

POTENTIALS OF SMIL APPLICATIONS FOR MOBILE DEVICES

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Received March 1, 2006
Revised May 30, 2006

The Synchronized Multimedia Integration Language (SMIL) is an XML based language for the synchronization of multimedial content. SMIL can be used to show all kinds of presentations on stationary and mobile devices. For the latter, a subset called SMIL mobile profile is standardized. SMIL has already started to influence certain mobile applications. Worth mentioning are electronic learning and mobile marketing, who both profit from utilizing SMIL presentations. This paper gives an introduction to SMIL. The different modules that establish a SMIL presentation are presented. Afterwards, mobile application scenarios that benefit from the usage of SMIL are shown, including e-learning, mobile communication and mobile marketing.

Keywords: SMIL, mobile Marketing, electronic learning
Communicated by: I. Ibrahim

1 Introduction

Mobile devices have become more and more popular in the last years. The most popular device is the cell phone, which, according to the Forrester statistic, more than 80% of all Europeans owned at the end of 2004 [4]. During the last years, a number of new mobile applications have been developed. Especially, more and more multimedia data is stored on a mobile device. This includes photos, video clips or music files from the build-in camera respectively music player. An interesting application is to create presentations out of these multimedia data. The W3C has defined a standard called SMIL to create such multimedia presentations.

SMIL (pronounced ‘smile’) is an abbreviation for the Synchronized Multimedia Integration Language and an XML based Markup Language for synchronizing multimedia contents as video, audio or text within a presentation. SMIL was developed as an open standard and became a recommendation of the World Wide Web Consortium (W3C) in 2001. In December 2005 the actual version, SMIL 2.1, was published [15].

SMIL has been designed for both, stationary and mobile devices. For mobile devices, the W3C has defined a subset of SMIL 2.1 called mobile profile. SMIL is widespread on mobile devices because it is used in the Multimedia Messaging Service (MMS) on cell phones [10]. MMS is the successor of the popular SMS that can be used to send text messages between

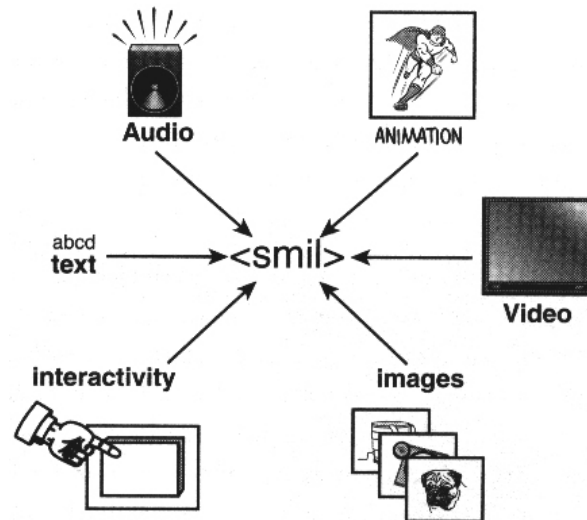


Fig. 1. SMIL can include different multimedia sources like audio, video and text (figure taken from [7]).

mobile phones. With MMS, the messages could include multimedia information like images or sound.

Some mobile applications benefit from the usage of multimedia presentations. These applications include e-learning, mobile communication and mobile marketing. By the usage of SMIL the human computer interface within these applications has been improved.

The aim of this chapter is to introduce the SMIL technology with a focus on mobile devices. The next section gives an introduction to SMIL. The conception of a SMIL presentation is shown in section 3. This section also includes some SMIL examples. Afterwards, different application scenarios are presented that are already utilizing SMIL. Section 5 concludes the paper by providing a discussion.

2 SMIL Basics

2.1 Definition

The syntax of SMIL is quite similar to the Hypertext Markup Language (HTML) [2]. The essential differences to HTML are the new tags for timing and layout in SMIL. The Synchronized Multimedia Integration Language was developed especially for multimedia presentations on the Internet. The word ‘integration’ shows that SMIL does not create media but integrates different multiple media into a single presentation [14]. Figure 1 shows an example where different multimedia sources like audio, video and text are integrated into one SMIL presentation.

