

# Multimedia Messaging Service Adaptation for the Mobile Learning System Based on CC/PP

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## ABSTRACT

It becomes enabled to provide variety of multimedia contents through mobile service with the development of high-speed 3rd generation mobile communication and handsets. MMS (Multimedia Messaging Service) can be displayed in the presentation format which is unified the various multimedia contents such as text, audio, image, video, etc. It is applicable as a new type of ubiquitous learning. In this study we propose to design a mobile learning system by providing profiles which meets the standard of CC/PP and by generating multimedia messages based on SMIL language through the adaptation steps according to the learning environment, the content type, and the device property of learners.

**Key words:** MMS, adaptation, m-learning, CC/PP, DOM

## 1. INTRODUCTION

With the development of high-speed wireless network system and the related terminal units, the first generation analog service is enhanced to the present 3rd generation mobile communication environment which enables transmitting not only the text but also the audio and moving images. The users, who already experienced the various multimedia contents through wired environment, now wants to experience the same services through their wireless environments. 3GPP and WAP Forum defined MMS which is the new format of messaging service that can be serviced though not only the existing network but also the 3rd generation wireless network [1,2].

MMS supports all of the current types of me-

dia(text, audio, image, video, etc) and all supports the media types which will have come in the future, thus it can be used not only for the personal communication, wireless navigation service, video news, advertisement, but also for the educational purposes. The interest for the ubiquitous learning environment is increasing in the current market, thus MMS can be applied as a new type of learning method. For this, however, the system needs to apprehend beforehand the heterogeneous environments such as learner's various device capabilities, network environments,

To provide the personalized service, it is needed to be provided beforehand the standardized profile for learners' environments, and also MMS which is exclusively adapted on the environments accordingly.

In this paper, the author proposed m-learning system that satisfies the conditions below, to provide adapted MMS for learners' environments. (1) establishes and manages the learners' information by database, (2) supports learners' profiles based on CC/PP, (3) selects appropriate multimedia contents for each learner's device, (4) generates MMS based on the SMIL language, (5) divides the learning situation to the dynamic and static, (6) re-

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organizes presentation forms either by singular or multiple contents, and (7) creates MMS by resizing so it can fit to the learner's device.

## 2. RELATED WORK IN CC/PP FOR MMS ADAPTATION

### 2.1 CC/PP

CC/PP(Composite Capability/Preference profiles) is a file that includes information about hardware, software, network, application service, etc. It is a standard for the server or contents providers to provide contents which satisfies the demand from the clients, and it explains how to modify the contents to meet with each client's preference [3]. There are UAProf(User Agent Profile), which defines the expanded framework which is to clarify and transmit the capacity and preference of terminal device, user, network, and UPS(Universal Profiling Schema), which is proposed for contents access and multimedia contents application at the Opera project of INRIA. UPS also has same format with UAPROF by satisfying the CC/PP standard, but it uses different words, thus the name of each property is differentiated [3,4,5].

### 2.2 MMS

The new messaging service, MMS(Multimedia Messaging Service) is supported at the existing

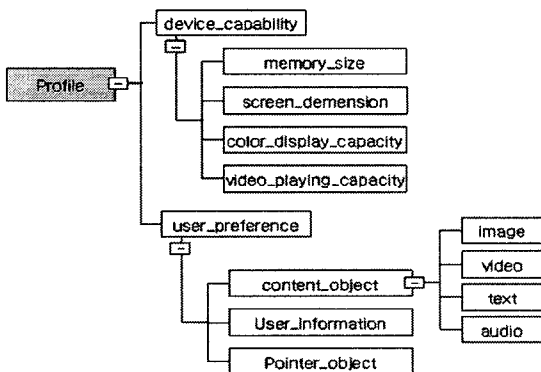


Fig. 1. Sample CC/PP profile

Table 1. Multimedia formats of MMS

Multimedia	Format
Text	AscII, ISO8859, UTF-8, UTF-16, etc
Image	JPEG, GIF, PNG, WBMP, BMP, etc
Audio	AMR, EVRC, QCELP, MIDI, etc
Video	MPEG4, H.263
synchronization	SMIL

and the 3rd generation wireless network to provide variety of multimedia service, led by 3GPP and WAP Forum. MMS is able to display various types of multimedia such as text, audio, image, video etc in the slideshow format which has multiple slide form, and it also enabled the actual ubiquitous messaging service with the internet e-mail system and MMS message exchanging system [2]. Table 1 shows multimedia formats enabling in MMS [6,7].

