Comparative analysis of web animation creation methods

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***Abstract*—** In this paper differences between HTML5/CSS3 and Flash are described. By using these two technologies animations can be created. Animations are great way to bring website to life. With animations interactive elements on the web pages can be created for both desktop and mobile devices. Paper describes both of these technologies in detail. A simple animations were created by HTML5/CSS3 and Flash in order to compare this process. All discovered data are presented in a comparative table and a conclusion was formed from them.

***Keywords*—** Animation, Web Animation, Flash, HTML5, CSS3, ActionScript®

I. Introduction

ANIMATIONS are one of most frequent types of multimedia data, which the users can meet as a promotional material, learning materials, gaming industry, but also an audio and video record on web pages. HTML5/CSS3 is the fifth revision of the HTML standard published by W3C. It is a well known markup language used to developing the web pages. HTML5/CSS3 was created to improve support for the latest multimedia technology. [1]. The second type is Flash and it is a multimedia and software platform from Adobe, that is mainly uses for creating vector graphics, animation, games and Rich Internet Applications (RIAs). Flash uses ActionScript® to code their animations. For playing of Flash animations Flash Player is uses, it is a plug-in for web browsers [2]. On the other hand an advantage of HTML5/CSS3 is a support of nearly all web browsers, it does not require an additional plugin to be installed. Flash is an older technology, as compared to HTML5/CSS3. It was one of the most popular ways to add interactivity, video and animations to the web sites. It is a question that is so popular to stay in tune.

II. Animation

Animations can be considered as a part of the video format. Computer animation is a combination of static and moving images. Each frame of the animation is static image. Animation is a sequence of images that are slightly different from each other and also must be displayed correctly which means in a pre-determined order and with proper frame rate. Animation is uses on web and web applications for creating of better and more pleasant users interface and also as a faster transmition of information than for example written text. There are several ways for creation of animations for the web. In this paper two ways will be descripted. [3].

A. Flash

Flash is a vector graphics tool that is uses mostly for creating of interactive web animations, presentations and games. Flash animations are representing by small file size because they are saved in vector format called SWF (Small Web Format). The Frame Rate should be set around 20 - 25 fps to gain nice and fluent animation.

Flash uses the XML format to communicate with the server-side script (such as ASPX, PHP etc.). Programming language of Flash is an ActionScript®. There are several libraries (classes) in order to simplify creation of animation in Flash repository. Main classes are:

1) ActionScript's® *LoadVars* class is used to work with smaller text files as user passwords or contacts. This class stores the data into the format which is sent to the server. It can be easily read or used to communicate with the server via SQL queries. [4]
2) Flash can play external MP3 files saved on the server. That is performed Streaming – the data are read from the server and played in the same time. The *Sound* class is used for music playing. The class controls the phase in the moment of playing. Due to its attributes it is possible to create a small sized animation with external music or voice. Flash can also play an external video. The playing of FLV videos is similar to playing of MP3 files. These video files are also stored and played from the server. [5]
3) Next two classes used by Flash are *NetSteam* and *NetConnection*. These classes provide connection between the player and source of the animation (camera, FLV file). Another external data that can be used in Flash animation are images. [6]
4) The Flash uses the MovieClipLoader ActionScript® class for loading of images and for controlling of their attributes. [7]

B. HTML5/CSS3

There are Animation, Transition and Transform modules in this tool. These modules are an extension of CSS syntaxes that are supporting in all modern browsers, replacing the traditional roles of JavaScript and Flash. Animations are making your

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websites more visually attractive and CSS3 is one of the best ways to create this animation. All three modules will be described in detail below. [8]

1) CSS Animation

With these kinds of animations, you can define not only the beginning and the end state but also any intermediate states lovingly known as keyframes (see Fig. 1). These intermediate states enable higher control over the motion of images [8], [9].

Keyframes animation starts with animation name, which must be unique. The animation is divided to sequences and these sequences may be specified in two ways [9]. The first is given by declaration:

```
@keyframes animation_name
{
from {left:0px;}
to {left:200px;}
}
```

Second way is specified as percentage in time [9].

```
@keyframes animation_name
{
0%   {left:0px;}
25%  {left:200px;}
50%  {down:100px;}
75%  {right:200px;}
100% {top:100px;}
}
```

If you do not define the start or the end states, it will be interpolate from other states.
You can change many CSS parameters in one animation [9], [10].

```
@keyframes animation_name
{
0%   {left:0px; background:green;
width:150px;}
100% {left:200px; background:yellow;
width:300px;}
}
```