Until the introduction of SMIL the provision of multimedia files on the Internet was quite problematical. A user who wanted to watch a multimedia file must have had installed different players on his computer. Guidelines how such a file should be presented were only available from individual manufacturers and did not allow a universally valid style for all players. In order to be able to guarantee a uniform standard also on this range, SMIL was developed.

2.2 Capabilities

A SMIL presentation consists of different medium types such as images, text, sound, and video, which are referenced using URLs. These media types are combined in one presentation and the position, scaling and view part can be set individually. The main advantage of SMIL is the usage of time. All components can change over time, either with or without user interaction. Thus, media can be faded in and out at predefined times or played synchronously next to each other. This is a major advantage compared to static web presentations.

SMIL permits complex multimedia presentations without using script languages like JavaScript. Since no script language is necessary, a SMIL presentation can be easily integrated into a web page. SMIL permits 'Random Access' – the presentation can be started everywhere, only an access to the URLs of the media content must be available.

2.3 Modules and Profiles

SMIL is divided into ten important functional groups of modules. These include the aspects of the temporal description, summarized in the timing and synchronisation module or the effects within a presentation, centralized in the transition module. An overview of the groups of modules with a short description gives the following table:

Group	No. of Modules	Description
Animation	2	Contains all elements and attributes for incorporating animation onto a time line and a mechanism for composing the effects of multiple animations.
Content Control	4	Provides elements to the selection of contents, adjustment and optimization as well as predefined systematical test attributes.
Layout	7	Provides elements and attributes that allow the positioning of media in the presentation.
Linking	3	Defines attributes that can be used to navigate within the SMIL presentation.
Media Objects	7	Contains elements and attributes to include and specify media objects.
Meta information	1	Defines meta information for a SMIL presentation.
Structure	1	Contains elements and attributes to structure a SMIL document.
Timing and Synchronization	20	Defines elements and attributes to coordinate and synchronize the presentation of media over time.
Time Manipulation	1	Introduces attributes which affect the playback so that the playing speed or the playing direction can be manipulated.
Transitions	4	Deals with transition effects in presentations.

Each individual module consists of elements and attributes. A selection of modules can be combined to a profile. Thus one can confine oneself to sub functions when producing SMIL

documents. This is helpful since the entire standard is quite extensive and sometimes not all modules are necessary for an area of application respectively not all clients do support the same functions. In addition, it is also possible to define new profiles and to extend the XML language. A profile is specified by its DTD^arespectively its XML pattern. The W3C Recommendation contains four profiles, which partial were already defined in SMIL 2.0. There is the SMIL 2.1 Language Profile, its subset the SMIL 2.1 Basic Language Profile as well as the new standardized SMIL 2.1 Mobile and the new defined SMIL 2.1 Extended Mobile Profile.

The SMIL 2.1 Language Profile uses the entire set of elements and attributes defined in the SMIL 2.1 specification. This profile is meant for desktop and server systems, that have to support a wide range of media presentations.

The SMIL 2.1 Basic Profile essentially covers the modest language scope of SMIL 1.0.

The SMIL 2.1 Mobile and the SMIL 2.1 Extended Mobile Profile were developed in order to correspond to functionalities of a large range of mobile devices, whereby animations, improved layout and timing functions are the main additions in the Extended Mobile Profile.

In the following section, the most relevant groups and their most important elements and attributes are presented. Note that due to the complexity of SMIL only a small part of the functionality can be presented in this chapter.

3 Conception of a SMIL presentation

3.1 *Syntax*

SMIL possesses many things in common with HTML but also some differences. In contrast to HTML, all tag names and attributes must be written with initial letters. SMIL tags are written in pointed parentheses and can contain several attributes which are separated by blanks. Their order can be arbitrary. Attribute values are always located in quotation marks. SMIL tags are case sensitive.