Multimedia message languages based XML is standardized to express MMS and the representatives are XHTML, SMIL, SVG, etc. SMIL enables unification and synchronization of multimedia, controls multimedia data type such as audio, video, text, image, etc, and enables the production of contents which is to be delivered to the users and the high-quality multimedia presentations [6].

### 2.3 Contents Adaptation

In the 3rd generation mobile communication, the mobile devices such as PDA and cellular phones become more diversified and more effective, so they are used broadly in the living circumstances. Users are demanding to use the plentiful and various contents just as they do in their desktop computers, but the services are limited due to the capabilities, preferences, bandwidth, etc of the user devices[8,9].

To provide appropriate contents for the characteristics of the users' devices and constraints, the adaptation process is required. Fig. 2 shows the varying capabilities of some MMS capable handsets available in the market today[9]. Currently the

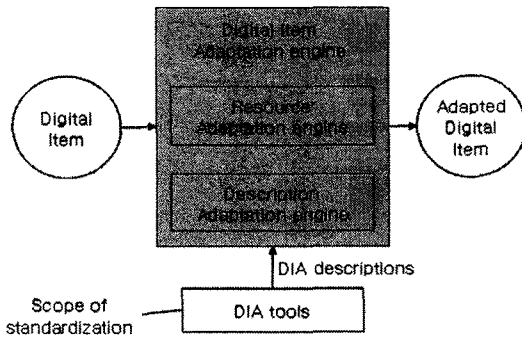


Fig. 2. Digital Item Adaptation Architecture

research to provide adapted learning contents for users is underway as the followings [10,11,12].

- AI learning system which provides specified contents for students depends on their level and character divided into groups
- Recognition to figure which service is needed, by whom, on what time, at the ubiquitous environment.
- Corresponding to expect various situations of the students, so the students can use the information either in dynamic or static situations.
- Controlling size of letter, image, and quantity of the data so the information can be read in any type of devices by figuring what type of device is currently being used by the user.
- Provide proper contents/environments/educational interaction by learner modeling which includes the learner's age, culture, knowledge level, etc.

### 3. DESIGN OF M-LEARNING SYSTEM FOR MMS ADAPTATION

In this paper, we study m-learning system which satisfies the following conditions to provide adapted MMS for the users based on the learner's CC/PP profile.

- First, establishes and manages the learner's information on the database
- Second, uses learner's profile based on the

CC/PP

- Third, selects only the type of multimedia contents that can be supported in the learner's device
- Fourth, generates MMS based on SMIL language.
- Fifth, divides the learner's situation by dynamic (mobile) or static (PDA).
- Sixth, organizes presentation format by recognizing if the number of content(s) is singular or multiple
- Seventh, adjusts the size of the presentation to fit into the learner's device.

Fig. 3 shows the whole proposed architecture of m-learning system for MMS adaptation.

#### 3.1 User Agent

The database manages not only the learner's ID and password but also the learner's CC/PP profile. When the learner is logged in, the user agent searches the learner information and the learner's profile, and then sends the profile to generate content of appropriate type in user's device. In present, almost mobile devices support not only SMS based on type of text but also MMS content type based various types of multimedia such as text, audio, image, video, etc. In this paper, the m-learning system generates adaptive MMS content for learner's environment by learner's profile.

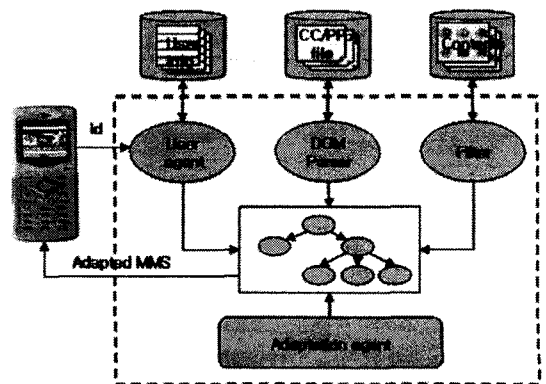


Fig. 3. M-learning system architecture

### 3.2 DOM Parser

CC/PP profile includes not only the software information, hardware specification, and network information but also the other information which are needed for adaptation[3]. By using DOM parser provided by Sun Microsystems, it analyzes XML type based on RDF, generates object tree structure and sends it to the system. M-learning system uses the required information for adaptation by navigating each node of tree[13].

