Media Resources Adaptation for Limited Devices

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Introduction

• Increasing demand for using rich content by small devices

• Several constraints

Adaptation of the content according to the client constraints
Related Media Resources Approach

- Transformation techniques can not be applied always (avoid semantic content distortion, lack of transformations)

- The approach of related resources enriches the adapting system by semantic substitution possibilities rather than transformations

- A relationship gathers two resources that exist in the same server or in different servers
- **Semantic considerations**
Based on the semantic of the original resource, i.e. what does the resource give as understandable information

- **Presentation considerations**
Concern the final presentation of the resource (format, colors number, size, resolution, etc.)

**Definitions used dynamically by the adaptation task**
Document Instances

- Document profiles describe a class of documents
- An instance may use a subset of particular resources
Client Profiling

**Profiling concept**: Definition of the environment characteristics in order to apply properly the content adaptation

**Client side**: the client must convey its capabilities regarding the support of multimedia resources to the server

Our approach: use of UPS to ensure the environment profiling
UPS: Universal Profiling Schema

New framework that completes CC/PP and HTTP for content adaptation

The definition is based on

- **CC/PP**: Composite Capabilities/Preference Profiles
  [http://www.w3.org/2000/07/04-ccpp#](http://www.w3.org/2000/07/04-ccpp#)

- **RDF**: Resource Description Framework
  [http://www.w3.org/1999/02/22-rdf-syntax-ns#](http://www.w3.org/1999/02/22-rdf-syntax-ns#)

+ Extension: Six new schemata
  Proper to the Content Negotiation
A Client Profile Example

```xml
<?xml version="1.0"?>
<rdf:RDF
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:ccpp="http://www.w3.org/2000/07/04-ccpp#"
   Lemlouma/NegotiationSchema/ClientProfileSchema03012002#">

   <rdf:Description ID="ClientResourcesProfile">

      <ccpp:component>
         <rdf:Description rdf:about="TerminalHardware">
            <neg:DeviceName>Ericsson-R320</neg:DeviceName>
            <neg:screen>30x23mm</neg:screen>
            <neg:PixelStretch>1.24</neg:PixelStretch>
            <neg:PhoneNumber>+33610987326</neg:PhoneNumber>
         </rdf:Description>
      </ccpp:component>

      <ccpp:component>
         <rdf:Description rdf:about="MultimediaServicesRequierement">
            ...
         </rdf:Description>
      </ccpp:component>

   </rdf:Description>
</rdf:RDF>
```
Content Negotiation

Objective: Send only media which are adapted to the client capabilities and preferences

Resources can be: substituted, removed or transformed

Detailed view of the used resources in a requested document is required

HTTP negotiation limitations: several accept headers, limited description syntax, etc.
Content Negotiation

Determination of used resources in a requested document

- procedure Treats_node(n) {
  - 1 if (n represents a media resource) {
  - 2 create an entry in the output CC/PP profile;
  - 3 explore n’s attributes;
  - 4 create media output attributes;
  - } else {
  - 5 if (n contains other child nodes) {
  - 6 for each child s {
  - 7 Treats_node(s); }
  - }
  - }
Profiling-Based Media Delivery

The adaptation task uses the profiles description to ensure a delivery of the adapted medias

1. for each
   2. (media resource category $X$ existing in the profile of the requested document) {
   3.   deliver $X$;
   4. } else {
   5.     look for $X$-related resources (equivalent-to or adapted-to);
   6.     evaluate the resources;
   7.     if (an appropriate resource exist) {
   8.         deliver it;
   9.     } else {
  10.       look for available methods to adapt $X$ according to $X'$ constraints;
  11.       if (such methods exist) {
  12.           apply the method on $X$;
  13.           deliver the result;
  14.       } else remove $X$;
  15.     } }
Processing Resources: Example