Like in XML, SMIL distinguishes between simple and double tags. Double tags are formed by an opening and a closing tag, e.g. `<smil></smil>`. Simple tags consist only of an expression and are terminated with a Slash, e.g. `<region/>`. Comments can be inserted at arbitrary places by using the same syntax as in XML.

3.2 *Essential structure*

Figure 2 shows the structure of a SMIL presentation. The XML root element is `<smil>`. Enclosed is the document head, recognizable from an opening `<head>` and a closing `</head>` as well as the body marked by `<body>` and `</body>`. The document head contains information about the physical layout of the medium, in which the SMIL contents are to be shown, and some metadata about the document, e.g. who wrote it or when was written. Moreover, it contains data concerning the individual regions of the presentation and their size and shape. It contains no information for time synchronization of the individual sources of the presentation.

The tag `<root-layout/>` is used within the `<layout>` tag and defines the basic layout of the SMIL window. Attributes for setting the background color or the width and height of the window can be used within this tag. Within a SMIL document only one `<root-layout/>` tag can be used.

^aDTD, Document Type Definition: a declaration in SGML and XML documents, which specifies the structure of such a document.

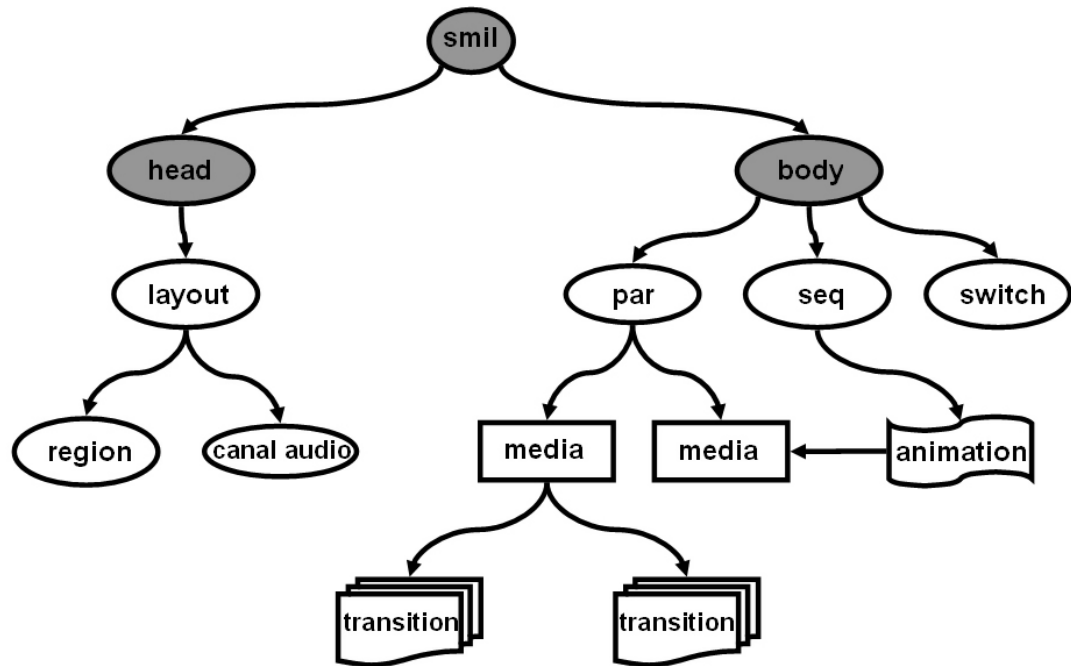


Fig. 2. Global structure of a SMIL presentation

The `<region/>` tag can be utilized to define parts within the `<root-layout/>` where multimedia data is presented. Each part is referenced by an id. Other possible attributes include `left`, `top`, `height` and `width` to specify the appearance window. The values can be indicated in pixels or percent. If several parts are defined, they can overlap. The presentation order can be set by the `z-index` attribute.

