

Universal Access to Multimedia Information on the Web

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Outline

- 1 Introduction
- 2 The problem of content universal access
- 3 Architecture
- 4 Describing the heterogeneous environment
- 5 Content negotiation and adaptation
- 6 Perspectives and ideas



Universal Access to the content

- **Networks become more and more heterogeneous**
- **Wide diversity of devices: PDA, Laptops, Smart phones, pagers, etc.**
- **Devices are heterogeneous (supported formats, access protocols, display size, power..) and present many limitations**
- **Content is more and more complex: many formats (HTML, XHTML, SMIL, WML ..), use of several media resources (video, audio ..), complex presentation scenarios**



Universal Access to the content

- Users want to access to the same content using these devices



- Display capabilities
- Access protocols
- Media support
- Languages & documents formats
- Protocol



Objective

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

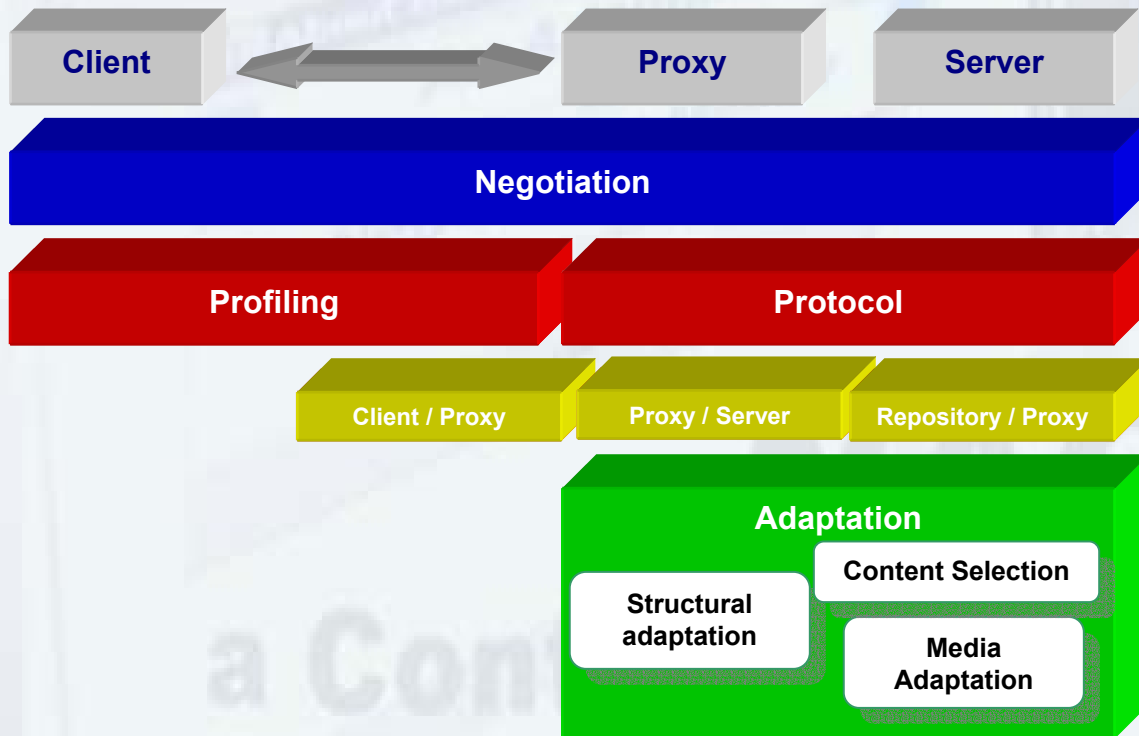
Need: Adapted content must be delivered according to end user preferences and terminal capabilities

A good architecture should ensure :

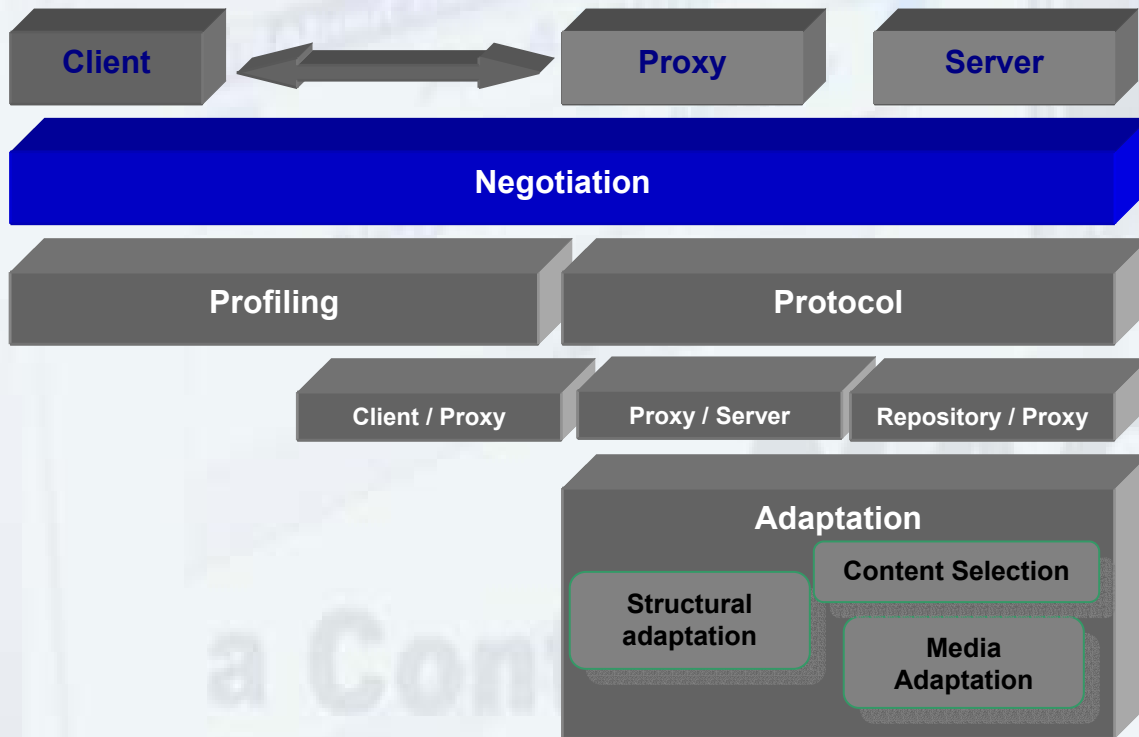
- Server content adaptation
- Content negotiation according to clients profiles
- Enabling the delivery of one content in different forms



