Content Interaction and Formatting for Mobile Devices

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Plan

1. Introduction
2. Passive and interactive content adaptation
3. Architecture overview
4. Profiling concept
5. Media and structural adaptation
6. User interaction and navigation
7. Content adaptation and formatting
8. Experimental results
9. Conclusions
Introduction

- Multimedia systems become more and more heterogeneous
- Several heterogeneous devices are used today
- Different complex applications and content exist on the servers side
- Increasing need to use the content using small devices and in non classical situation (example in mobility)
- Problem: mobile devices are different and subject of many limitations: screen, memory, processor, etc.
- Current adaptation systems use transformation languages (ex. XSLT) and media objects adaptation such as video and images transcoding
Introduction

• Current techniques are usually not sufficient to guarantee a correct handling in particular for very limited devices such as mobile phones.

• Structural adaptations can generate a non adapted content for the displaying limitations of the terminal (large amount of data).

• Media transcoding may result in a severe degradation of the quality compared to the original content.

• Current techniques are based on a one pass adaptation process: no interaction between the user and the original content.

• How can we enable an optimized use of the Web and multimedia applications for limited terminals?
Passive and Interactive Content Adaptation

- Passive content adaptation
- Interactive content adaptation

Interaction request / adapted answer
Architecture Overview

- **NAC (Negotiation and Adaptation Core):** A proxy-based architecture, negotiation and adaptation services for heterogeneous environments.

Diagram:
- **Client** → **Proxy** → **Serveur**
- **Negotiation**
- **Profiles**
- **Protocol**
- **Adaptation**
  - Content selection
  - Structural adaptation
  - Resources adaptation
- **Client / Proxy** → **Proxy / Serveur** → **Proxy / Repository**
• The interactive adaptation system: NAC enriched by
  1. Adaptation component
     • processes the interaction requests of the user and applies a structural
       and media adaptation on the original content
     • the result of the adaptation is transmitted to the client formatter
  2. Client formatter
     • presents the different parts of the adapted content
     • The user can start an interaction with the adapted content
     • Interactions trigger navigation requests which are sent to the
       adaptation components
Profiling Concept

• UPS (Universal Profiling Schema): A description model based on CC/PP and RDF

• Handles the properties of the terminal context (hardware, software and user characteristics) and its environment

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
Media and Structural Adaptation

- **Structural** adaptation is used to adapt textual information within a given structure.

- **Media** adaptation is used to adapt resources used in different multimedia languages.

- **SMIL regions** concept is used and extended to provide more flexibility in the presentation process and the displaying size allocation.

- A user interaction may concern a textual part or a media resource of the content.

- Structural and media adaptation are dynamic to handle the different user interactions.
User Interaction and Navigation

- A region is associated with a set of events that triggers the interaction with the content presented within the region.

- Content linear navigation: the user can select a particular region, and, via the proxy, navigate in the different parts of the content.

- Hierarchical navigation: the user can request the current part of the document in more details.

- A media object (text, image, etc.) can be navigated and displayed in a region of a limited device screen.

- Content parts are adapted and transmitted or simply ignored depending on the defined user preferences.

- The hierarchical navigation avoids content distortion especially for images due to the adaptation of media objects for small screen displays.
User Interaction and Navigation

Content adaptation using regions

Mobile devices are not able to perform an advanced content formatting process in particular for accessing to huge content. This process should be co-
User Interaction and Navigation

Linear navigation requests

Linear and hierarchical navigation requests

- A user interaction triggers the same adaptation method with different instances of the context variables
User Interaction and Navigation

- A text node is decomposed into a set of sub-nodes according to the text length and the client’s device characteristics.

- This decomposition is achieved in streaming.

- The user navigates to the different parts of an original textual element using the direction keys of the device (Left and Right keys).

- The content of an image node is resized according to the corresponding region.

- After the user interaction (using the direction keys: Left, Right, Up and Down) a partial area of the original image is resized and rendered in the selected region.

- Left and Right direction keys enable linear navigation between sibling content blocks. Up and Down keys allow a hierarchical navigation.
User Interaction and Navigation

Content navigation within regions
Content Adaptation and Formatting

- The formatter component presents the content of the regions and adds listeners in order to intercept the user interactions.

- A user interaction triggers a request sent to the adaptation component of the proxy.

- A request includes a set of parameters such as: the selected region, the part of the content currently displayed, the user interaction event.

- The proxy replies to the client request by an adapted content portion extracted from the original content.

- The different parts of the content can be navigated progressively and are only sent when necessary.
Content Adaptation and Formatting

- To adapt an area \((w_o, h_o)\) of an original image to a region \((w_r, h_r)\), the image area is resized to:
  \[ w_{\text{adapted}} = \alpha \cdot w_o \]
  \[ h_{\text{adapted}} = \alpha \cdot h_o \]
  where \(\alpha = \text{Min} (w_r/w_o, h_r/h_o)\)

- Textual content is extracted from the original document according to the region dimensions and the width and height of the destination font.

- In a given textual region, the width of each presented line must not exceed the region’s width and similarly for the region height.
Experimental Results

- An adaptation module, implemented in Java, is integrated to the negotiation and adaptation module of the NAC architecture (proxy level).

- The module ensures:
  - content decomposition in streaming
  - linear and hierarchical navigation
  - user interactions processing

- A formatting module is implemented for mobile phones using J2ME: version 1.0 of Mobile Information Device Profile (MIDP) and Connected Limited Device Configuration (CLDC).

- The formatter uses:
  - the Portable Network Graphics (PNG) format
  - various text fonts (the combination of the three supported faces, styles and sizes of MIDP 1.0)
## Experimental Results

<table>
<thead>
<tr>
<th>Regions (w, h) pixels</th>
<th>Rich platform – Emulator (ms)</th>
<th>Mobile platform (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(80,60)</td>
<td>54</td>
<td>765</td>
</tr>
<tr>
<td>(120,80)</td>
<td>124.4</td>
<td>1767</td>
</tr>
<tr>
<td>(100,100)</td>
<td>132.2</td>
<td>1913</td>
</tr>
<tr>
<td>(120,120)</td>
<td>158</td>
<td>2342</td>
</tr>
</tbody>
</table>

Regions formatting time
## Experimental Results

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<tbody>
<tr>
<td>(80,60)</td>
<td>60.2</td>
<td>810</td>
</tr>
<tr>
<td>(120,80)</td>
<td>136</td>
<td>1855</td>
</tr>
<tr>
<td>(100,100)</td>
<td>142.4</td>
<td>2001</td>
</tr>
<tr>
<td>(120,120)</td>
<td>164.2</td>
<td>2530</td>
</tr>
</tbody>
</table>

**Displaying time**
Conclusions

- Mobile devices become more and more used to access and use the Web any time and anywhere

- Developing adaptation systems for limited terminals becomes necessary

- The proposed system is based on interactive adaptation techniques

- The system includes a stream-based text formatter together with an interaction-based access to adapted rich multimedia content

- The interaction-based system allows to:
  - consider the user preferences
  - optimizes the adaptation and the environment resources
  - improve the adaptation quality of service
Thank you