

Content Interaction and Formatting for Mobile Devices

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November 2005

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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?

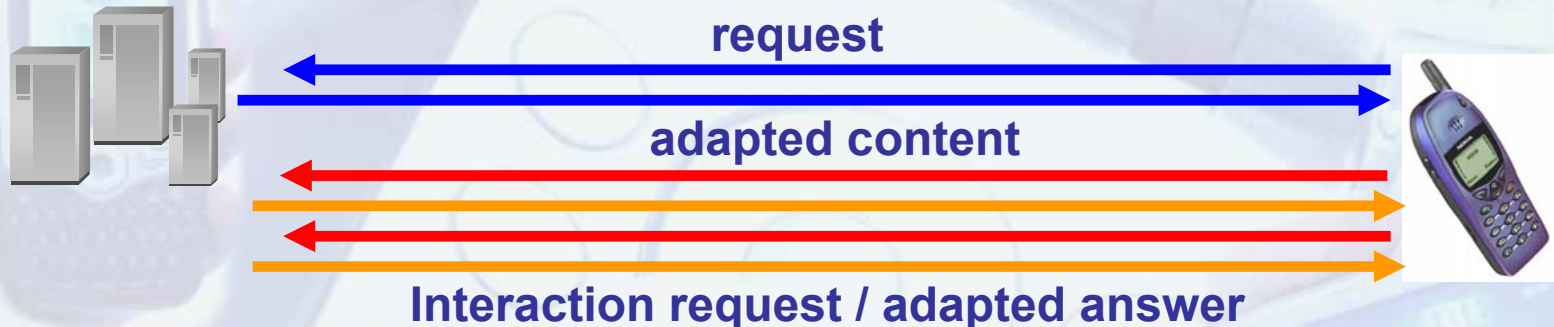


Passive and Interactive Content Adaptation

- Passive content adaptation

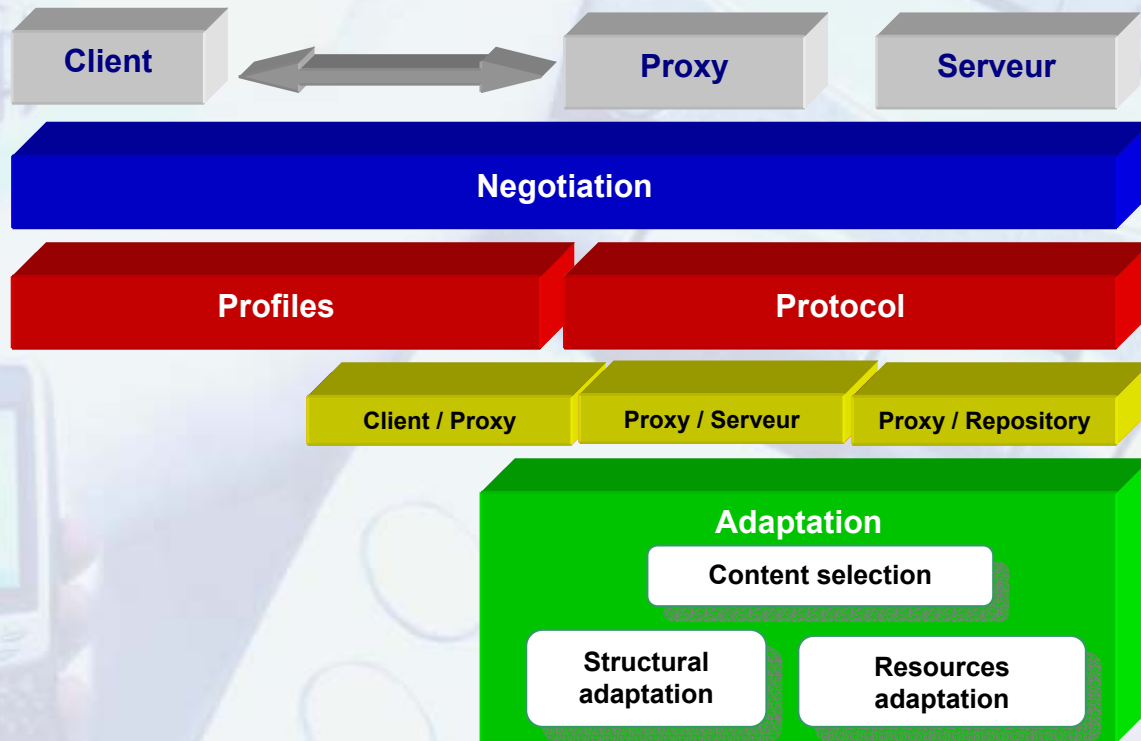


- Interactive content adaptation



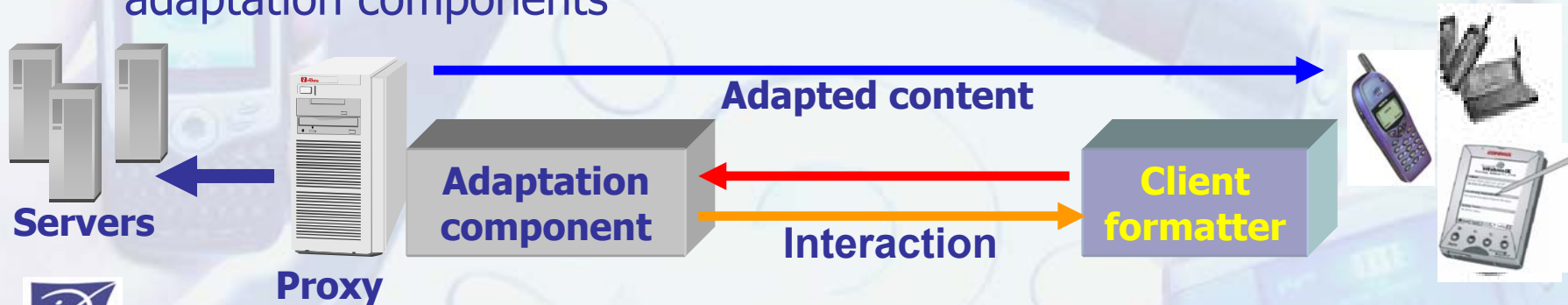
Architecture Overview

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



Architecture Overview

- 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#>



RDF: Resource Description Framework

<http://www.w3.org/1999/02/22-rdf-syntax-ns#>

+



**Extension: Six new schemata
Proper to the Content Negotiation**

[http://www.inrialpes.fr/opera/people/Tayeb.Lemlouma/
NegotiationSchema/*03012002#](http://www.inrialpes.fr/opera/people/Tayeb.Lemlouma/NegotiationSchema/*03012002#)



