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## SVG for WebGIS

**Ph.D. Robert SZCZEPANEK**

Cracow University of Technology  
Institute of Water Engineering and Water Management  
ul. Warszawska 24, 31-155 Cracow, Poland  
e-mail: robert@iigw.pl

### Abstract

Scalable Vector Graphics (SVG) format is in development since 1998 by W3C SVG working group. Its specification based on XML grammar makes it excellent, scalable tool for interactive WebGIS creation. SVG code can be easily combined with several web standards (CSS, XSL) and run on resource-limited devices. Several rendering methods like filtering, gradients and animation are included in specification, but not all of them are supported by web browsers. The paper describes practical issues of SVG implementation for web presentation of hydrometeorological data. Rendering of text and graphical elements for presentation of spatial data from automatic monitoring system were tested on leading web browser (Internet Explorer, Mozilla Firefox and Opera). To archive good scalability of web application, SVG embedment in XHTML code was of main concern, not SVG standalone approach. Several methods of embedded SVG image rendering were tested - <object> tag, <embed> tag and <iframe> tag. Some of the presented methods are not recommended, but still in use and working. Native implementation of SVG by web browser in the year 2007 still is far from perfection. None of them ensures full SVG embedded support, but significant progress in recent years should be stated.

**Keywords:** SVG, WebGIS, crisis management

### 1. INTRODUCTION

Not always valuable and mature standard is spread out and supported by commercial companies. One of such standards with long and hard life is Scalable Vector Graphics (SVG). SVG 1.1 standard published in 2003 as SVG 1.1 Specification has many advantages which make it good framework for WebGIS applications. The most important of them are: open standard, scalability, interactivity, excellent documentation, easy to implement grammar and support for DOM. SVG files are XML documents written in plain text, so generated documents are not small, even when zipping mechanisms are implemented on server side. Several other measures like CSS and symbol or marker tags can be implemented to significantly decrease SVG files size.

After almost one decade of development SVG is still not fully implemented by leading web browsers (SVG 1.1 Test Suite 2006). SVG is scalable and can work on many platforms - from Graphical User Interfaces on mobile devices (SVG Tiny) to web based applications. Several vector editors (Corel Draw, Adobe Illustrator) support already SVG. SVG can be combined in one document with Cascading Style Sheets (CSS), Extensible Stylesheet Language (XLS) and many others popular standards. SVG standard can be used in wide spectrum of fields, from simple presentations in mobile phones, cartographic e-documents (Čerba 2006), dynamic and interactive web applications generated on-fly by PHP scripts (Neumann and Winter 2004), to sophisticated 2D animations.

Dealing with web applications there are however few problems related to SVG. First one is the support of SVG by web browsers. At the moment only one popular browser (Opera) supports most of SVG standard. Three main web browsers for October 2007 are (Gemius SA 2007):

- for polish web sites MSIE 61,5%, Firefox 31,6%, Opera 6,0%
- for czech web sites MSIE 70,2%, Firefox 25,6%, Opera 3,2%

Three web browsers were used for research: Microsoft Internet Explorer 7.0 with Adobe SVG Viewer 3.03, Mozilla Firefox 2 and Opera 9. MSIE even in the newest version 7 does not support SVG at all. To display SVG, Adobe SVG Viewer (ASV) plug-in must be installed. The only problem is that

Adobe has announced it will discontinue support for ASV on January 1, 2009. Mozilla Firefox 2 and Opera 9 have native SVG support.

Second problem is how to represent SVG in web browser – as stand alone graphics or graphics embedded in XHTML document. Stand alone graphics are rarely used because several elements of web page should be coded outside SVG object. So embedded SVG seems to be better solution.

Regional system of monitoring for Żywiec County was objective of SVG test implementation. Żywiec region located close to Slovak and Czech border is a perfect place to test interoperable, trans-boundary systems for WebGIS. Most of the data comes from local monitoring system, but some data are automatically gathered from Cieszyn and Bielsko-Biała. System is used for crisis management and for planning and analysis purposes. Measurement data from 28 automatic stations are collected every 10 minutes and transmitted to central database. Web interface contains procedures of automatic refresh of spatial distribution map for several hydrometeorological parameters like air temperature, precipitation depth, wind direction and wind speed.