- SMIL 2.0 includes related resources in the SWITCH element

  Negotiation dimension: language

```xml
  - <switch>
    <audio id="sound" src="/media/audioVersions/russian.mp3" begin="1" dur="30" systemLanguage="ru" />
    <audio id="sound" src="/media/audioVersions/japanese.mp3" begin="1" dur="30" systemLanguage="jp" />
    <audio id="sound" src="/media/audioVersions/english.mp3" begin="1" dur="30" />
  </switch>
  - <switch>
    <text src="Privyet. Menya zovout Dominique." region="lyrics1" dur="30" systemLanguage="ru" />
    <text src="Konnichi-wa! Boku wa Dominiku desu." region="lyrics1" dur="30" systemLanguage="jp" />
    <text src="Hello, my name is Dominique." region="lyrics1" dur="30" />
  </switch>
  - <switch>
    <text src="Ya zhivou v Kanade." region="lyrics2" dur="30" systemLanguage="ru" />
    <text src="Kanada ni sunde-imasu." region="lyrics2" dur="30" systemLanguage="jp" />
    <text src="I live in Canada." region="lyrics2" dur="30" />
  </switch>
```
Processing Resources: Example

UPS profile

<neg:display>101x52Pixels</neg:display>
<neg:PixelStretch>1.24</neg:PixelStretch>

<!-- Here the language -->
<neg:systemLanguage>ru</neg:systemLanguage>
</rdf:Description>
</ccpp:component>

accept-language: fr

HTTP request

Resources are selected according to the negotiation dimension

Hello, my name is Dominique.
I live in Canada.

Privyet, mienya zovut Dominique.
Ya zhivou v Kanade.
The Evaluation of Media Adaptation

When the adaptation is beneficial?

\[ G_{Time} = \frac{\Delta Size}{B} - \sum_{i=l+1}^{n} T_Transformation_k (MR_i^Y) \]
Architecture Overview

1. ANM Proxy
2. UCM Module
3. Adaptation Engine
4. SMIL Player
Adaptation Methods

- Allows to transform an original service to another format which matches well client characteristics

1) Can adapt the document structure:
   Example:
   1- Adapting HTML (XHTML) documents to WML for WAP devices
   2- Adapting SMIL 2.0 to SMIL basic (switch evaluation), which can be used for clients that support MMS for instance

2) Or adapt the different used media:
   Example:
   1- Image Transcoding
   1- A method that transforms text to speech
   2- Text to SMS messages
Media Resources Adaptation: Substitutions

- `<xml version='1.0' encoding="iso-8859-1"?>`
- `<xsl:stylesheet xmlns:xsl='http://www.w3.org/1999/XSL/Transform' version='1.0'>`
- `<xsl:template match="html">
  <wml>
    <card id="main" title="{head/title/text()}" newcontext="true">
      <xsl:apply-templates select="body/node()" />
    </card>
  </wml>
</xsl:template>`
- `<xsl:template match="img">
  <xsl:variable name="image_resource_name">
    <xsl:value-of select="concat(substring-before( @src,'.'),'-adapted_to.wbmp')" />
  </xsl:variable>
  <img src='{$image_resource_name}' alt="[IMAGE: {@alt}]" />
</xsl:template>`

```
xalan.bat -IN HTML000.html -xsl HTML2WML wmlpage.wml
```
Media Resources Adaptation: Real-Time Methods

- After the NAC installation:
  1- Profile Selection using UCM module:

    - Client: My Pocket PC
    - Proxy address: 194.199.20.8
    - Proxy port: 1977
    - Client profile: \{My Documents\}Pr

  2- The client requests the content: a JPEG image
Media Resources Adaptation: Real-Time Methods

- **Result:**
  - The device receives an image adapted to its displaying capabilities.
Media Resources Adaptation: Scenario

Profiles matching:
- UPS Profile
+ HTTP Request
+ Image Profile

Device Screen: 240X320
Original Image: 682X909
Proxy is able to resize images

Decision: Adapt the image and send the adapted content
Media Resources Adaptation: Real-Time Methods
Conclusions

• Media adaptation in heterogeneous multimedia systems has a vital importance to respect the wide diversity of clients

• Structural transformations (like XSLT-based transformation) are not sufficient

• The definition of semantic relationships between resources ensures an efficient adaptation system and completes structural transformation

• Outgoing:
  – Developing the device independence principles
  – Adaptation of SMIL multimedia content for small devices (ICME 2003)
  – Definition of contextual based transformation language
Thank you

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