A simple example containing the basic tags has the following structure:

```

<smil xmlns="http://www.w3.org/2005/SMIL21/Language">
<head>
<meta name="title" content="1st SMIL example"/>

<!--Layout definition -->

<layout>
<root-layout width="300" height="200"
  background-color="white" />
<region id="image_region" width="216" height="181"
  left="25" top="30"/>
</layout>
</head>
<body>

<!-- Definition of the presentation content -->
  
```

```
</body>
</smil>
```

In the example a display size of 300×200 pixels is specified. The initial position of the window begins 30 pixels below and 25 pixels left within the display. The width and height of the window is set to 216×181 pixels.

The SMIL content is integrated in the `<body>` tag. Different multimedia objects can be combined into one presentation. Besides pictures and text also animations, sound and videos can be used within a presentation. The integration of the individual media objects is made by according tags. The following media objects can be integrated:

Audio files: Using the (`<audio/>`) tag, real media (rm), waveform audio (wav), Apple's audio interchange format (aif), Quick Time sounds (mov) and MP3 files (mp3) are accepted.

Video files: The `<video/>` tag accepts real media (rm), Microsoft Audio Video Interleave (avi), Quick Time movies (mov), Microsoft advanced streaming format (asf), Vivo video (viv) and Mpeg (mpeg) video files.

Image files: By utilizing the `` tag, images in the graphics interchange format (gif), joint photographic experts group (jpeg) format and portable network graphics (png) format can be integrated.

Animations: For animations, the `<animation/>` tag could be used. It accepts macromedia flash animations (swf).

Text files: It is also possible to include text files. This can be done with the `<text/>` tag that accepts ASCII texts (txt).

Text streams: Text streams in RealText (rt) can be included by using the `<textstream/>` tag.

All tags provide a number of different attributes. One common attribute is `src` that indicates the URL of the media location. By using the `region` attribute, a media can be bound to a special region of the presentation window.

3.2.1 Synchronization

SMIL provides two important tags for synchronizing media.

The `<seq>` tag specifies that the containing elements are played in sequence in the same order as they appear in the source code. The `<seq>` tag provides two important attributes: `begin` and `dur`. The source code:

```
<seq>


</seq>
```

defines two images that are shown in sequence. After 2 seconds, the first image (`image1.jpg`) is shown. It is visible for 6 seconds. The second image (`image2.jpg`) is presented after a break of 2 seconds. This image is visible for 6 seconds. The presentation duration amounts to 14 seconds altogether.

The `<par>` tag specifies that its children are presented in parallel. The presentation of all children starts at the same time. In order to show multiple elements at the same time, different regions have to be defined first. Otherwise, all elements would overlap because they would be shown in the same region. The following source code:

```
<par>


</par>
```

defines two images (`image1.jpg` and `image2.jpg`) that are shown in parallel. The presentation of both images is started after two seconds (`begin="2s"`). The first image is visible for 6, the second image for 4 seconds. Note that the images are assigned to different regions (`image_region1` und `image_region2`). The total presentation time amounts to 8 seconds.

The tags `<seq>` and `<par>` can be combined. The possibilities for the combination of different groups and individual elements are almost unlimited.

3.2.2 Switch

In order to be able to adapt the presentation to different clients, the `<switch>` tag can be utilized. Using this tag, a SMIL presentation can react to the conditions of the client. The `<switch>` tag reacts to a number of attributes including the system bitrate, system language, or the number of display colours. The following code:

```
<switch>
<audio src="audio-english" system-language="en" />
<audio src="audio-french" system-language="fr" />
<audio src="audio-german" system-language="de" />
</switch>
```

plays an audio file containing welcome greetings in either english, french, or german language, depending on the client language.

3.2.3 Hyperlinks

Hyperlinks in SMIL are used in a similar way to HTML. They are set using the `<a>` tag. The user can click on a hyperlink to open either internal or external pages. The following example:

```
<a href="video2.rm">
  <video src="video1.rm" region="video_region"/>
</a>
```

creates a link that links the first video (`video1.rm`) to the second one (`video2.rm`). When the user clicks on the first video, it will be replaced by the second one.

