Adapted Content Delivery for Different Contexts

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Outline

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Introduction

• Actual multimedia systems become more and more heterogeneous
• A wide diversity of devices => **Contexts**

- Displaying capabilities
- Access methods
- Media support (images, video, text, etc.)
- Languages (SMIL, MMS, WML, cHTML, etc.)
- Protocols: HTTP, WAP, UDP, etc.
Introduction

**Problem:** Original content that exist in the server side can not be used directly by all the clients

**Need:** Adapted content must be delivered according to end user context: preferences and capabilities

A good architecture should ensure:
- Server content adaptation
- Content negotiation according to clients profiles
- Enabling the delivery of one content in different forms
The Adaptive System

- A basic solution for multimedia content negotiation and adaptation for heterogeneous systems.

- Based on several recent technologies: XML, RDF, CC/PP, SMIL ...

- Matching and negotiation algorithms are flexible and so the solution can be enriched at any time to meet particular needs.
The Adaptation Layer

Adaptation Engine
- Server
- Proxy
- Other

Definition of transformation and adaptation methods

Apply documents selections

Help the transformation

Documents generation

Services Demandes

Requests of Negotiation

Clients

Adaptation Layer

Documents Authoring
Context Description

• What is a context?
  “Any information that can be used to characterize the situation of any entity” (Dey A. K.)

Why?
– Document context
– Device context

• The absence of useful tools (HTTP limitations)
  => UPS schema: CC/PP model and RDF semantic
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#"
        xmlns:neg="http://www.inrialpes.fr/opera/people/Tayeb.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="MultimediaServicesRequirement">
        ....
      </rdf:Description>
    </ccpp:component>
  </rdf:Description>
</rdf:RDF>
```
Structural Transformations

- From a structure to another: e.g. HTML to WML for mobile phones

- Problem requires one transformation per couple of context:
  
  \[ \text{<document context, device context>} \]

- Generic Transformations
  
  Objective:
  
  - Minimize the transformation complexity: The number of authored transformation methods
  - Enable automatic adaptation
Ideal Solution

• One transformation method for every:
  <client request, document context, device context>

• The method should be able to adapt any requested document for any target device context

• Very difficult to provide one global transformation due to the High complexity:
  (devices complexity) X (clients requests) X (server content)
Proposed Solution

- Ensuring generic transformation using a two-step based transformation:
- Generate a transformation $T$ for $<$requested document, device context$>$

![Diagram]

- Apply the transformation on the requested document
Application using XSLT

- Client profile: device context
- Predefined style sheet: a set of generic templates
- Generated style sheet: a set of static templates
Media Transformation

- Includes non structural transformation and applied directly on medias: e.g. image compression, video resizing, etc.
- The client context is considered as:
  "a set of variables that reflect the state of the client capabilities and preferences"
- Context values are taken as input and the corresponding adaptation methods are applied
- Example:
  - Device Context (PDA) = {screen_width = 240, screen_height = 320, … }
  - Content Context (image) = {width = 500, height = 309, … }
  - Applied method = Image resizing from (500,309) to (240,320)
1. ANM Proxy
2. UCM Module
3. SMIL Player used for the experimentation
4. Adaptation Engine
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
Adaptation Method Example

xalan.bat –IN HTML000.html –xsl HTML2WML  wmlpage.wml
How does It work?

• The proxy performs in a session one or several adaptations

  • Context of the current session:
    – Client profile
    – Content
    – Server capabilities
    – Proxy capabilities, etc.

• To give a general idea:

  • Example 1: Image adaptation
  • Example 2: SMS sending
  • Example 3: Language adaptation
Example 1

- After the NAC installation:
  - The device (Pocket PC here) selects its profile:

```
Client: My Pocket PC
Proxy address: 194.199.20.8
Proxy port: 1977
Client profile: \My Documents\Profiles
```

- The client requests the content: a JPEG image
Example 1

- Result:
  - The device receives an image adapted to its displaying capabilities
Example 1

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
Example 1
Example 2

- The device requests an HTML document
Example 2

Apply the method on the content
= Send SMS to the phone

Client

```xml
<!-- A transform to SMS Form -->
- <rdf:li rdf:parseType="Resource">
  <neg:ResourceType>method</neg:ResourceType>
  <neg:ResourceName>MobileSMS</neg:ResourceName>
  <neg:ResourceFormat>java</neg:ResourceFormat>
  <neg:OutputResourceType>SMS</neg:OutputResourceType>
  <neg:OutputResourceFormat>sms</neg:OutputResourceFormat>
</rdf:li>
```

Server

```
- <rdf:Description ID="HardwarePlatform">
  <rdf:type rdf:resource="http://www.inrialpes.fr/open03012002#HardwarePlatform"/>
  <neg:DeviceType>Mobile phone</neg:DeviceType>
  <neg:DeviceName>Nokia-3310</neg:DeviceName>
  <neg:PhoneNumber>0610987326</neg:PhoneNumber>
  <neg:screen>30x23mm</neg:screen>
  <neg:display>101x52Pixels</neg:display>
  <neg:PixelStretch>1.24</neg:PixelStretch>
  <!-- composed elements are not supported until -->
</rdf:Description>
```
Example 3

• The client requests a SMIL 2.0 document

The proxy adapts the SMIL presentation with respect to the client profile: 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>
```
Example 3

HTTP request

accept-language: fr

SMIL content is adapted (UPS override HTTP parameters)
Conclusions

- Considering the context and resolving the problem of content adaptation in heterogeneous multimedia systems represents actually a very important topic.

- Ensuring such solutions needs the use of several technologies that ensure handling multimedia content and adapting it for different contexts.

- Architecture development has allowed:
  - The creation of new profiling schema: “UPS” for the context (environment) description
  - Definition of a negotiation protocol: client and server (or proxy)
  - Making the transformation more generic using a two steps transformation approach
  - Ensuring a flexible architecture that accept the enrichment by additional adaptation methods proper to a particular need

- Outgoing:
  - Defining a new context (environment)-based transformation language (extending XSLT?)
  - Developing the device independence principles
  - Adaptation of SMIL (ICME 2003) and considering the network state
Thank you

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