## 2. EMBEDDING TAGS

First tag to be tested was OBJECT. It is recommended by W3C and supported by new browsers. The disadvantage is that it does not allow scripting. Applied form of SVG map as OBJECT was the following:

```
<object data="map.svg" width="730" height="600" type="image/svg+xml"></object>
```

Microsoft Internet Explorer 7.0 with Adobe SVG Viewer 3.03 had serious problems with embedded SVG. MSIE could not display SVG element due to “unknown coding”. As page was designed mainly for polish users, coding page was set to standard in Poland ISO-8859-2.

```
<?xml version="1.0" encoding="iso-8859-2" standalone="no"?>
```

An alternative could be UTF-8, but web page with this coding also was not displayed by MSIE. Two last browser (Firefox and Opera) displayed SVG element properly (fig.1, fig.2). SVG object was located at left side of browser window. Right side was dedicated to time management and parameters selection.

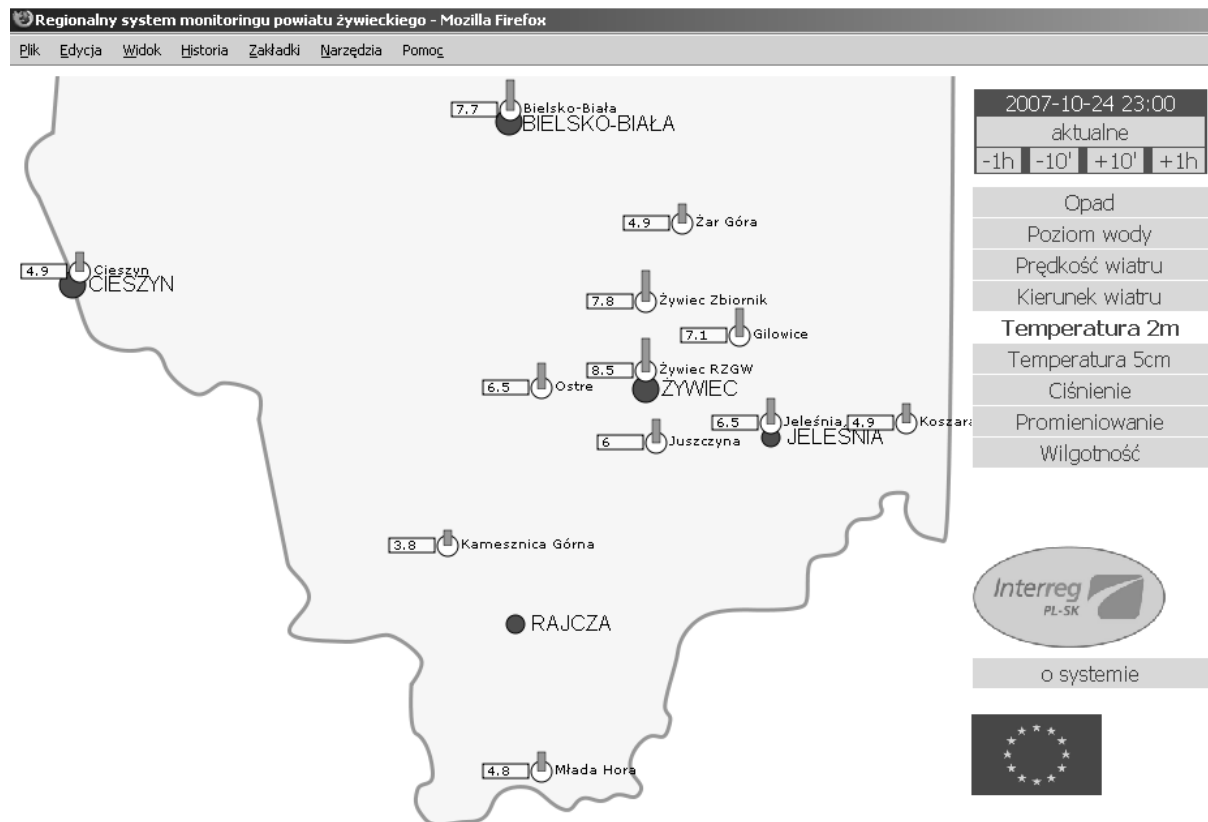


Figure 1. SVG embedded presentation view in Mozilla Firefox 2.0 as object tag and embed tag.

