Firefox 2.0, Internet Explorer 7.0, Opera 2.0 and Safari 3.1 Web browsers
- Objectives
  - Determine the accessibility of HTML and SVG documents
  - Determine the proper rendering of the content of each type of the documents in two different locations (server and client)
Figure 5: Experiment results for HTML and SVG documents located in the eEEL server.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Browser</th>
<th>Server Files</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Class Diagram</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HTM</td>
</tr>
<tr>
<td>XP</td>
<td>Firefox</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>Internet Explorer</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Opera</td>
<td>2 3</td>
</tr>
<tr>
<td></td>
<td>Safari</td>
<td>3</td>
</tr>
<tr>
<td>Vista</td>
<td>Firefox</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>Internet Explorer</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Opera</td>
<td>2 3</td>
</tr>
<tr>
<td></td>
<td>Safari</td>
<td>3</td>
</tr>
</tbody>
</table>

Legend:
- 0: The document could be accessed and the content of the document could be displayed properly
- 1: The document could be accessed but over-lapping of textual information occurs
- 2: The document could be accessed but the font size of the textual information is larger than the one accessed with the IE Web browser
- 3: The document could be accessed but most of the content is inundated by the background colour
- 4: The document could be accessed but minor alignment disorder for the positions of textual information occurs
- 5: The document could not be accessed
Figure 6: Experiment results for HTML and SVG documents located in the eEEL client.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Browser</th>
<th>Class Diagram</th>
<th>Sequence Diagram</th>
<th>Use Case Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>HTM</td>
<td>SVG</td>
<td>HTM</td>
</tr>
<tr>
<td>XP</td>
<td>Firefox</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Internet Explorer</td>
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<td>0</td>
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</tr>
<tr>
<td></td>
<td>Opera</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Safari</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Vista</td>
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<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Internet Explorer</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Opera</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Safari</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Legend:
- 0: The document could be accessed and the content of the document could be displayed properly.
- 1: The document could be accessed but overlapping of textual information occurs.
- 2: The document could be accessed but the font size of the textual information is larger than the one accessed with the IE Web browser.
- 3: The document could be accessed but most of the content is inundated by the background colour.
- 4: The document could be accessed but minor alignment disorder for the positions of textual information occurs.
- 5: The document could not be accessed.
Cross Web Browser Compatibility

- 5 observable behaviours
  1. The document could be accessed but over-lapping of textual information occurs.
  2. The document could be accessed but the font size of the textual information is larger than the one accessed with the IE.
  3. The document could be accessed but most of the content is inundated by the HTML background colour.
  4. The document could be accessed but minor alignment disorder for the position of textual information occurs.
  5. The document could not be accessed
Cross Web Browser Compatibility

- **ExperimentAnalyses**

1. For the Firefox, Opera, and Safari Web browsers, each Web browser produces the same results for the both platforms and the both file locations. Behaviour #1, Behaviour #2, Behaviour #3, and Behaviour #4 would be further investigated.

2. The Internet Explorer Web browser produces a 100% results for the XP platform but not for the Vista platform. Behaviour #5 would be further investigated.

3. The Safari Web browser produces a near 100% results for the both platforms and the both file locations. Behaviour #3 would be further investigated.
Behaviour #1

- Web browser: FireFox
- Culprit: dy attribute and em type value in the SVG
  `<tspan>` element

```xml
<text ...... >
<tspan>
<tspan x='100' dy='1.2em'>Add</tspan>
<tspan x='100' dy='1.2em'>Administrator</tspan>
</tspan>
</text>
```
Behaviour #1

- Remedy: specify absolute value for \( y \) attribute in \(<tspan>\) element

```html
<text ...... >
<tspan x='100' y='110'></tspan>
<tspan x='100' y='120'>Add</tspan>
<tspan x='100' y='130'>Administrator</tspan>
</text>
```
Behaviour #2

- Web browser: Firefox and Opera
- Culprit: Web browser default font size
- Remedy: Set the default font size to 14
Behaviour #3

- Web browser: Firefox, Opera, and Safari
- Culprit: The HTML `<embed>` tag and `bgcolor` attribute of the HTML `<body>` tag

```html
<body bgcolor='black'>
<div align='center'>
<embed src='....svg' width='...' height='...' type='...' />
</div>
</body>
```
Behaviour #3

- Remedy: Use CSS `<style>` to specify the background colour and HTML `<iframe>` to embed the SVG document

```html
<body style='background-color: black'>
<div align='center'>
<iframe src='....svg' width='...' height='...' type='...' frameborder='0' style='background-color: white' />
</div>
</body>
```
Behaviour #4

- Web browser: Opera
- Culprit: `x` attribute in the SVG `<tspan>` element

```xml
<text ...... >
<tpan>UML</tspan>
<tpan x='100' y='120'>Class</tspan>
<tpan x='100' y='130'>Diagram</tspan>
</text>
```
Behaviour #4

- Remedy: Specify the value for \( x \) attribute in all the SVG `<tspan>` elements

```xml
<text ...... >
<tspan x='100' y='110'>UML</tspan>
<tspan x='100' y='120'>Class</tspan>
<tspan x='100' y='130'>Diagram</tspan>
</text>
```
Behaviour #5

- Web browser: IE on Vista
- Culprit: IE settings
- Other example: http://www.w3cschools.com
- Remedy: reset the IE settings
TPA Limitations

- Class Diagram
  - Unable to generate a composite view (only itemized view)
- Sequence Diagram
  - Unable to provide flexibility in the ordering of the participating objects
- Use Case Diagram
  - Unable to generate a composite view (only itemized view)
  - Incomplete use case triplets categorization (subsidiary use case – subsidiary use case does exist)
Conclusion

- Paper focus: SVG application in UML system modelling in eEEL, a thin-client online collaborative CASE tool, that enables software teams that are geographically distributed collaborate on a software development.
  - Automated rendering of UML diagrams
  - Web-enabled (address the how, when, where of SVG accessibility)
Future Works

- Incorporate other UML diagrams
- Improve the triplet positioning algorithms
- Provide dynamic triplet positioning in composite and itemized views
- Provide interactivity to the generated UML diagram
Biography

- Dr. Sellappan Palaniappan is an Associate Professor with the Information Technology Department, Malaysia University of Science and Technology.
- Louis Ling is a Research Affiliate with the Information Technology Department, Malaysia University of Science and Technology. He is currently with Materialise Software (Malaysia Regional Office) as a Software R&D Engineer.
You have just experienced one of the many potentials of SVG application!

... and keep promoting SVG to be a worldwide-accepted standard!!!!

Thank you!