Pervasive Multimedia Markup Language (PMML): an XML-based multimedia content specification for pervasive access

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ABSTRACT

With the rapid development of the Internet based connection to different devices such as PDA, WAP phones, and pagers, one-document-many-presentation has become a converging issue in the development of various markup languages for description of content and presentation. Many works have been done in this area while few of them consider the issue of rich media. To address it, this paper proposes the Pervasive Multimedia Markup Language (PMML), an XML based notation for specifying rich media content without making any assumption on the capability of the viewing devices.

Keywords

PMML, Pervasive, Transcoding, Multimedia.

1. INTRODUCTION

Internet has been extended rapidly to pervasive access. Diversely, each pervasive device processes a different combination of characteristics, such as CPU power, screen size, data transfer rate, and user input interface. Hence, to deliver a content, the presentation has to be tailor-made for every target device to suit its format and features. It not only incurs the overhead on the content authoring, but also hinders the dissemination of information over the pervasive platforms.

Therefore, it is most desirable to have only one single document for a content, and be able to create automatically the appropriate presentation for any specific device upon request [1]. Researchers, such as Chandra [2], Han [3] and Bharadvaj [4] utilize transcoding proxies to provide differentiated Web services to different clients based on their device parameters and the network characteristics. Another approach is based on content annotation techniques [5, 6]. Existing contents, say HTML documents, can be annotated with meta-information to facilitate semantic content analysis and adaptation to formats of other device types. Mohan [7] provides a framework in which transcoding policies can be formulated and analysed.

While many works have been done, few of them focus on the issues of rich media. In this paper, we extend our work [1] and propose the **Pervasive Multimedia Markup Language (PMML)** as a notation for multimedia content specification under the one-document-many-presentations consideration.

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2. PMML FEATURES

PMML has to capture only the device-independent content that is necessary and sufficient for producing the presentations for individual devices. To address such requirement, PMML is designed with three features:

1. Multi-modality: Different devices are designed with different presentation powers. Therefore, the markup language should be powerful enough to allow the content author to describe a content such that it can be adapted to different presentation modalities according to the device capability.

2. Multi-quality: Due to the limitations of computing power, network bandwidth and screen size of the client device, we may have to downgrade the details or quality of the content before transmitting it to the client. Therefore, the markup language should allow the content author to describe how to downgrade the content quality according to the device's presentation power.

3. Device-independent formatting: To create an aesthetic presentation, the author may like to specify how s/he wants the images and the text objects to be positioned. On this, PMML is designed to allow the author to specify the size and positioning of the content objects without making any presumptions on the screen size.

2.1 Multi-modality

It is important not to forfeit the integrity of the content when adapting it to different pervasive devices. We exploit alternative media formats or modalities when encoding multimedia content to meet the goal. For instance, a video clip can be played with selected image frames, augmented with transcribed text in place of the audio script. While a panorama would require a moderately powerful CPU, the presentation can also be done with one or a couple of images when coping with low-CPU devices. Therefore, our strategy is to transform the content among different modalities to suit the device in its video, audio and graphics handling capabilities.

PMML provides an *altmodal* attribute for all the multimedia tags to resolve the multi-modal issue. The following PMML script states how to specify multi-modal by the *altmodal* attribute. It states that if the panorama is not supported by the device, the multimedia (an animation sequence) specified in "living_anim.pmml" is presented as an alternative.

```
<panorama altmodal="living_anim.pmml">
<photo src="living_room.jpg" />
<script src="living_room.au" transcript="The living room is furnished in a contemporary style" />
</panorama>
```

Additionally, even if the designer does not specify any value for the *altmodal* attribute, multi-modality can still be achieved based on the cross-modal adaptation as illustrated in Figure 1. In the horizontal dimension, a video can be transformed into an image animation sequence, or an audio can be transcribed into text.

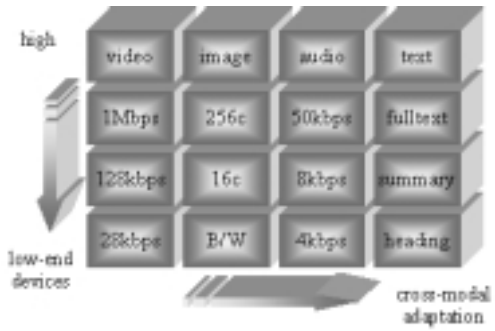

Figure 1: Modality and Quality Transformation Matrix for Multimedia content adaptation

2.2 Multi-quality

In the case that the device has the ability to show a particular type of rich media, the quality of the result may depend on the resolution, the bandwidth, as well as the computing power of the device. Based on the level-of-detail adaptation in Figure 1, the content can be adapted to different detail or resolution automatically depending on the ability of the device. In addition, PMML provides the *altlod* tag and the *importance* attribute which allow the designers to control the presentation quality.

Using the *altlod* tag, the designer specifies multiple ways of presentation for a particular content. The transcoder will choose the best way based on the device's capability. The following PMML script gives a panorama in two levels of detail.

```
<panorama>
<altlod>
<photo src="high_res.jpg" />
</altlod>
<altlod>
<photo src="low_res.jpg"/>
</altlod>
</panorama>
```

The *importance* attribute is more semantic oriented. The designer can specify the importance of each individual segment in the content. Depending on the capacity of the device, the transcoder can remove any segment which is relatively unimportant. The following PMML script demonstrates how we use the *importance* attribute. When the device is powerful enough, the script shows the heading together with the two paragraphs. In the worst case, it only shows the heading.

```
<h1 importance="essential"> PMML</h1>
<paragraph importance="important">
<em>Abstract</em>: This paper proposes the PMML, a notation for specifying rich media content ...
</paragraph>
<paragraph>
Information access on the Internet or the World Wide Web is no longer restricted to the browsers on PCs ...
</paragraph>
```

2.3 Device-independent formatting

Apart from multi-modality and levels of detail, another important issue is to enable the designer to tailor-make the look and feel of the presentation. This has been studied in many other markup languages like HTML. However, most of them make assumptions on the capabilities of the presentation device. In contrast, PMML aims to provide device-independent tags. These tags handle the formatting specification irrespective of the screen size in the following aspects:

1. Font size: PMML provides 6 relative font sizes, namely **tiny**, **small**, **normal**, **large**, **very large**, **huge**.
2. Size and position of rich media object: PMML provides 3 tags, namely *bigicon*, *smallicon* and *plate* tags for the layout of rich media objects. Relative size and positioning are specified with the *width*, *aspect* and *align* attributes.
3. Serialization of table: PMML specifies adaptable table layout using the *importance* attribute. However, if the device is incapable of showing a table altogether, it will show the serialized form.

3. FUTURE WORKS

In a project conducted at our Institute, we have implemented the transcoders for PMML. Our next step is to further develop the PMML transcoding system so that it is able to (i) extract the client's device capability, and (ii) obtain the user's preference from the respective profiles. Given that both aspects are handled well, we are able to present a PMML document fully meeting the personalized user requirements and making best use of the specific device capabilities.

4. REFERENCES

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