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

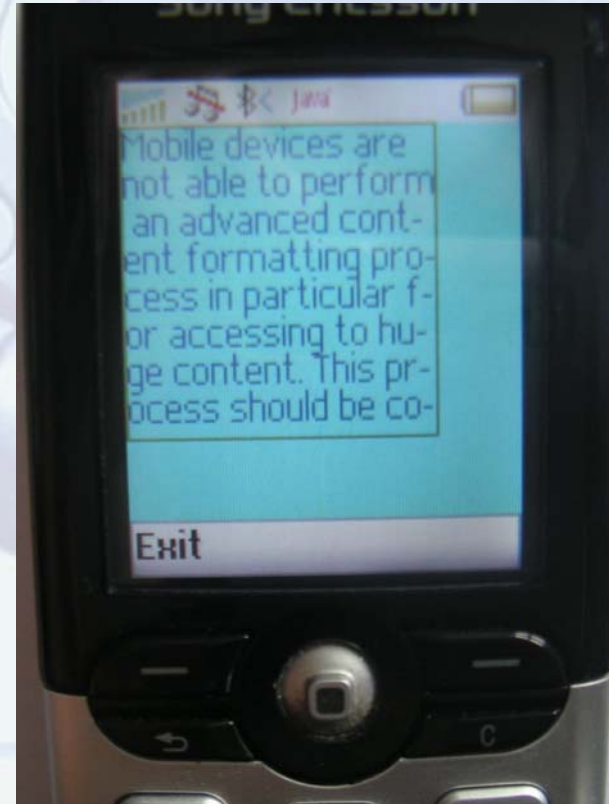


User Interaction and Navigation

- 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



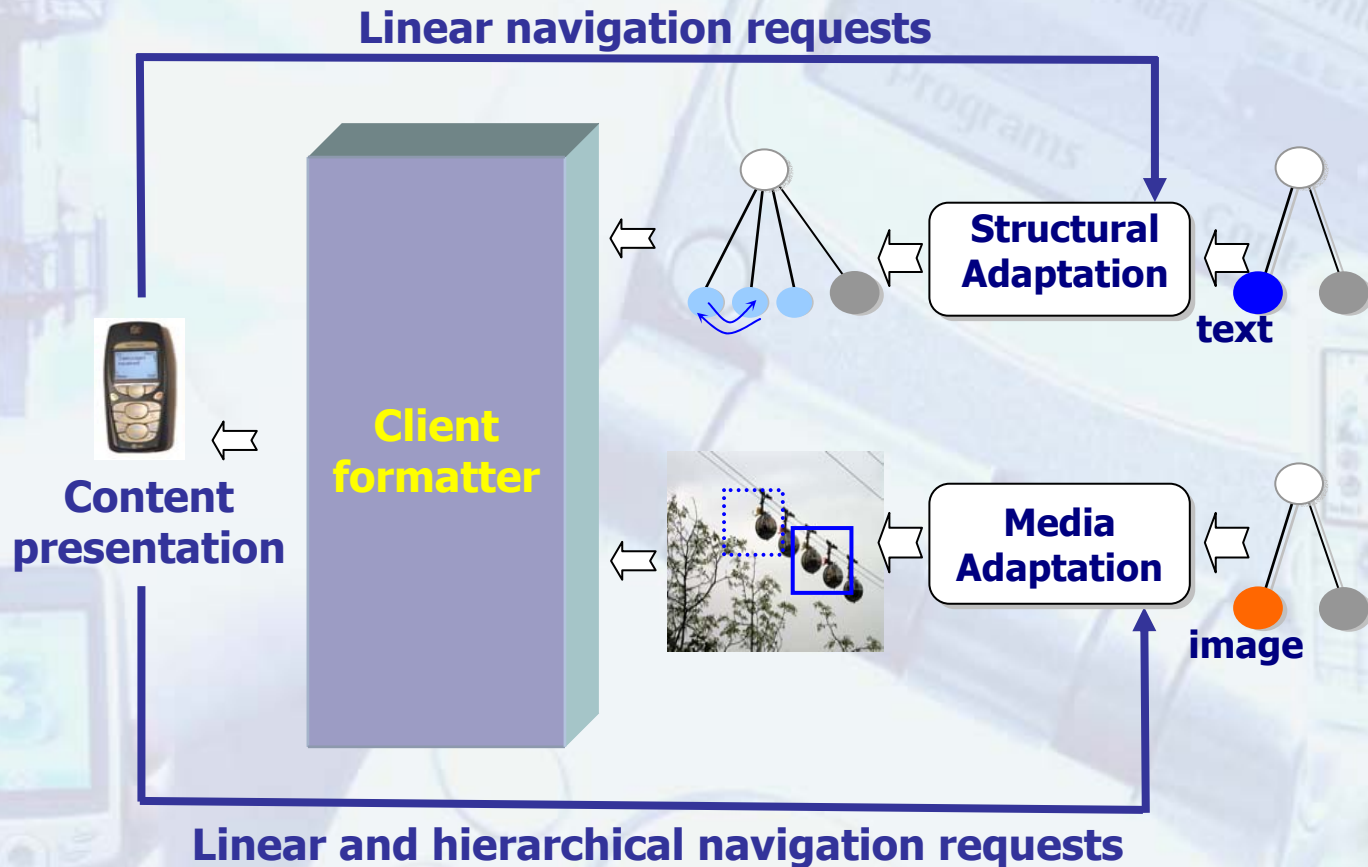
User Interaction and Navigation



Content adaptation using regions



User Interaction and Navigation



- 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:

$$W_{\text{adapted}} = \alpha \cdot W_o$$

$$h_{\text{adapted}} = \alpha \cdot h_o \quad \text{where } \alpha = \text{Min} (w_r/w_o, h_r/h_o)$$

- 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

Regions (w, h) pixels	Rich platform – Emulator (ms)	Mobile platform (ms)
(80,60)	54	765
(120,80)	124.4	1767
(100,100)	132.2	1913
(120,120)	158	2342

Regions formatting time



Experimental Results

Regions (w, h) <i>pixels</i>	Rich platform – Emulator (<i>ms</i>)	Mobile platform (<i>ms</i>)
(80,60)	60.2	810
(120,80)	136	1855
(100,100)	142.4	2001
(120,120)	164.2	2530

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



The background features a collage of mobile devices. In the upper right, a hand holds a silver phone with a screen displaying a menu with options like 'Sport', 'Profile: Normal', 'Downloads', and 'Programs'. In the lower left, a hand holds a black phone with a large green '3' on its screen. In the lower right, a hand holds a blue phone. The background also includes faint sketches of a tower and a smiley face.

Thank you