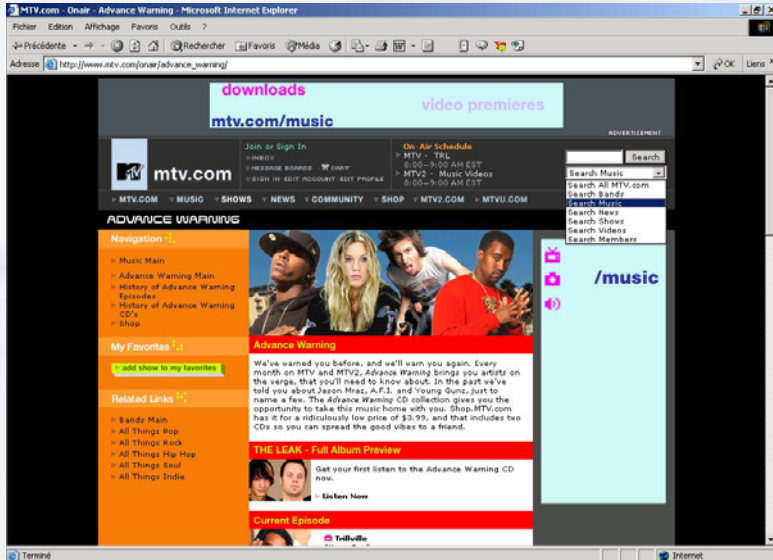
Architecture



Architecture: Negotiation



Content Negotiation



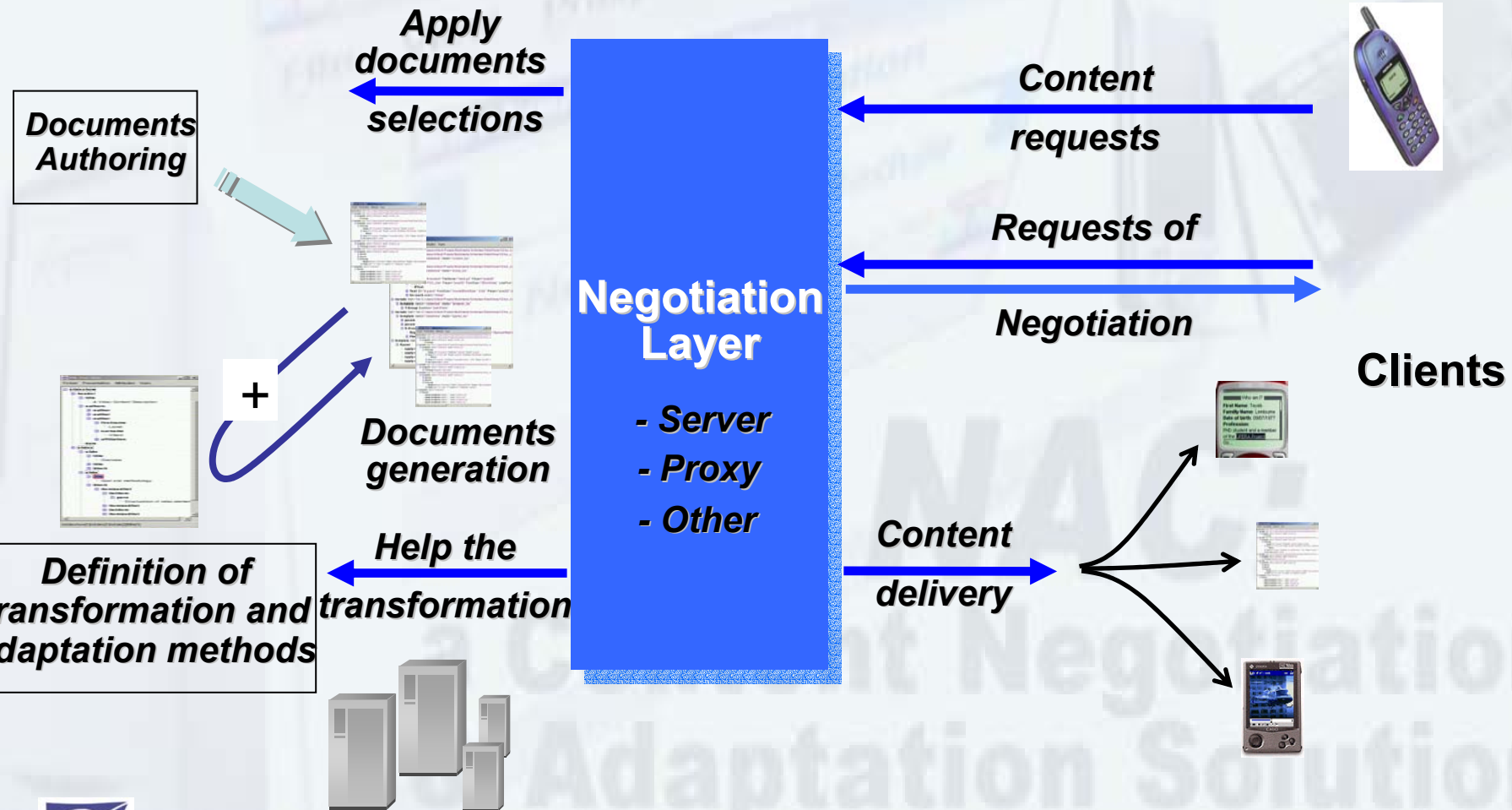
HTTP / RTP / RTSP/ WAP
wireless LAN, cellphone,
broadband, telephone
networks...

Problems

- Device hardware capabilities
- User preferences
- Content formats, versions, protocols & networks
- Delivery of the same content to different devices: adaptation
- Device independence authoring model



The negotiation layer



Content Negotiation

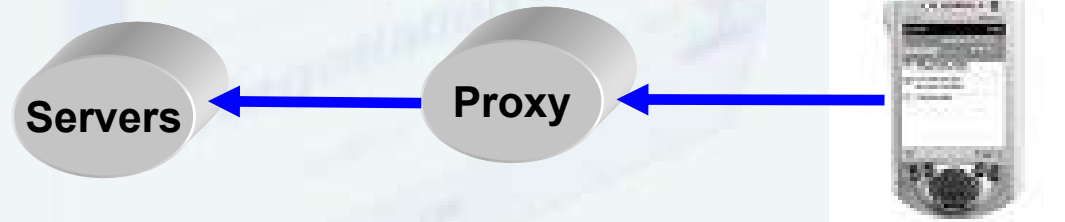
- **Objective** : Make the best decision in order to send a content that matches the device context
- **We need to answer many questions:**
 - What is the context of the client (in terms of constraints)?
 - How to manage and analyze clients context?
 - Is the client capable to use the original content?
 - If there are many versions of the original content, which version to send? How to manage versions?
 - Is the system capable to transform the original content to satisfy the client context?
 - Which adaptation method to apply and how?
 - Could we combine adaptation methods to provide new adaptation capabilities?



The Architecture Organization

A- Proxy-based negotiation architecture

Based on the use of an intermediate proxy between the client and the server of content



– Advantages

- Completely transparent for the server and the client
 - An adapted solution to existing schemes and protocols
- Doesn't impose any requirements on the server side

– Limitations

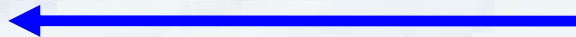
- Dependent to the content negotiation used by the server (HTTP/1.0, TCN, etc.)
- Can't achieve an advanced content negotiation



The Architecture Organization

B- Server-based negotiation architecture

Here the server is responsible to achieve the content negotiation



– Advantages

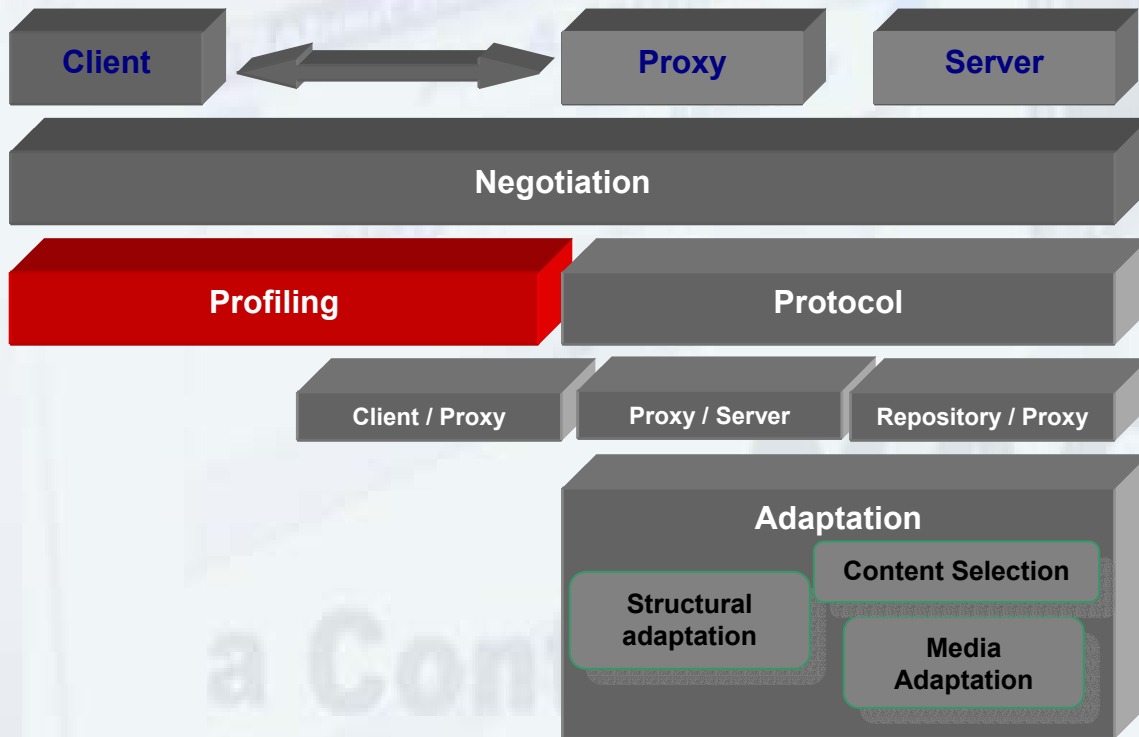
- Allows to achieve an advanced content negotiation
- An independent solution to the existing limited schemes

– Requirements

- Requires the definition of a server description: document profiles, methods profiles, etc.
- Include the negotiation in every server of the network



Architecture: Profiling



Context Description

- **Objective** : provide a model that describes the characteristics and the constraints of the environment components.
- Universal profiling :
 - All the environment elements can be described.
 - A schema is defined and associated to a category in order to guarantee the description



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#>



RDF: Resource Description Framework

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

+



**Extension: Six new schemas
Specific to the Content Negotiation**

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



Profiling Schemas

In order to meet the content negotiation needs, we have designed our proper schema

Our schema includes

A) Client:

- 1/ Client Profile (platform: software & hardware, main services)
- 2/ Client Resource Profile (services requirements detail)

B) Server:

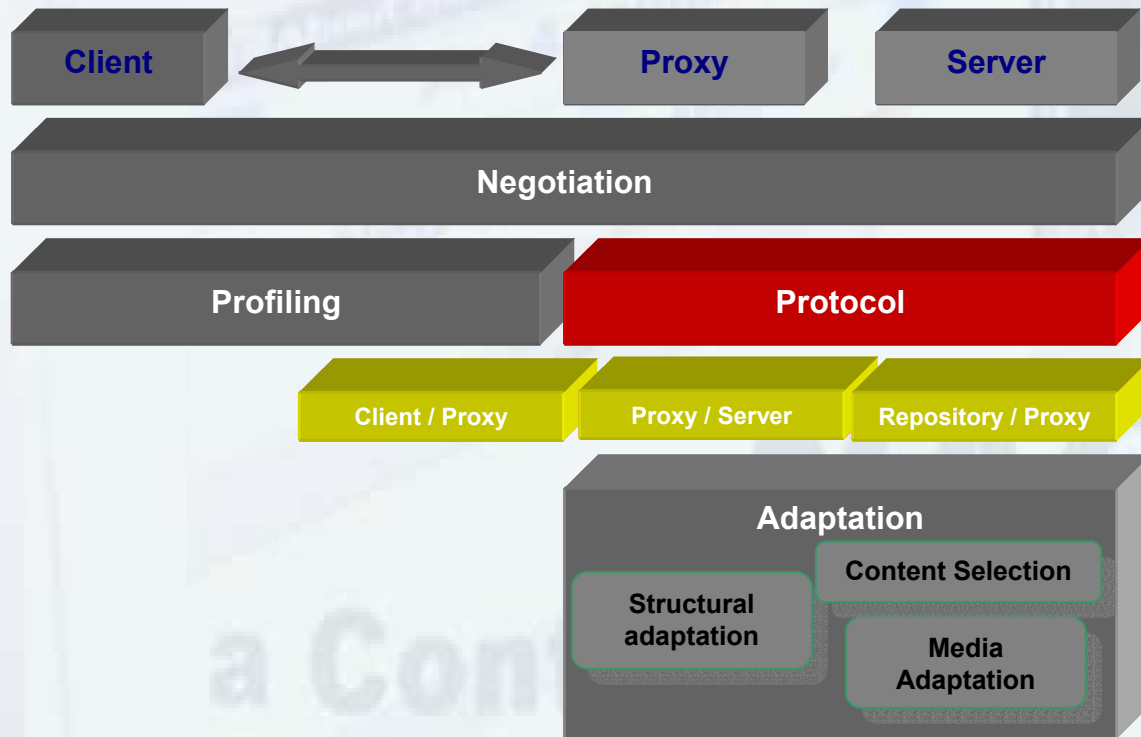
- 3/ Document Instance Profile (HTML, WML, etc.)
- 4/ Resource Profile (wbmp, jpg, gif, au, etc.)
- 5/ Adaptation Method Profile (XSLT style sheet, programs, scripts, etc.)

C) Network:

- 6/ Network Profile (network speed, bandwidth, sessions, etc.)



Architecture: Protocol




Negotiation protocol

- **Objective** : exchange the negotiation-based information between the architecture actors in an optimal way
- Protocol actors: client, proxy, server and profiles repository