SMIL introduces another element that is not available in HTML: The exclusive (`<excl>`) tag. Using this tag, users can define portions of the document that continue playing while other parts change to show the destination of the link. This can be elegantly used to create

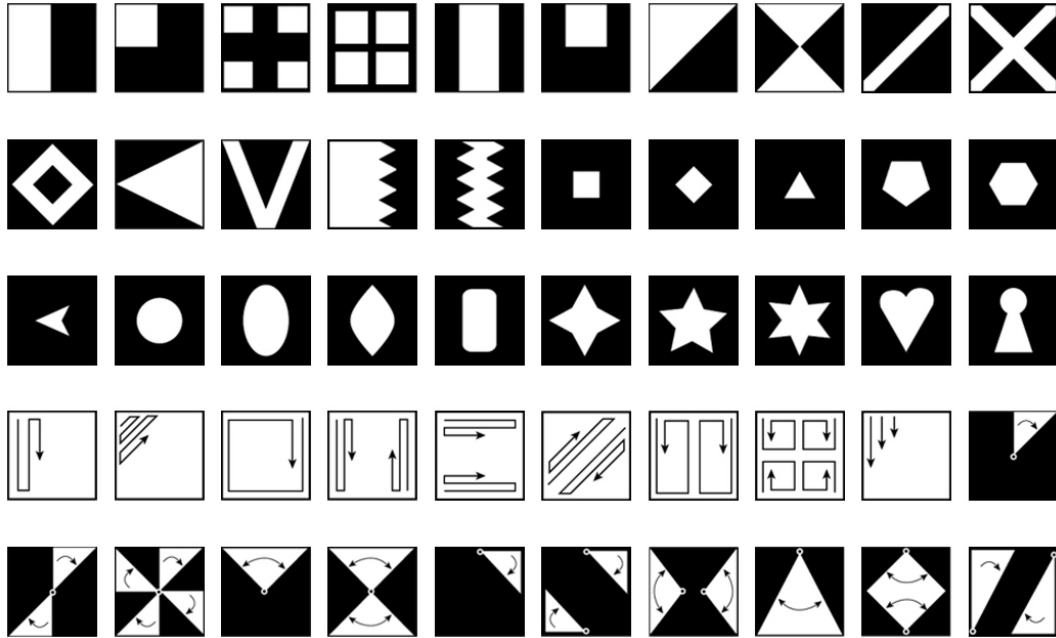


Fig. 3. Some possible transition effects

so called jukebox buttons that users can press in any order to start a subpresentation.

3.2.4 Transitions

Transitions can be used to fade over picture and video files. Each transition is defined in a `<transition>` tag. All `<transition>` tags have to be defined in the `<head>`. A defined transition can be used by a media element. The SMIL standard has defined a large number of possible transition effects. They are shown in figure 3. The following example defines two transitions:

```

<head>
  <transition id="fade1" type="barWipe"
    subtype="leftToRight"/>
  <transition id="fade2" type="miscDiagonalWipe"
    subtype="doubleBarnDoor" />
  ...
</head>
<body>
  <seq>
    <video src="video1.rm"
      transInt="fade1" />
    <video src="video2.rm"
      transOut="fade2" />
  </seq>
</body>