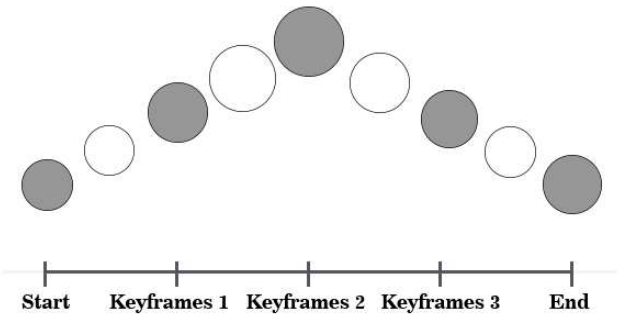

Fig. 1 CSS Animation

2) CSS Transitions

For this type of animation only starting and final state is defined and all movements between these two states is interpolated, see Fig. 2. This method is frequently used for simple animation such as entering of the various objects into the site [11].

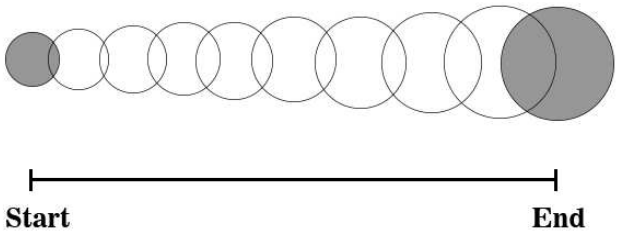

Fig. 2 CSS Transitions

3) CSS Transfrom

A transformation is an effect performing an element shape, size and position change. The CSS transform property allows you to visually manipulate element. There are several different transform functions which applies a different visual effects [11],[12]. These functions are described below:

1) Rotate - The origin of the rotation is at the centre of the element. Positive value of angle rotates the element clockwise, negative value counter-clockwise, see Fig. 3.

```
transform: rotate(angle);
```

2) Scale - This method is used to adjust the size of the element which can be adjusted horizontally, vertically or as a combination of these, see Fig. 3.

```
transform: scaleX(value);
transform: scaleY(value);
```

3) Screw - With the *skew* method the element turns around the X and Y axes by the specified angles, see Fig. 3.

```
transform:  skewX(angle);
transform:  skewY(angle);
```

4) Translate - With the translate method, the element is moved from its current position to a new one determined by the X and Y axes parameters, see Fig. 3.

```
transform:translateX(tx)
transform:translateY(ty)
```

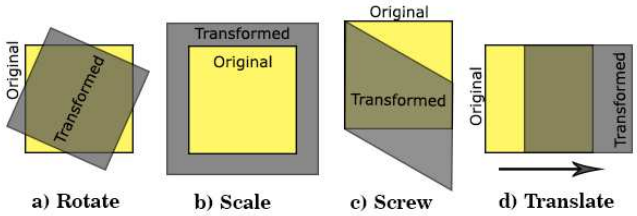

Fig. 3 Transform method

III. COMPARISON OF HTML5/CSS3 AND FLASH

Since Adobe announced the end of support of Flash for mobile devices, the debate has begun whether exists another way to create animations. One of the possible successors is HTML5/CSS3. But this technology has a lot of opponents who do not believe in its potential. Flash does not lose popularity from day to day. On the other hand, HTML5/CSS3 specifications are gaining popularity during a last few years. A huge progress and inclusion of new features allow solving of parts which was addressed by Flash in the past. HTML5/CSS3 has a large advantage in W3C specifications which are implemented in all web browsers. In order to remain main format for web animations Adobe's SWF must adapt market trends. There is growing number of devices running on iOS operating system where the format SWG is not supported. Because of that animation in SWG format must be converted into HTML code. Helpful tool is Adobe Wallaby that are able to converts SWF files into HTML5 format. Same functions is provided by Google Swiff which is a web-based tool developed by Google. Their main goal is to display SWF content on devices that does not support Flash, such as iPhone, iPad, and Android Tablets [13].