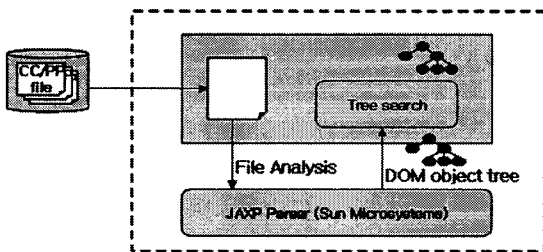


Fig. 4. DOM Parser

### 3.3 Filter

The system constructs the multimedia objects concerned with the subject and support the content executed in the user's mobile environment to user. Compatible problems can be occurred because the mobile devices from different companies support different type of multimedia formats. After filter searches the profile and the device properties, select and provide specifically appropriate multimedia objects for the users by filtering. Table 3 shows the device capabilities of various devices.

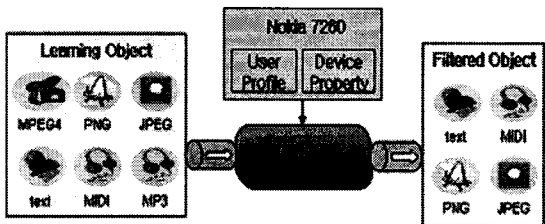


Fig. 5. Filter

Table 2. Parser Algorithm

```

Document ccpp_parser() {
    Class.forName("sun.jdbc.odbc.JdbcOdbcDriver");
    db = DriverManager.getConnection("jdbc:odbc:dsn_ccpp"); // Connecting Database
    stmt = db.createStatement();
    resultSet = stmt.executeQuery(sql_login); // user's id and password checking in Database
    if(not empty in resultSet) {
        DocumentBuilderFactory factory = DocumentBuilderFactory.newInstance
        factory.setIgnoringElementContentWhitespace(true);
        parser = factory.newDocumentBuilder(); // JAXP Parser creation
        Document ccpp_tree = parser.parse(user's ccpp_filename);
        // DOM object tree creating by ccpp_file
        return ccpp_tree ;
    }
}
    
```

Table 3. Device capabilities [14]

	Nokia 6600	Nokia 7260	Sony Ericsson P900	Sony Ericsson T68i	Motorola V600
Image	JPEG, GIF, PNG, BMP	JPEG, GIF, PNG, BMP	JPEG, GIF, PNG, BMP	JPEG, GIF	JPEG, GIF, PNG, BMP
Screen Size	176×208	128×128	208×320	101×80	176×220
Size	100K	45K	300K	50K	100K
Color Depth	16bit	12bit	16bit	8bit	16bit
Audio	AMR, WAV, MIDI	MIDI	AMR, WAV, MIDI	AMR, MIDI	AMR, MP4, MP3, MIDI
Video	3GPP	NA	3GPP, MPEG4	NA	3GPP, MPEG4

Table 4. Filter Algorithm

```

Vector filter(Document ccpp_tree) {
    Class.forName("sun.jdbc.odbc.JdbcOdbcDriver");
    db = DriverManager.getConnection("jdbc:odbc:dsn_ccpp"); // Connecting Database
    stmt = db.createStatement();
    rs_contents = stmt.executeQuery(sql_subject) ;//Content_list querying selected a subject by user
    while(rs_contents.next()) {
        flag = check_multimedia_type(rs_contents.getObject("object_file"));
        // each multimedia file's type checking by CC/PP tree and Handse tProperty
        if(flag==true) {
            vector_filtered_objects.addElement(content_list.getObject("object_file"));
            // add the multimedia file in Vector
        }
    }
    return vector_filtered_objects ;
}