```

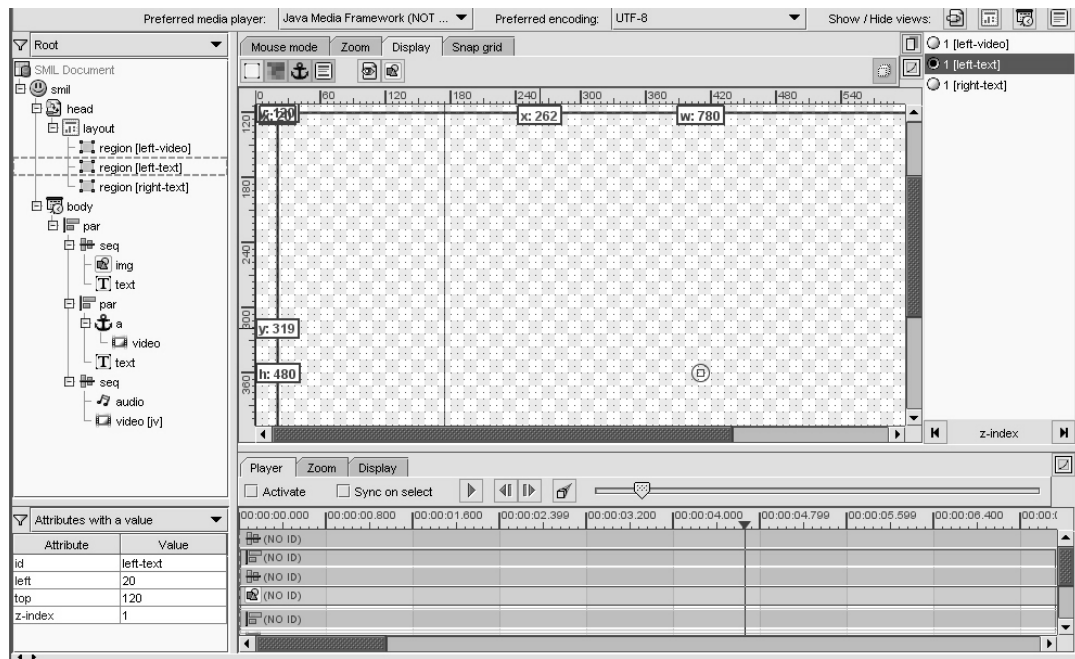



Fig. 4. Main view of LimSee2.

The first transition is of type `barWipe` and has the subtype `leftToRight`. This corresponds to the top-left icon in figure 3. The second transition is of type `miscDiagonalWipe` and has the subtype `doubleBarnDoor`. This corresponds to the top-right icon in figure 3. By using the `transIn` or `transOut` attributes, all picture and video references can specify the transition to use. In the example, the transition `trans1` is played when the first video is shown. The second video is faded out using transition `trans2`.

4 SMIL Applications

4.1 Handling Presentations

For creating SMIL presentations, a number of editors already exist. Some of them are shown in the next subsection. Afterwards, different SMIL players are shown that can be utilized to present a SMIL presentation.

4.1.1 Editors and Authoring environments

A SMIL presentation is an XML file that can be written with a typical ASCII editor. All SMIL files are stored with the ending `.smil` or `.smi`.

Besides ASCII editors, a number of other environments exist. One example is the freeware editor LimSee2. Figure 4 shows a screenshot of LimSee2. To create SMIL presentations with LimSee2, only little SMIL syntax knowledge is required. Additionally, a number of commercial software products support the creation of SMIL presentations. Examples are Adobe GoLive CS2 [11] or the CWI GRiNS Editor [1].

4.1.2 Players

SMIL presentations can be integrated into a web site or stored as a standalone. In the first case, the browser must be able to interpret SMIL. Currently, Internet Explorer 6.0 supports the complete SMIL 2.0 standard. Other browsers like Firefox or Opera provide no or only very limited support.

For standalone presentations, a number of players exist, some of them concentrate on mobile devices. One example is the the PocketSMIL 2.0 ^bplayer of INRIA. Currently, only the free available AMBULANT Open SMIL Player 1.6^c supports SMIL 2.1 including SMIL 2.1 Mobile and Extended Mobile Profiles, as well as the SMIL 2.1 Language Profile. Additionally, this player provides full backward compatibility with SMIL 2.0. Open source builds of Ambulant are available for Win32, Linux, Mac OS X, Win-CE and Win32-Tablet.

4.2 E-Learning

In the area of electronic learning, SMIL can play a major role. The area of E-Learning distinguishes between asynchronous and synchronous activities. An asynchronous activity can be used by the user independently of time (and place). Synchronous activities are bound to a certain date (and location). SMIL is typically used for asynchronous activities.