Some differences between HTML5/ CSS3 and Flash:

- HTML5/CSS3 does not need plug-in compared to Flash which need an external plug-in.
- Flash does not support from Apple mobile devices, but HTML5/CSS3 runs on Apple mobile devices.
- Flash is more popular for creating animation than HTML5/CSS3.
- Flash uses more CPU power than HTML5/CSS3.
- Most of web-based games are built using Flash.
- The vast majority of browser market now supports HTML5/CSS3 video and animations. [14]

TABLE 1. COMPARISON TABLE OF HTML5/CSS3 AND FLASH [8]

Comparison table		
	HTML5/CSS 3	**Flash**
Desktop operating systems	Microsoft Windows, Apple Mac OS X, Linux	Microsoft Windows, Apple Mac OS X, Linux, Solaris
Mobile operating systems	Windows Phone 8+, Android 2.3+, Apple iOS 6+, Symbian Belle+, BlackBerry OS 7+	Up to Android 4.0, Windows RT
Vector graphics formats	Vector Graphic (SVG)	Small Web Format (SWF) with embedded graphics
Programmig languages	JavaScript	ActionScript®, Pixel Bender
Data formats	CSS3, HTML, XML, JSON	JSON, XML, Subset of CSS1
Data compression	GZIP compression for HTML, JS and CSS files	LZMA or DEFLATE for SWF files
Image formats	PNG, JPEG, Animated GIF	PNG, JPEG, JPEG - XR, Single-frame GIF
Video codecs	H.264 (MP4), ogg/Theora and VP8 (WebM)	Sorenson Spark, On2 VP6, H.264 (MPEG-4 Part 10)
Audio codecs	MP3, Ogg Vorbis, WAV, AAC and WebM Vorbis	ADPCM, MP3, HE-AAC (MPEG-4 Part 3)

A. Analysis of HTML5/CSS3 and Flash animations effectivity

Same simple animations were created in both technologies in order to comparison of their effectivity. A person with ordinary experience in HTML5/CSS3 and Flash was chosen for test performing. This person made this simple animation and after that the particular points was evaluated.

TABLE 2. VIEWPOINTS OF THE TEST

Viewpoints of the test		
	HTML5/ CSS3	**Flash**
File size	36,4 kB	11,9 kB
Time of creation	7 min	4 min
Number of lines	45	15
Knowledge	Knowledge of HTML5 and CSS3	Knowledge of ActionScript® language

The animations were created in two development environments. Adobe Flash Professional CC was used for Flash developing and Microsoft Expression Web for creating of HTML5 code. The total size of the HTML and CSS files is bigger than Flash files. Flash generates only one file (SWF) including source images which is compressed. On the other hand in HTML5/CSS3 the images are stored in original format. Their size is counted in the total size of animation. With other files like CSS styles the total size is considerably bigger. Also HTML5 code is twice longer then the Flash code. Images in HTML5/CSS3 have to be positioned manually, therefore it takes much more lines of code. This positioning of the particular elements in HTML5/CSS3 is more difficult than positioning in Flash. In Flash elements are just pulled on the

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right place from library of sources. It is a possible way to create image with SVG. It is a vector graphic format which generated image with HTML5 code. SVG is a technology, which can enable images to express mathematically. Linear motion is adjustable very simple in HTML5/CSS3 but complicated movement along curve is more difficult.

Also keyframes are added to the animation by CSS3 code as a percentage parameter of animation duration. The testing suggests that HTML5/CSS3 technology is good choice for creation of basic web animations both for desktop and mobile devices. On the other hand Flash stays best choice for advance animations and game developing.

IV. Conclusion and Future Work

Animations can quickly grab attention and increase the visual catchiness. Web animations can be created in several ways. Flash does not lose popularity from day to day. This is a big system that does not include only Flash and Flash player, which are used for creation and playing of animations. There are others software like Flash Builder for the development of games and applications using *ActionScript*® and the open source Flex framework. Adobe AIR (Adobe Integrated Runtime) is a cross-platform environment to facilitate developing applications based on HTML, Flash, Flex and AJAX. Adobe AIR enables developers to package the same code into native applications and games for Windows and Mac OS desktops as well as iOS and Android devices. In all the previous software Flex platform is used which is highly productive application framework intended for creation of expressive web applications that are consistently supported across all major browsers and devices.

By using of HTML5 an appearance of the elements in animation can be changed. In HTML5 are more options for easy animations creation. It can be created by using of the animation transitions to move the element from one place to another. It is also possible to set keyframes for determining of the animation course or transitions between individual keyframes by one of the CSS3 parameters.

Using of Flash is still irreplaceable in this area. But it has to adapt according to a market development mainly represented by mobile devices running on iOS and Android which does not support Flash files. Therefore Adobe is more focusing on usage of HTML5 and CSS3 technologies. Several software programs for transferring of Flash files into HTML5 code were developed.

This paper is focused on the differences between animations creating by using two technologies (HTML5 and Flash). Tests were made with a simple animation which was assessed in several points of view. This study will continue as a deeper research of these technologies for complex animation. There also will be more technologies include in further testing such a JavaScript etc.

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