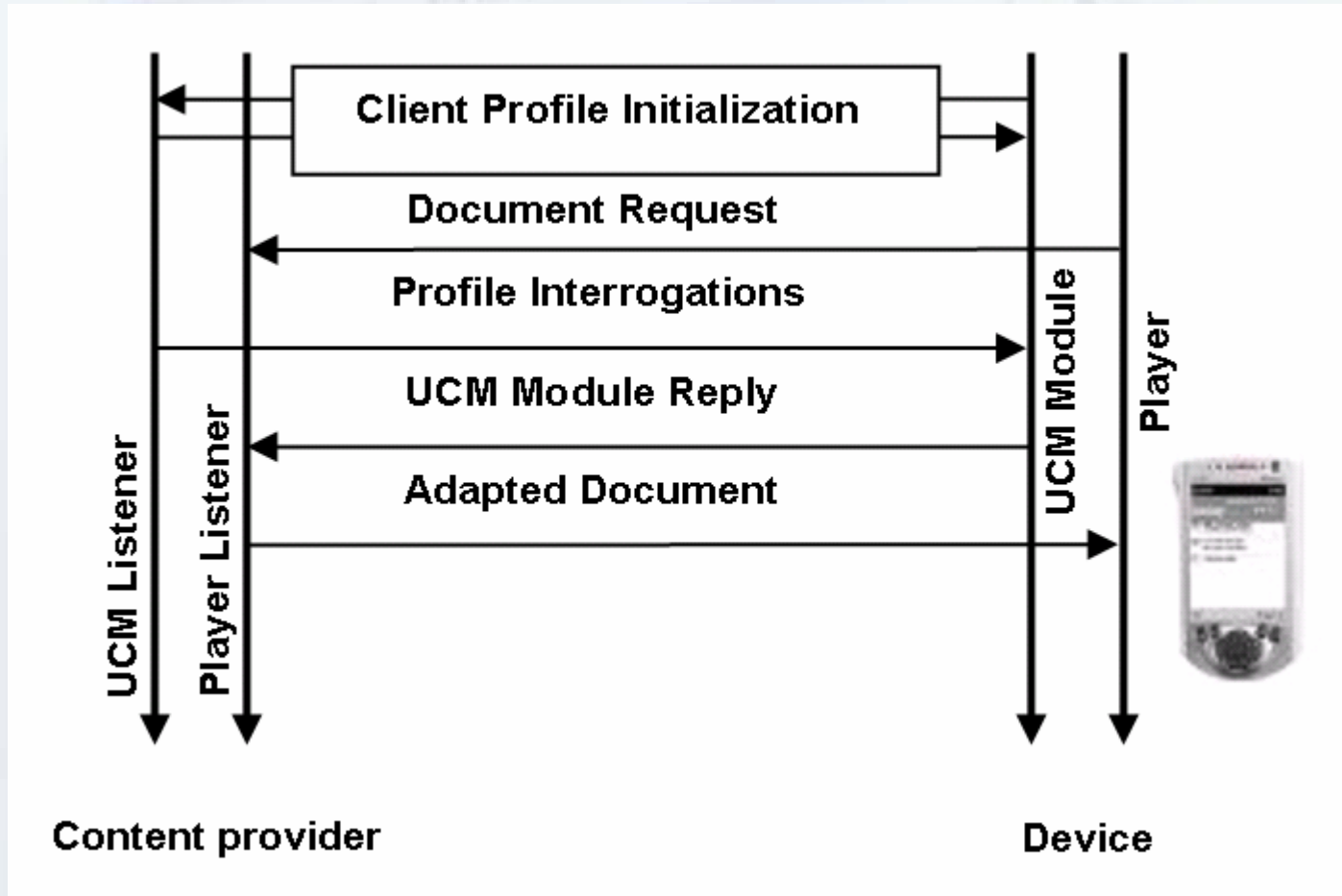


Exchange Protocol

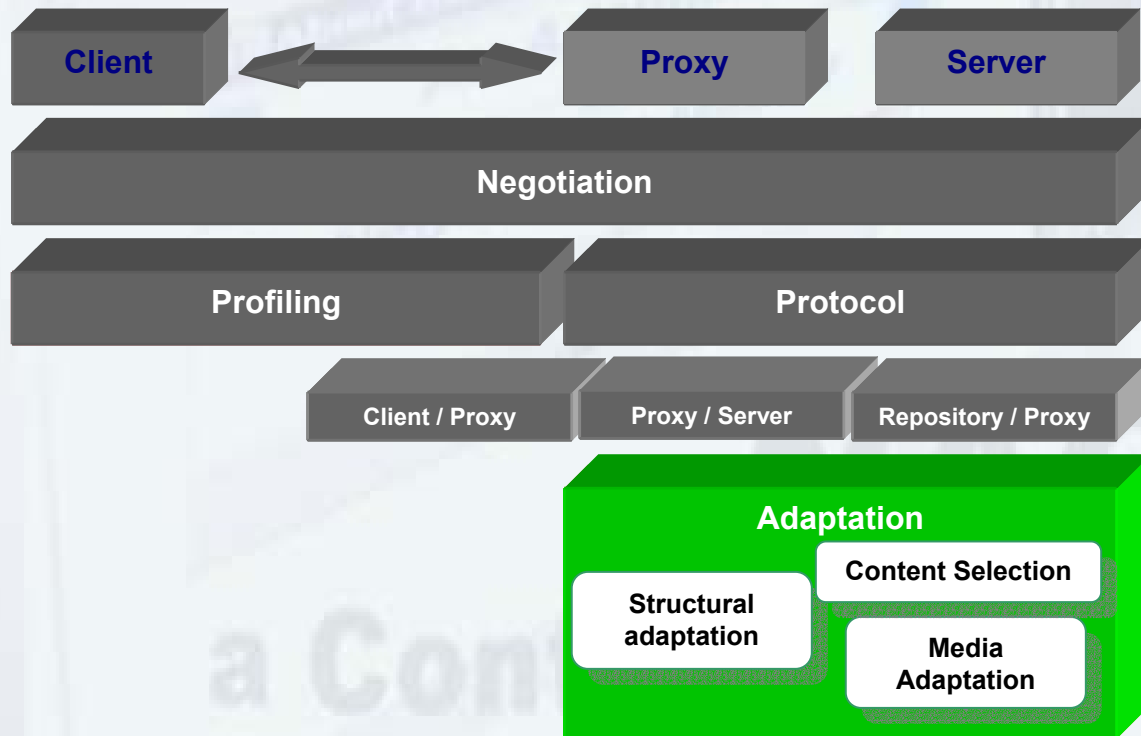
- Independent from the communication protocol  can be used with existing protocols HTTP, etc.
- The protocol defines the following minimal set of message types:
 - GET_GLOBAL_PROFILE
 - OK_SENDING_PROFILE
 - OK_SENDING_CHANGE
 - NO_PROFILES_CHANGE
 - NO_PROFILE_ACQUISITION
- Messages are exchanged between the UCM listener (proxy) and UCM of the embedded device



Exchange Protocol



Architecture: Adaptation



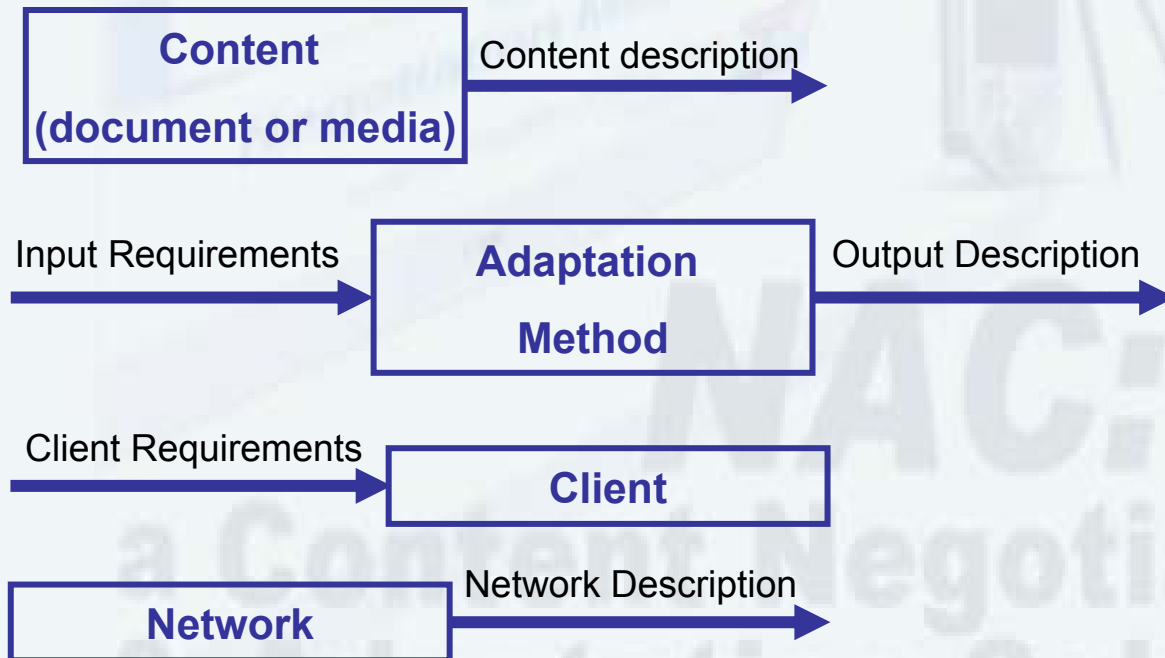
Content Adaptation

- **Objective** : Adapt the same original content to different contexts
- **Structural Adaptation** : apply the adaptation on the structure of the content
- **Media Transcoding** : apply the adaptation on at the encoding level of the content
- **Content selection**
- **Problem**: How to make the adaptation automatic? And the adaptation system flexible?



Adaptation Graph

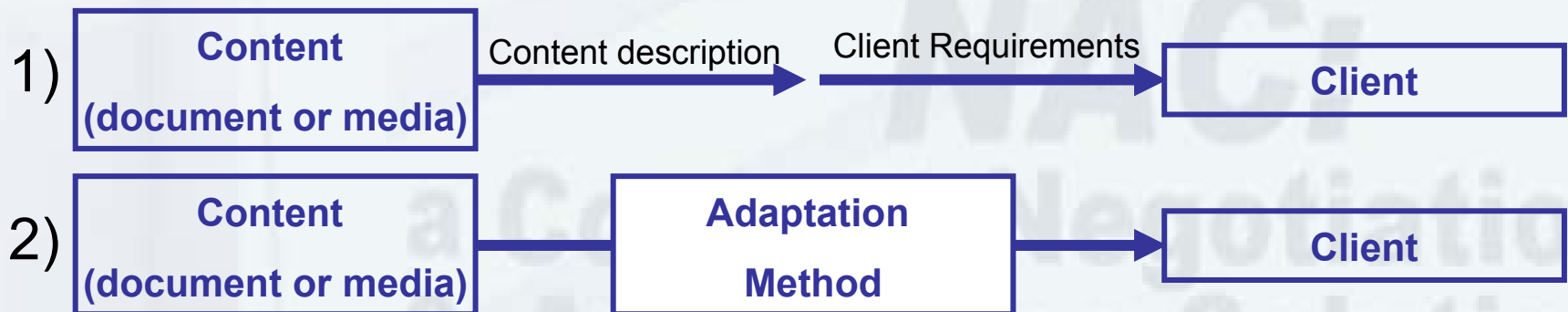
The proposed profiling model (UPS) can be represented by the following components



Adaptation Graph

A content negotiation is equivalent to find the **optimal path** of connected components from the content description To the client requirements

Examples:



Variants Selection

- Choose the best variant of the multimedia content or object on behalf of the user agent
- Based on:
 - Available variants (server)
 - Variants descriptions (UPS)
 - User requirements (UPS)
- Selection criteria may include the language, the media type, the char-set, etc.
- SMIL case: SMIL 2.0 allows using the **switch** element to specify inside the document a collection of alternative elements



Variants Selection

A 'switch' example

SMIL:

```
<par>
  <audio src="welcome to inria.wav" . . . />
  <switch>
    
    
    
    
  </switch>
</par>
```



Variants Selection

A 'switch' example

UPS: ..., *Device screen: (240, 320), ...*

Adapted SMIL:

```
<par>  
  <audio src="welcome_to_inria.wav" . . . />  
    
</par>
```

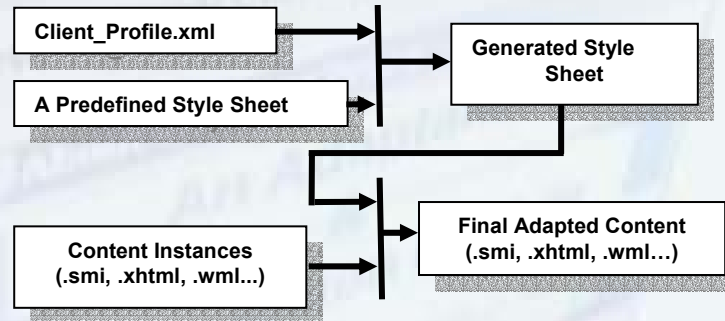


Structural Adaptation

- **Objective** : Transform the original structure to a new structure that matches the target environment
- Structural Adaptation : Transform and change the structure of the original document tree to satisfy the client requirements
- Problems:
 - Legacy content : requires structure corrections
 - Automatic structural transformations
 - Contexts change



Dynamic transformation



- Client profile: device context
- Predefined style sheet: a set of generic templates
- 1) **Using XSLT**: Generated style sheet: a set of static templates
- 2) **Use of contextual variables**:
 - Transformation rules are associated to contextual variables
 - Variables are instantiated during the content delivery