The work of Rocchetti and Salomoni [13], was one of the first systems that utilized SMIL technology in their so called web based Multimedia Learning Environment (MLE). MLE is a networked educational software application that provides a virtual learning environment in which students and teachers can carry out both asynchronous and synchronous activities. It uses a number of different technologies for presenting the learning content. The following activities were provided by MLE:

Lecture: An electronic lecture can be created by a sequence of electronic slides accompanied by prerecorded audio/video streams.

Virtual laboratory: The virtual laboratory is an environment designed to simulate certain tests to enable a learning-by-doing.

Virtual library: The virtual library contains electronic books that a student can read or print.

Evaluation process: This process is needed to evaluate the student and automatically generate the results.

The MLE system is based on a number of different technologies including HTML, Java, and Java Applets. For a number of services, especially lecture and virtual library, SMIL presentations are used [12].

MLE does not support mobile devices. However, there exist numerous other approaches in the area of mobile learning. Chen et al. [3] propose a mobile learning system for scaffolding bird watching learning (BWL). In this system, each learner is equipped with a PDA containing a wireless network card. The BWL focuses on the mobile ad-hoc network connection that enables students and teachers to work with the same distributed systems.

^bURL: <<http://opera.inrialpes.fr/pocketsmil/>>

^cURL: <<http://ambulantPlayer.org>>

Another mobile learning system that utilizes SMIL is MobiLearn [16]. MobiLearn focuses on creating content that can be displayed on different stationary and mobile devices. To do this, each learning unit is described using an XML document. By utilizing XML transformation languages like XSL the XML document can be converted into various widely used structured document formats like HTML, SMIL or PDF.

4.3 Mobile Marketing

Mobile Marketing [5] is one of the key areas for SMIL. Kotler et al. define mobile marketing as "any paid form of presentation and promotion of goods, services and ideas by well-identified promoters using wireless delivery channels" [8].

Compared to traditional marketing, mobile marketing has a number of advantages. One of the most important one is the interactivity: By using the mobile device as the targeting platform, customers could answer to special marketing campaigns.

Mobile marketing can be separated in two campaign forms:

Pull Campaigns: In a pull campaign, a customer is starting the process by connecting to a company or service provider to receive marketing information. Typically, to motivate the customer, an extended content is transmitted to him. This could include games, special information or lotteries.

Push Campaigns: In a push campaign, a company or service provider sends promotions to selected customers.

Since the beginning, SMIL has been used as the technology in mobile marketing. One of the first applications was done by Hasbro, the company who created the Monopoly game. They sent a SMIL animation to 1000 preselected users. The presentation contained three animated pictures from the game Monopoly with text and sound. The main aim of this campaign was to get more people on the myMonopoly page [6].

The Wella virtual kiss, developed by 12Snap, Germany is another interesting mobile marketing campaign using the SMIL technology. The virtual kiss is a presentation that contains a short kissing animation followed by the sponsor (in this case Wella) message. At the end, the name of the sender is shown. The receiver could transmit the virtual kiss to other friends and replace the original name with his own. The replacement is done by changing some tag contents from the SMIL presentation.

The V-Card application is proposed by Mohr et al. [9] and can be seen as the successor of the virtual kiss. In a first step, the user needs to provide the V-Card server some information about his device and the content he wants to be shown in the final presentation. For this step, an SMS gateway is installed. The user can send a normal SMS, for example:

```
WANTED Rainer uid=0815
```

The example is shown in figure 5. *WANTED* is one of V-Cards predefined styles, *Rainer* and *uid* refer to the receiver of the presentation. The receiver has to be registered in order to receive any SMIL presentations. When the SMS is received by the V-Card server, a parser parses the text of the message and retrieves the relevant data. This data is used to create a presentation. In the example, the style *WANTED* is used. On this style, the name of the receiver (*Rainer*) and the image of the receiver (retrieved from the V-Card database) are set. The final presentation is transmitted to the receiver. V-Card can generate different types of presentations. Another option could be the generation of a jigsaw using an image.