Second tag for testing was EMBED. This method is supported by many browsers and allows scripting. Embed is old style syntax and was never part of HTML standard, that is why it is impossible to create valid XHTML code. Applied form of SVG map as EMBED was the following:

```
<embed src="map.svg" width="730" height="600" type="image/svg+xml"></embed>
```

The only browser able to display this tag was Firefox. MSIE was not able to display web page at all. Opera tried to display page but after few seconds crashed.

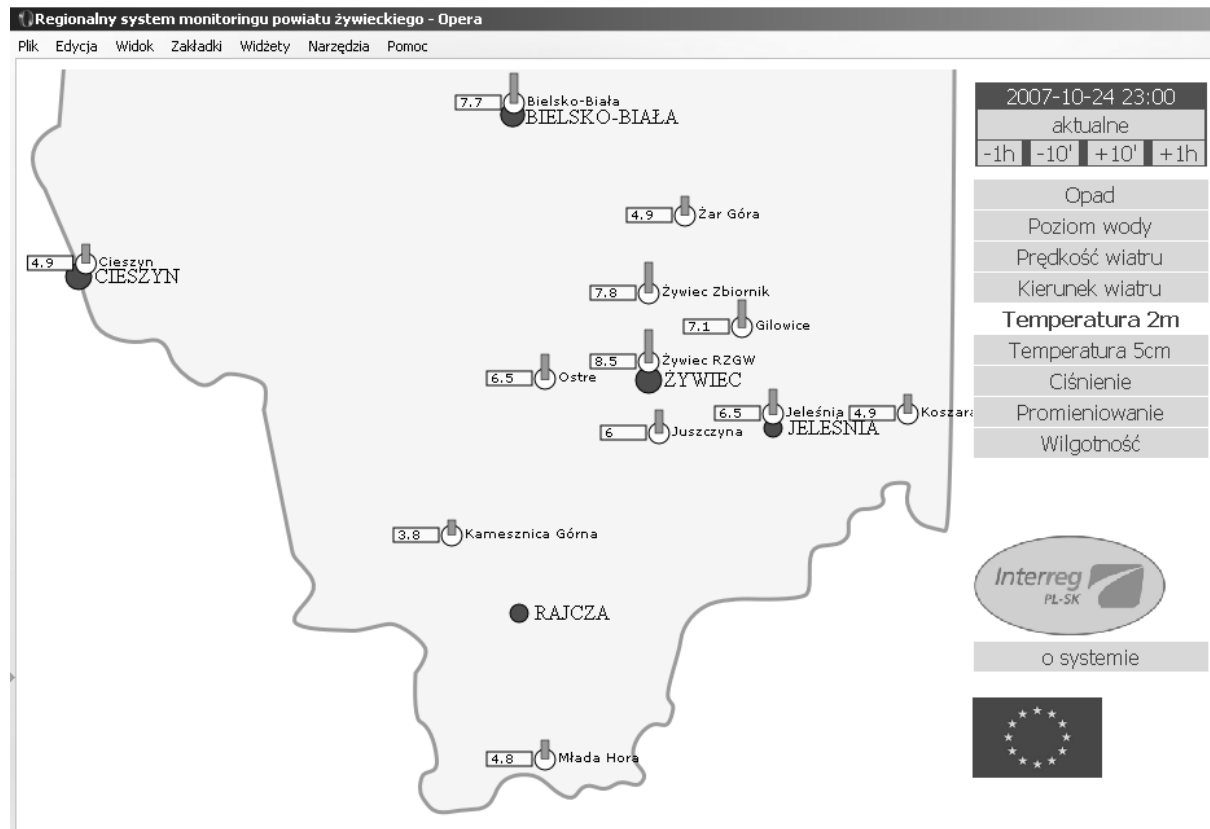


Figure 2. SVG embedded presentation view in Opera 9.2 as object tag.