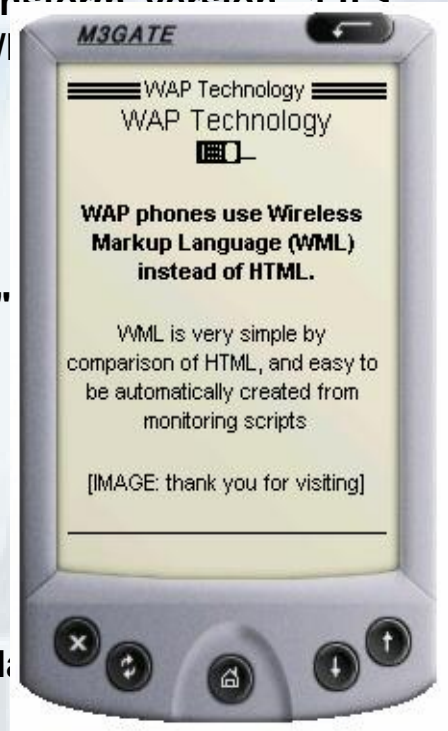
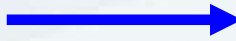


Structural Adaptation : Example

```
<?xml version='1.0' encoding="iso-8859-1"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0">
<xsl:output doctype-public="-//WAPFORUM//DTD WML 1.3//
system="http://www.wapforum.org/DTD/wml13.dtd" />
```



```
{()}" newcontext="true"
body/node()" />
```



```
<xsl:value-of select="concat(substring-before( @src, '.'), '-ad
</xsl:variable>
<img src='{ $image_resource_name }' alt="[IMAGE: {@alt}]" />
</xsl:template>
```



Media Adaptation

- **Objective** : Transform the original encoding to a new format that satisfies the target environment
- **Media Adaptation** : re-encode the media content with respect to the user agent capabilities in handling and processing media resources
- **Problems and requirements** :
 - Many formats can be used in the original content
 - The adaptation system should be able to find an equivalent representation of the original resources supported by the user agent
 - The adaptation should be optimal to guarantee an efficient content delivery
 - Versions management and adaptation should work together



Media Transcoding

- **Usually the Web content references media objects**
- **Media resources should not be sent directly if they do not satisfy the client requirements**
- **Media resources can be:**
 - Substituted
 - Removed or
 - Transformed to an acceptable format using available adaptation methods
- **Implemented media adaptations include:**
 - image and video resizing, image compression, image generation (SVG to Image, mathML to SVG, mathML to image, real time video adaptation), video personalization, etc.



Media Adaptation: Example



ANM Proxy

UPS profile

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 Adaptation for Preferences

The media adaptation considers the preferences of the user:
language, fonts, etc.

- **Example: SMIL adaptation to the user preferences**
 - 1) *User agent is a video client*
 - 2) Content Adaptation Dimension = {Language}
 - *Preferred language is:*
 - 1) French
 - 2) English(See generated videos)



Media Adaptation for Preferences

```
<neg:display>101x52Pixels</neg:display>  
<neg:PixelStretch>1.24</neg:PixelStretch>  
<!-- Here the language -->  
<neg:systemLanguage>ru</neg:systemLanguage>  
</rdf:Description>  
</ccpp:component>  
<ccpp:component>
```

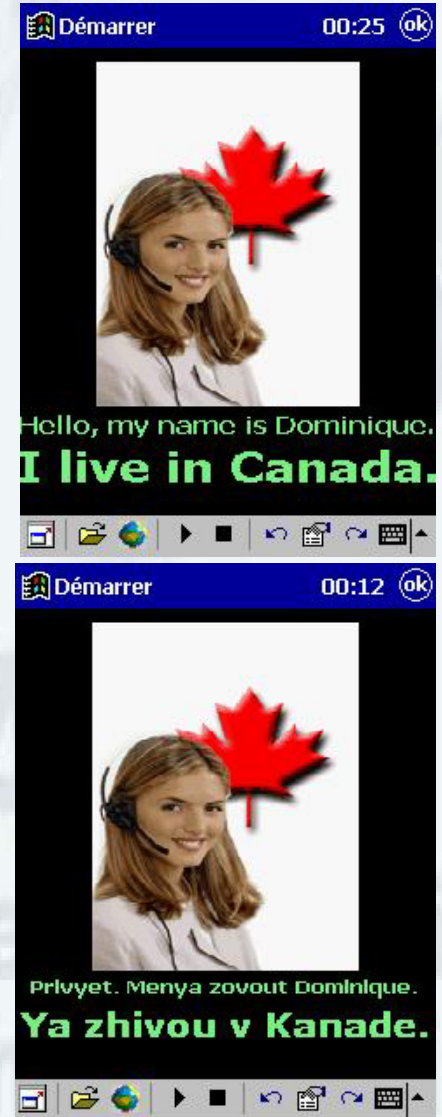
UPS profile

accept-language: fr

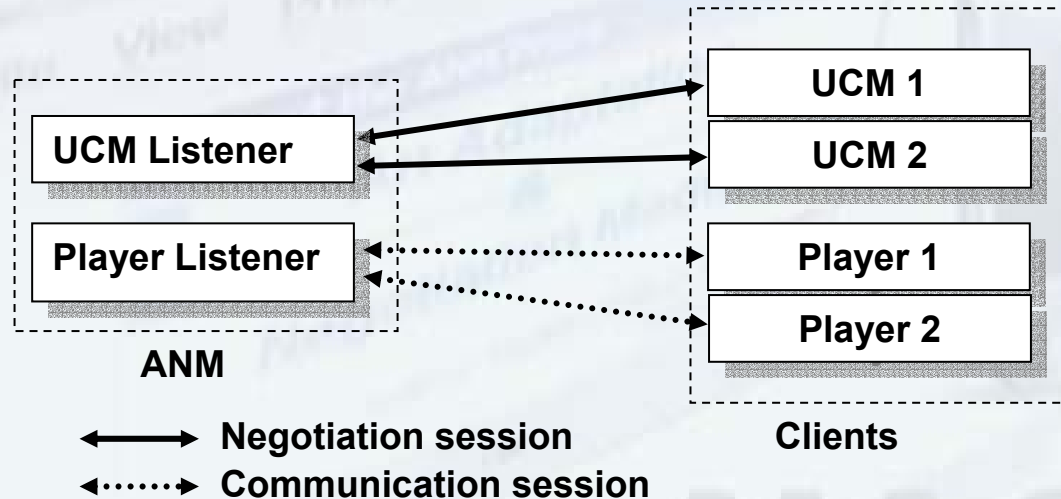
HTTP request



SMIL content is adapted
(UPS override HTTP
parameters)



Architecture Overview of NAC (Negotiation and Adaptation Core)



- **Communication:** traditional requests
- **Multithreaded:** used to support concurrent access of clients, i.e. players and UCM modules
- **Negotiation:** information about the context and the context change



Architecture's Main Entities

- 1 **Content Adaptation and Negotiation Module (ANM)**
- 2 **User Context transmission (UCM and the profiles repository)**
- 3 **Presenting multimedia content on embedded devices (PocketSMIL)**
- 4 **Adaptation methods & techniques of the architecture**



Profiles Repository

Objective: Allow an efficient management and handling of the device profiles

- Provide automatic services related to the profiles processing :
 - profiles interrogation
 - context extraction
 - profiles update
- Minimize the traffic and negotiation messages exchange
- Services can be exploited directly by the entities of the system (proxy, server, client)

Exposed Methods	Parameters	Signification
getProfile	profileID	request a profile in the repository
getContextAtomic-Value	profileID CCPPComponentID contextEntity	request a value in a profile
getSubContext	profileID XPathExpression	request a subcontext in a profile
updateContext-AtomicValue	profileID CCPPComponentID contextEntity	update a value in a profile

Implemented methods of the repository

Repository (HTML version):

<http://opera.inrialpes.fr/people/Tayeb.Lemlouma/MULTIMEDIA/UPS-Client-Repository/ups-client-repository.html> (117 devices)



Performance evaluation

Adapting SMIL to Video clients

<par>

```
<video id="vid" region="region_video" src="Videos/orange4_f.mpg"/>
```

```