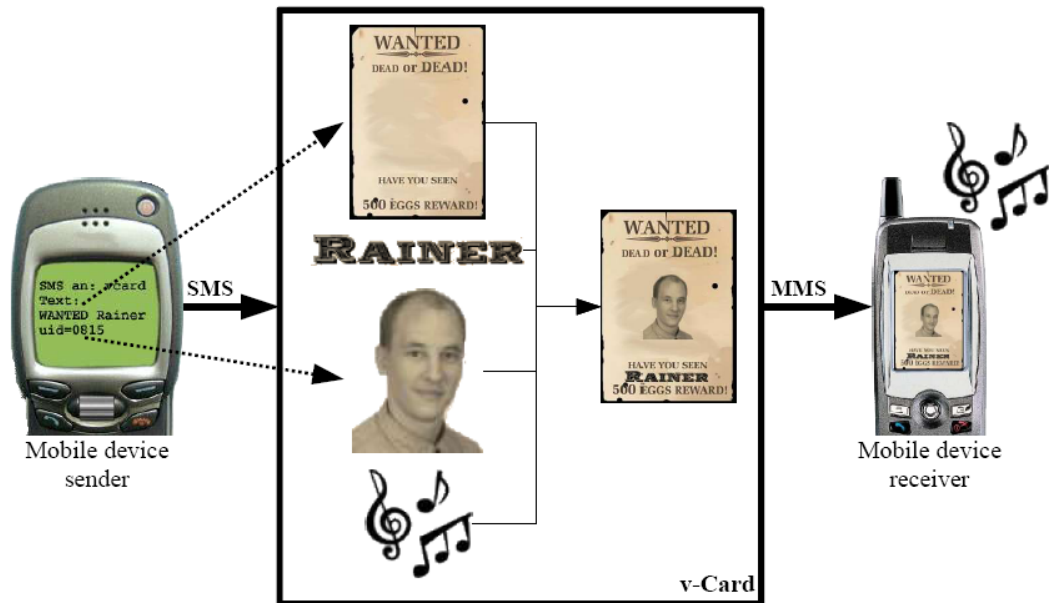


Fig. 5. An example V-card (figure taken from [9]).

One of the main advantages of V-Card is the way the user can generate a SMIL presentation. Instead of a mobile SMIL editor that would be difficult to handle, this solution works by sending simple SMS to a server that need to contain the personalized information used to generate the presentation. SMS could even be replaced by MMS to send multimedia information from the sender to the V-Card. Using this option, a sender could take a photo from a nice place, create an MMS out of it, add some more information to this MMS and send it to the V-Card server. The V-Card server could use the taken picture to create a presentation.

5 Discussion

The SMIL 2.1 standard makes high featured multimedia presentations on mobile devices possible. As all new mobile phones already include a SMIL player to present MMS messages, there is great potential for SMIL based mobile applications. Some possible areas, including electronic learning and mobile marketing, were addressed in this paper. For generating presentations, SMIL has a number of advantages compared to other approaches:

- It is easy to generate a SMIL presentation. All SMIL presentations are XML files that can be edited with a simple text editor.
- SMIL supports a wide range of different media objects that can be integrated in a presentation. Additionally, the presentation can be made interactive by the usage of hyperlinks.
- SMIL is optimized for lower memory and lower bandwidth devices like mobile devices. A SMIL presentation does not include media files but contains only references to these files. All media files have to be loaded only once and when they are needed. By using interactive presentations, it is possible that certain media files are not loaded at all.

However, SMIL has also some disadvantages. These include:

- All media file sources have to be available. When a media file is deleted, a SMIL presentation that references this file is not running correctly any more.
- Although SMIL is a standard, not all players have implemented all modules. This could lead to presentations that could not be executed on certain players.
- The presented SMIL tools to generate new presentations are somewhat limited. This could change in the future.

Despite these disadvantages, SMIL could become a major technology in the future. Other application domains like mobile help systems or multimedia applications could benefit from SMIL presentations.

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