```

Table 5. Adaptation Agent Algorithm

```

Document adaptation_agent(Vector vector_filtered_objects, Document ccpp_tree) {
    Document mms_tree = MMS_tree_creation(); // MMS tree creation
    screen_size[] = mobile_screen_size(ccpp_tree);
    root_layout_creation(screen_size[], mms_tree);
    category = category_group(screen_size[]);

    If(vector_filtered_objects.size() <=1) // Number of the multimedia contents
    {
        object_layout_creation(screen_size[], mms_tree) ;
        object_node = Object_node_creation(vector_filtered_objects.elementAt(0), category);
        append_object_node(object_node, mms_tree);
    }else if(vector_filtered_objects.size() >=2)
    {
        device_type = checking_device_type(ccpp_tree);
        If(device_type == "PDA") // Type of device is PDA
            PDA_sequence_exchanging(vector_filtered_objects);
        Else if(device_type == "mobile") // Type of device is mobile
            Mobile_sequence_exchanging(vector_filtered_objects);

        while( i < vector_filtered_objects.size())
        {
            object = vector_filtered_objects.elementsAt(i);

            // Hyperlink button creation
            hyperlink_button_creation(vector_filtered_objects.elementsAt(i), mms_tree);
            object_node = Object_node_creation(vector_filtered_objects.elementAt(i),category);
            total_object_node_size +=object_node_size(object_node);
            // Device's screen size
            if(total_object_node_size < screen_size && object.indexOf("text")>0) {
                append_object_node(object_node, mms_tree, "parallel");
                object_layout_creation(object_node_size(object_node), mms_tree) ;
                total_object_node_size=0;
            }else {
                append_object_node(object_node, mms_tree, "sequence");
                object_layout_creation(object_node_size(object_node), mms_tree) ;
            }
        }
    }
    return mms_tree;
}

```

### 3.4 Adaptation Agent

MMS sender sends the multimedia contents by significant order and generates MMS to order how to be rendering at the receiver's terminal. Then it generates MMS object tree based on SMIL language by Parser and adapts the tree structure by the conditions below. MMS objects are the filtered multimedia contents by Filter.

(1) Number of the multimedia contents

First, displays tag which corresponds to the multimedia type if the multimedia content is singular.

Second, generates buttons which hyperlinks to each multimedia contents so the repeated learning opportunity can be provided to the learners if the number of multimedia contents are multiple.

(2) Type of device

First, if the user's device is mobile, then predicts the user's situation as dynamic and displays in the order of audio, movie, image, and text.

Second, if the user's device is PDA, then predicts the user's situation is static and displays in the order of text, image, movie, and audio.

(3) Device's screen size

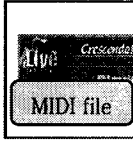
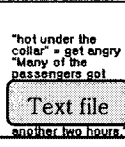
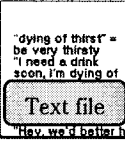


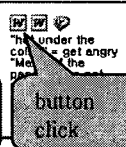


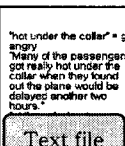
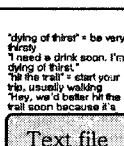
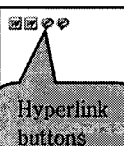
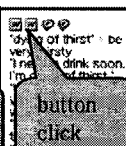



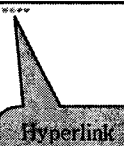
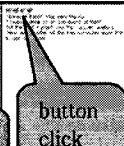
First, controls the size of text's font depends on the screen size of the user's device by 3 big categories as  $T = \{t1, t2, t3\}$ , where  $t1$ : Under  $120 \times 160$  resolutions,  $t2$ : Under  $176 \times 208$  resolutions, and  $t3$ : Over  $176 \times 208$  resolutions [15].

Second, controls the screen layout size of MMS slide.

Third, controls number of the multimedia contents for presentation of each slide.