```

```

```

</par>



Performance evaluation

Adapting SMIL to Video clients

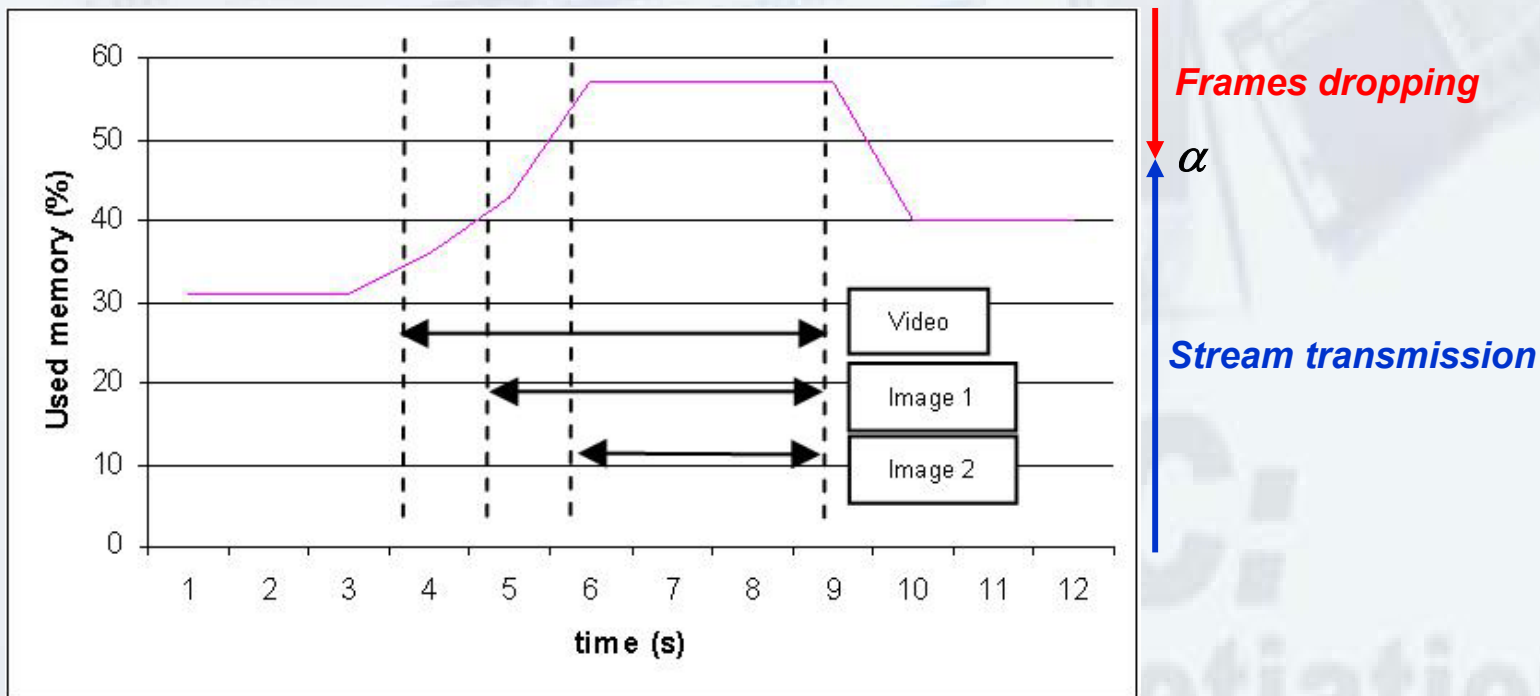
	Video 1	Video 2
Output format	uncompressed format (RGB 24-bit)	
Video dimensions	352x288	
Frame rate (fps)	25.0	25.0
Video size (Kbytes)	197918	227940
Video duration (s)	30.99	30
Frame Number	801	750
Frame duration (s)	0.0387	0.04
Encoding and storing time (ms)	35972	39577
Average encoding time (s/frame)	0.045	0.053



Performance evaluation

Adapting Video to devices with limited CPU

- Adapting a media stream to the device capabilities: Memory-based adaptation to avoid devices blocking

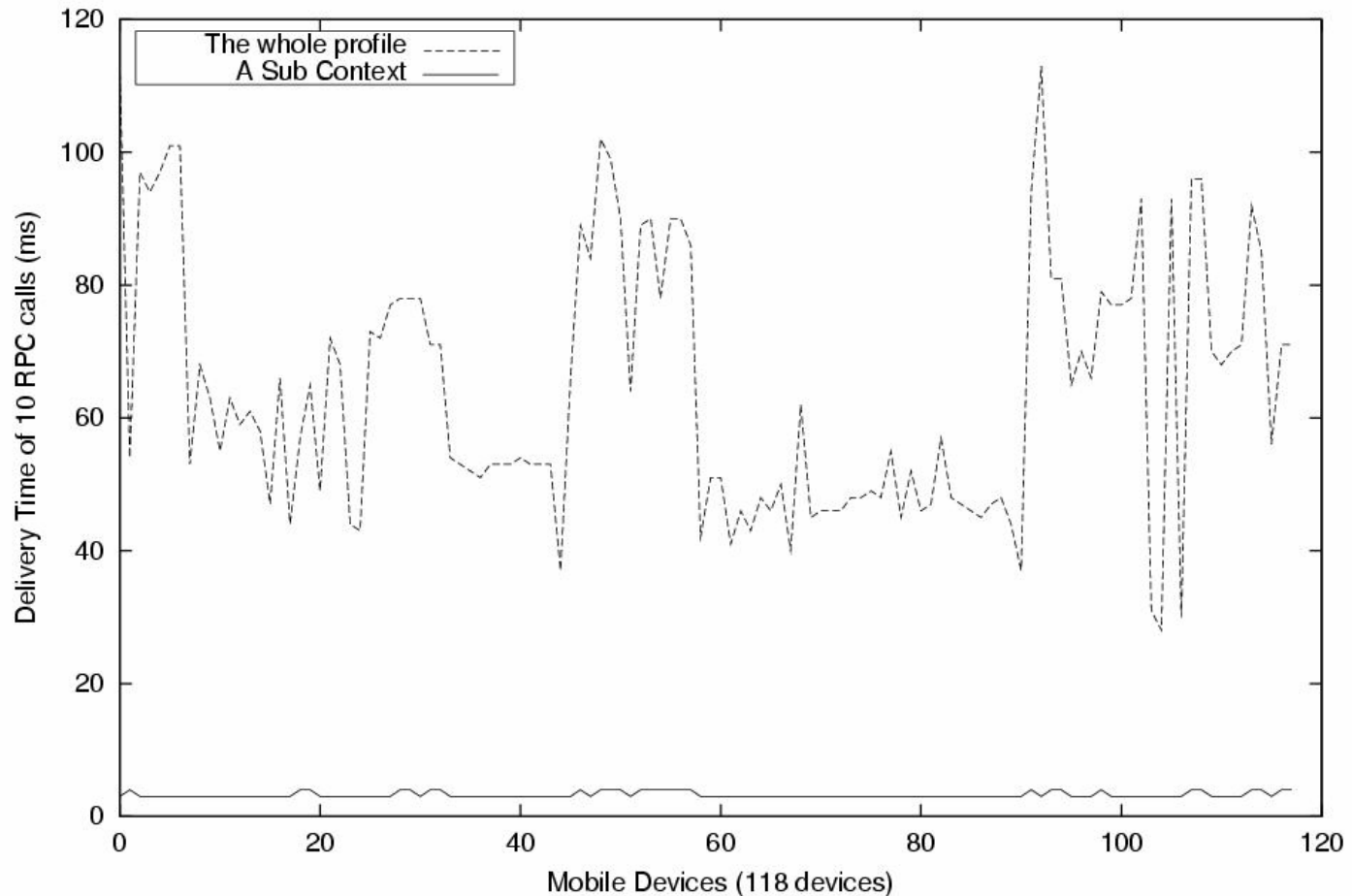


- Dropping of the video frames when the percentage of the used memory starts to be higher than a given value α