Third tag for testing was IFRAME. Applied form of SVG map as IFRAME was the following:

```
<iframe src="map.svg" width="730" height="600"></iframe>
```

This tag is not recommended and rarely used for such purpose. Behavior of web browser was similar to EMBED tag, but additionally this tag adds thin border around inserted map.

Test developed by W3C (SVG 1.1 Test Suite 2006) was used as tool for browsers evaluation. This confirmed only problems found working with MSIE+ASV. During this test it was impossible to display embedded SVG in MSIE+ASV. Only stand alone versions were properly rendered. Few of SVG properties implemented in this test was also used to evaluate some features of SVG which could be useful in WebGIS applications. Full set of properties and actions contains 256 elements, but only part of them is important from GIS presentation and interaction point of view. SVG contains properties for coordinate transformation for easy representation of map in SVG viewport, filters for powerful manipulation of images, font and text properties for text management and manipulation, DOM interaction procedures, masking properties, script handling, styling CSS, animation procedures and others.

### 3. INTERACTION

WebGIS is not only display of spatial information but also interaction with user. SVG contains many properties and actions to accomplish such demands. One of the most important is support of

hyperlinking. SVG documents can contain elements with reference to other objects (maps, schemes, web pages). Support of this property is well documented and easy to implement. Example of such hyperlink is shown on figure 3, where circle representing location of monitoring station is hyperlink to web page containing more detailed information about selected meteorological parameter at selected location.



Figure 3. Hyperlinks - part of SVG implementation.

Support of DOM's object model gives developers great access to many elements of web XHTML/SVG presentation. This is usually done using JavaScript.

#### 4. VISUAL EFFECTS

One of basic operations working with map is change of view. The simplest operations are zooming and panning. Support for this basic functionality is different in browsers under investigation. The worst situation is with Firefox which does not offers any functions related to zooming/panning. In Opera and ASV user is able to zoom in, zoom out and pan.

SVG enables drawing of very sophisticated graphical elements including i.a. Bezier's curves. But critical issue related to its XML roots and cartographic objective is how to decrease file size and at the same time facilitate use of repeatable elements. First method is use of CSS to save presentation properties of SVG elements in one place, and second are tags for making graphical symbols which could be then reused. Such library of graphical symbols can be for example set of primitives for wind speed and direction representation (fig.4). Once defined, they can be used several times, making cartographic work faster and more flexible. There are two tags for making such reusable elements – symbol and marker. With marker tag, selected primitive can be rotated in desired direction.



Figure 4. Symbols defining different wind speed and wind direction as SVG symbols.

Several text effects are available in SVG and most of them is well supported by browsers. But sometimes the quality of rendering is not as good as expected. ASV and Opera have high quality rendering algorithm. Problems with text rendering quality are in Firefox. Sample text to path align results are shown on figure 5.



Figure 5. Rendering text to path align in SVG by MSIE+ASV, Firefox and Opera.

Finally, SVG standard contains properties and actions for animation. Some critical information visualised on map can be better visible using dynamic 2D effects. Animation in SVG is extremely easy to implement and powerful. The only problem is optimisation of rendering engines in web browsers, but hopefully it will be improved. Opera and ASV supports selected properties of animation. Firefox is enable to render animations and can display only static elements. Animation effects can be achieved in Firefox by manipulating SVG DOM properties, but probably this is not the proper way of application development.

## 5. CONCLUSIONS

There are many arguments for developers to start implementing SVG in their WebGIS applications. SVG is well documented and relatively easy to implement. Except Microsoft Internet Explorer, other leading web browsers support at least basic functionality of SVG 1.1.

If embedding SVG element in XHTML code, OBJECT tag should be the first one of interest. It is recommended by W3C and well supported by Firefox and Opera. Other methods are not recommended.

Depending on objective, Firefox or Opera are better solutions as interface platform for WebGIS application. Firefox is more fault tolerant while Opera offers more SVG functions and better rendering engine. All browsers support basic interaction with user including hyperlinking and scripting. Symbol and marker tags are useful for cartographic presentations, where many objects must be reused. There are few practical inconveniences of using specific SVG properties, but hopefully next versions of web browsers will fix them.

## 6. REFERENCES

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