## 4. SIMULATION AND RESULT

Table 6. Results of adapted MMS files

Hardware capabilities	Screen shot in process of time					
Vendor="Nokia" Model="7260" Type="mobile" ScreenSize="128*128*12"	 <p>MIDI file</p>	 <p>Text file</p>	 <p>Text file</p>	 <p>Hyperlink buttons</p>	 <p>button click</p>	 <p>button click</p>
Vendor="Motorola" Model="V600" Type="mobile" ScreenSize="176*200*16"	 <p>MIDI file</p>	 <p>MP3 file</p>	 <p>Text file</p>	 <p>Text file</p>	 <p>Hyperlink buttons</p>	 <p>button click</p>
Vendor="Nokia" Model="2160" Type="PDA" ScreenSize="400*640*24"	 <p>Text file</p>	 <p>MIDI file</p>	 <p>MP3 file</p>	 <p>Hyperlink buttons</p>	 <p>button click</p>	

```

<?xml version="1.0" ?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:prf="http://www.w3.org/TR/WD-profile-vocabulary#"
- <rdf:Description about="HardwarePlatform">
  <prf:Defaults Vendor="Nokia" Model="2160" Type="PDA"
    ScreenSize="400*640*24" CPU="PPC" Keyboard="Yes"
    Memory="16mB" Bluetooth="YES" Speaker="YES" />
</rdf:Description>
- <rdf:Description about="SoftwarePlatform">
  - <prf:CcppAccept-Charset>
    - <rdf:Bag>
      <rdf:li rdf:datatype="Literal">US-ASCII</rdf:li>
      <rdf:li rdf:datatype="Literal">ISO-8859-1</rdf:li>
      <rdf:li rdf:datatype="Literal">UTF-8</rdf:li>
    </rdf:Bag>
    </prf:CcppAccept-Charset>
  </rdf:Description>
- <rdf:Description about="EpcEmail1.0">
  <prf:Defaults HTMLVersion="4.0" />
</rdf:Description>
- <rdf:Description about="EpcCalendar1.0">
  <prf:Defaults HTMLVersion="4.0" />
</rdf:Description>
- <rdf:Description about="UserPreferences">
  <prf:Defaults Language="English" />
</rdf:Description>
</rdf:RDF>

```

Fig. 6. CC/PP Profile sample file of Nokia 2160 Fig. 7. MMS sample file by CC/PP Profile of Nokia 2160

```

<?xml version="1.0" encoding="EUC-KR"?>
<smil xmlns="http://www.w3.org/2001/SMIL20/Language">
<head>
  <layout>
    <root-layout background-color="white" height="640" width="400"/>
    <region height="200" id="pic1" left="10" top="30" width="300"/>
    <region height="500" id="pic1" left="10" top="230" width="300"/>
    <region height="20" id="m0" left="10" top="10" width="20"/>
    <region height="20" id="m1" left="30" top="10" width="20"/>
    <region height="20" id="m2" left="50" top="10" width="20"/>
    <region height="20" id="m3" left="70" top="10" width="20"/>
  </layout>
</head>
<body>
<seq>
  <par dur="indefinite">
    <text dur="15" region="pic1" src="vocal.txt"> <param name="fontSize" value="3"/> </text>
    <text dur="15" region="pic1" src="vocal.txt"> <param name="fontSize" value="3"/> </text>
  </par>
  <audio region="pic" src="sound.midi"/>
  <audio region="pic" src="toic(sound.mpg3"/>
</seq>
<seq>
  <rd dur="indefinite">
    <text begin="b0.activateEvent" region="pic" src="vocal.txt"> <param name="fontSize" value="3"/> </text>
    <text begin="b1.activateEvent" region="pic" src="vocal.txt"> <param name="fontSize" value="3"/> </text>
    <audio begin="b2.activateEvent" region="pic" src="sound.midi"/>
    <audio begin="b3.activateEvent" region="pic" src="toic(sound.mpg3"/>
  </rd>
   
   
</seq>
</body>
</smil>

```

## 5. CONCLUSIONS

This paper proposed m-learning system which provides adapted learning MMS for the learners in heterogeneous environments. MMS is generated and displayed as presentation format which is the unified message with multimedia contents such as text, audio, image, video, etc. With using CC/PP profile which provides the information about learner's environment, MMS based on SMIL language, which is adapted to the learner's device capability, learning status, multimedia contents type, etc, is generated. This paper focuses on MMS adaptation on presentation format than on adaptation on media itself. The research on the adaptation of media type upon the learner's environment and on the adapted AI learning system to provide customized contents upon the learner's character will be continued by the author later on.

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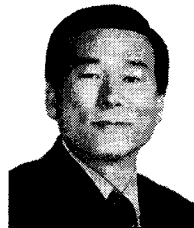
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