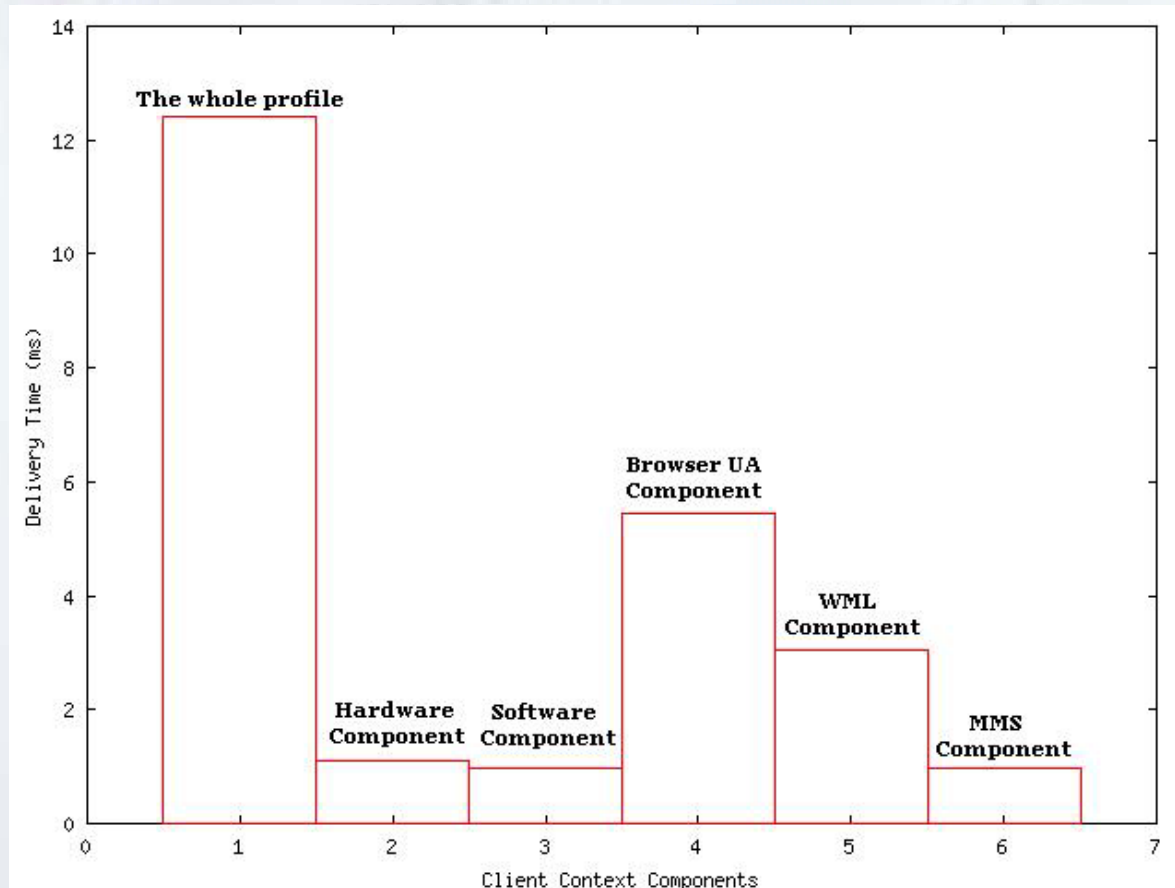
Performance evaluation

Use of profiles repository



Performance evaluation

Use of profiles repository



Media Adaptation

Delivery of adapted content

- Evaluation of delivery time and media adaptation:
- Adaptation: send only useful content



The client can use the received content

Bandwidth gain

Delivery time minimization

Media Resource	Size (bytes)	Applied Compression (%)	Transformation Time (millisecond)	Delivery time (millisecond)
Image 1	23366	50	362,20	356
Image 2	13998	80	360,20	214
Image 3	9776	90	297,16	149

Media adaptation and delivery time



W3C & Standardization

- CC/PP

- CC/PP Software resources

- (<http://www.w3.org/Mobile/CCPP/>)

- **The UPSProfiles Package** - A package for the creation of valid CC/PP profiles
 - **NAC**: A Negotiation and Adaptation Core

- Device Independence

- (<http://www.w3.org/2001/di/>)

- UPS: Universal Profiling Schema
 - Contribution with my experience in content adaptation and NAC development
 - W3C drafts and notes: "**Authoring Techniques for Device Independence**", W3C Note, 18th February 2004.



Conclusions

- **Universal access represents a very hot topic**
- **The proposed architecture (NAC) ensures the content adaptation and negotiation in heterogeneous environments**
- **NAC development has allowed:**
 - The creation of new profiling schema (UPS) for environment description
 - Definition and implementation of a negotiation protocol
 - Developing dynamic adaptation mechanisms (lacking in HTTP) and transformation (lacking in XSLT)
 - Ensuring a flexible architecture that accept the enrichment by additional adaptation methods proper to a particular need (adaptation graph)
- **Several W3C standards has been used: XML, RDF, CC/PP, XSLT, XQuery, DI guidelines , SVG, MathML, ...**



Conclusions

- NAC has been used in many existing platforms: wired and wireless networks and for many devices: PC, laptops, PDA and mobile phones
- Allow providers personalization and control of the content

- Enable the content negotiation
- Develop a flexible adaptation system
with respect to the device independence principles

➔ **Allows to provide a universal access of the content**



Perspectives

- **Profiling** : generalize the profiling concept to applications and services to enable context based customization
- **Adaptation** : make services and content more adaptable
- **Negotiation** : enable and develop negotiation in client/server architectures
- **Device independence** : develop and implement the device independence vision for content, applications and services.
- **Standardization** : NAC concepts can play an interesting role in W3C standardization



For more reading

- "***Authoring Techniques for Device Independence***", W3C Note, 18th February 2004.
- "***Context-Aware Adaptation for Mobile Devices***", IEEE International Conference on Mobile Data Management, Berkeley, California, USA, January 19-22, 2004.
- "***Encoding Multimedia Presentation for User Preferences and Limited Environments***", IEEE International Conference on Multimedia & Expo (ICME), Baltimore, Maryland, USA. July 6-9 2003. pp. 165-168.
- "***Adapted Content Delivery for Different Contexts***", SAINT 2003 Conference, Orlando, Florida, USA, January 27-31, 2003. IEEE Computer Society publication. pp. 190-197.
- "***SMIL Content Adaptation for Embedded Devices***", SMIL Europe 2003, Paris, February 12-14, 2003.
- **My publication page:**
<http://opera.inrialpes.fr/people/Tayeb.Lemlouma/publication.html>



Thank you

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Additional slides



About Me

- **Tayeb Lemlouma**
- Member of the **WAM** (Web Adaptation Multimedia) project in INRIA, France.
- Member of the **Device Independence** Working Group in the World Wide Web Consortium (W3C)
- PHD: "**Multimedia Services Negotiation and Adaptation Architecture in Heterogeneous Environments**". Thesis directors: Dr. Nabil LAYAÏDA and PR. Cécile ROISIN.



Research interest

- Web and XML Technologies
- Mobile Computing
- Heterogeneous environment
- Content Adaptation
- Multimedia Document Processing
- Multimedia Services Negotiation



Recent activities

- Member of the OPERA project in INRIA, France. (2000-2002)
- OPERA-Alcatel Bell Collaboration (2001-2002):
- W3C DI WG (Since January 2003)
- Content Adaptation
- Multimedia Document Processing
- Multimedia Services Negotiation



Thesis realization

- The design of the **NAC architecture**
- The definition of the **UPS Model**
- The definition of a **negotiation protocol**
- **NAC**: Negotiation and Adaptation Core prototype.
- **ANM** proxy
- **UCM** module
- **SMIL Palyer**
- **Content adaptation** methods
 - Structural transformation methods
 - Media resources adaptation
- Other related applications and APIs: CC/PP package, Live video adaptation..



The use of profiles



```
- <rdf:Description ID="HardwarePlatform">
  <rdf:type rdf:resource="http://www.inrialpes.fr/opei
    03012002#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>
</neg:components>
```

Client

```
<!-- 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

Apply the
method on the
content

=

Send SMSs to
the phone



Other Profiles Examples

```
- <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:ccpp="http://www.w3.org/2000/07/04-ccp"
  xmlns:neg="http://www.inrialpes.fr/opera/people/Tayeb.Lemlouma/NegotiationSchema/ClientProfileSchema-03012"
- <rdf:Description ID="ClientProfile">
- <ccpp:component>
- <rdf:Description ID="HardwarePlatform">
  <rdf:type rdf:resource="http://www.inrialpes.fr/opera/people/Tayeb.Lemlouma/NegotiationSchema/schema-
    03012002#HardwarePlatform" />
  <neg:DeviceType>PDA</neg:DeviceType>
  <neg:DeviceName>IPAQ 3600</neg:DeviceName>
  <neg:screen>30X23mm</neg:screen>
  <neg:display>101x52Pixels</neg:display>
  <neg:PixelStretch>1.24</neg:PixelStretch>
  </rdf:Description>
</ccpp:component>
- <ccpp:component>
- <rdf:Description ID="SoftwarePlatform">
  <rdf:type rdf:resource="http://www.inrialpes.fr/opera/people/Tayeb.Lemlouma/NegotiationSchema/schema-
    03012002#SoftwarePlatform" />
  <rdf:type rdf:resource="SoftwarePlatform" />
  <neg:PlatformName>WCE</neg:PlatformName>
  <neg:PlatformVersion>3.0</neg:PlatformVersion>
  </rdf:Description>
</ccpp:component>
- <ccpp:component>
- <rdf:Description ID="BrowserUA">
  <rdf:type rdf:resource="http://www.inrialpes.fr/opera/people/Tayeb.Lemlouma/NegotiationSchema/schema-
    03012002#BrowserUA" />
  <neg:PlayerName>IE</neg:PlayerName>
  <neg:PlayerVersion>5.0</neg:PlayerVersion>
- <neg:OnlySupportedResources>
- <rdf:Bag>
  - <rdf:li rdf:parseType="Resource">
    <neg:ResourceType>textResume</neg:ResourceType>
    <neg:ResourceFormat>txt</neg:ResourceFormat>
  </rdf:li>
```

chema-

ia-

chema-

ia-



Variants Selection

A 'in-line test attribute' example

SMIL:

<par>

```
<textstream src="presentation_speech_translation.rt"
systemLanguage="fr" />
```

```
<audio src="presentation_speech.mp3" ... />
```

```
<video src="presentation.mpg" ... />
```

</par>



Variants Selection

A 'in-line test attribute' example

UPS:

language: English

SMIL:

<par>

<audio src="presentation_speech.mp3" . . . />
<video src="presentation.mpg" . . . />

</par>



Document Transformation

Example

SMIL:

- `<body>`
- `<seq>`
- `<par>`
- `<audio id="audio" src="sarah.mp3" begin="0s" end="12s"/>`
- ``
- ``
- `</par>`
- `<video region="r4" src="iceage.mpeg" begin="3s" end="30s"/>`
- `<par>`
- ``
- ``
- `</par>`
- `</seq>`
- `</body>`



Document Transformation

UPS:

```
<ccpp:component>
```

```
<rdf:Description rdf:about="NonSupportedResources">  
  <rdf:type rdf:resource="Resources" />  
  <neg:NonSupportedResources>  
    <rdf:Bag>  
      <rdf:li rdf:parseType="Resource">  
        <neg:type>video</neg:type>  
        <neg:format>mpeg</neg:format>  
        <neg:profile>device-profiles/mpeg-profile.xml</neg:profile>  
      </rdf:li>  
      ...  
    </rdf:Bag>  
  </neg:NonSupportedResources>  
</rdf:Description>
```

```
</ccpp:component>
```



Document Transformation

Adapted Document

- `<body>`
- `<seq>`
- `<par>`
- `<audio id="audio" src="sarah.mp3" begin="0s" end="12s"/>`
- ``
- ``
- `</par>`
- `<par>`
- ``
- ``
- `</par>`
- `</seq>`
- `</body>`



Structural Adaptation Example: Filtering

- A technique applied by the proxy to reply to clients limitation
- Replies are done according to the declared user profile
- The filtering principle is achieved by:

Processing the client profile

+

Removing non supported resources (images, video, styles, ect.)
from different services



Client Profile



Media Adaptation for Capabilities

- Example

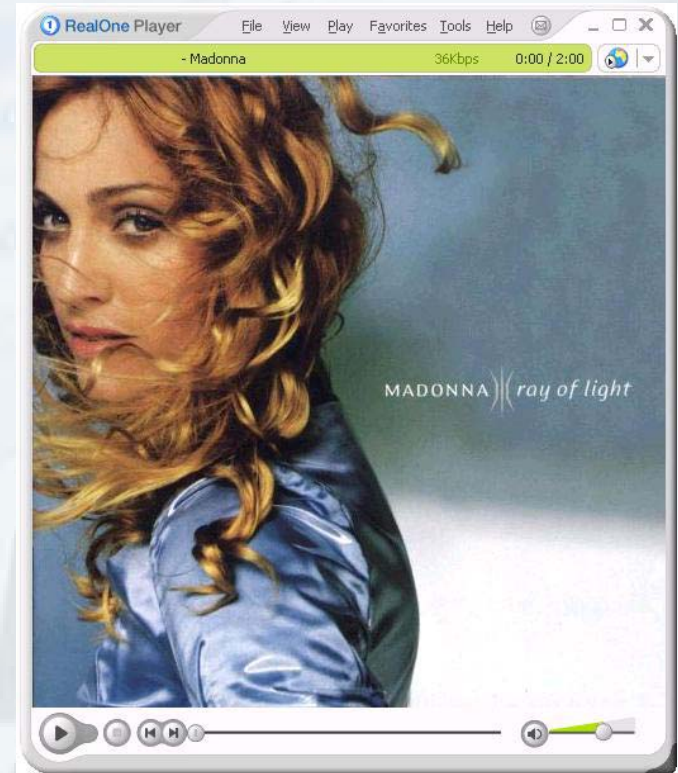
```
<body>  
  <par dur ="120s">  
    <audio src="Frozen.mp3"/>  
      
  </par>  
</body>
```



Original SMIL on a PDA



Adapted SMIL on a PDA



Original SMIL on a PC



The Overall Scenario

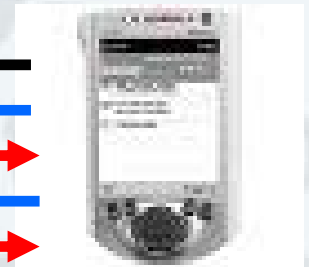
- One of the following services is delivered:

- The original service
- The original service after filtering
- An extended service
- The service via server method
- A negative reply

Initialization

Content Negotiation

Services deliverance



A Client Profile Example

```
<?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/DocumentInstanceSchema-03012002#">
  <rdf:Description rdf:ID="DocumentInstanceProfile">
    <ccpp:component>
      <rdf:Description rdf:ID="DocumentInstanceDescription">
        <neg:InstanceType>HTML</neg:InstanceType>
        <neg:InstanceFormat>html</neg:InstanceFormat>
        <neg:InstanceVersion>4.01</neg:InstanceVersion>
        <neg:InstanceDoctype>http://www.w3.org/TR/html4/loose.dtd</neg:InstanceDoctype>
        <neg:InstanceName>EXAMPLE.html</neg:InstanceName>
        <neg:InstanceLanguage>english</neg:InstanceLanguage>
        <neg:InstanceSize>910Bytes</neg:InstanceSize>
        <neg:InstanceLocation>Smil/T/NEGOTIATION/WAP/</neg:InstanceLocation>
        <neg:InstanceServer>http://opera.inrialpes.fr/</neg:InstanceServer>
      </rdf:Description>
    </ccpp:component>
  </rdf:Description>
  <ccpp:component>
    <rdf:Description rdf:ID="MultimediaContent">
      <rdf:type
rdf:resource="http://www.inrialpes.fr/opera/people/Tayeb.Lemlouma/NegotiationSchema/DocumentInstanceSchema-03012002#MultimediaContent" />
      <neg:content>
        <rdf:Bag>
          <rdf:li rdf:parseType="Resource">
            <neg:ResourceType>image</neg:ResourceType>
            <neg:ResourceFormat>jpg</neg:ResourceFormat>
          </rdf:li>
        </rdf:Bag>
      </neg:content>
    </rdf:Description>
  </ccpp:component>
</rdf:RDF>
```



Variants Selection: SMIL Case

SMIL + UPS = Adapted SMIL

- The content selection can be expressed using the SMIL system test attributes
- The proxy evaluates the test using the information extracted from the different UPS profiles
- New SMIL content is sent to the client



A Client Profile Example

```
<?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">
    <rdf:type rdf:resource="http://www.inrialpes.fr/...
HardwarePlatform"/>
    <neg:DeviceName>Ericsson-R320</neg:DeviceName>
    <neg:screen>30x23mm</neg:screen>
    <neg:PixelStretch>1.24</neg:PixelStretch>
    <neg:PhoneNumber>0610987326</neg:PhoneNumber>
  </rdf:Description>
</ccpp:component>
```

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

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



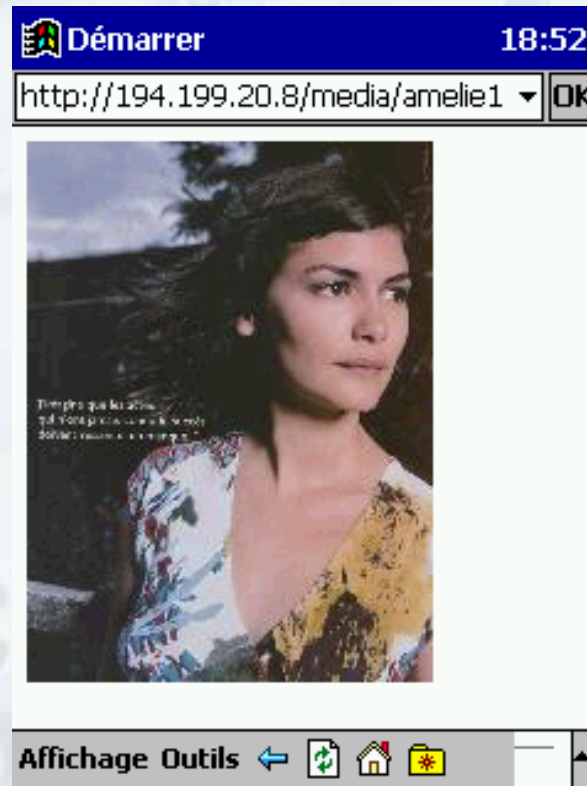
Document Transformation

- The transformation is applied to the document structure
- Depending to the UPS description, the structural transformation can:
 - Keep the same media resource used by the original document,
 - Filter it, or
 - Require an external transformation to adapt the media AND/OR the structure



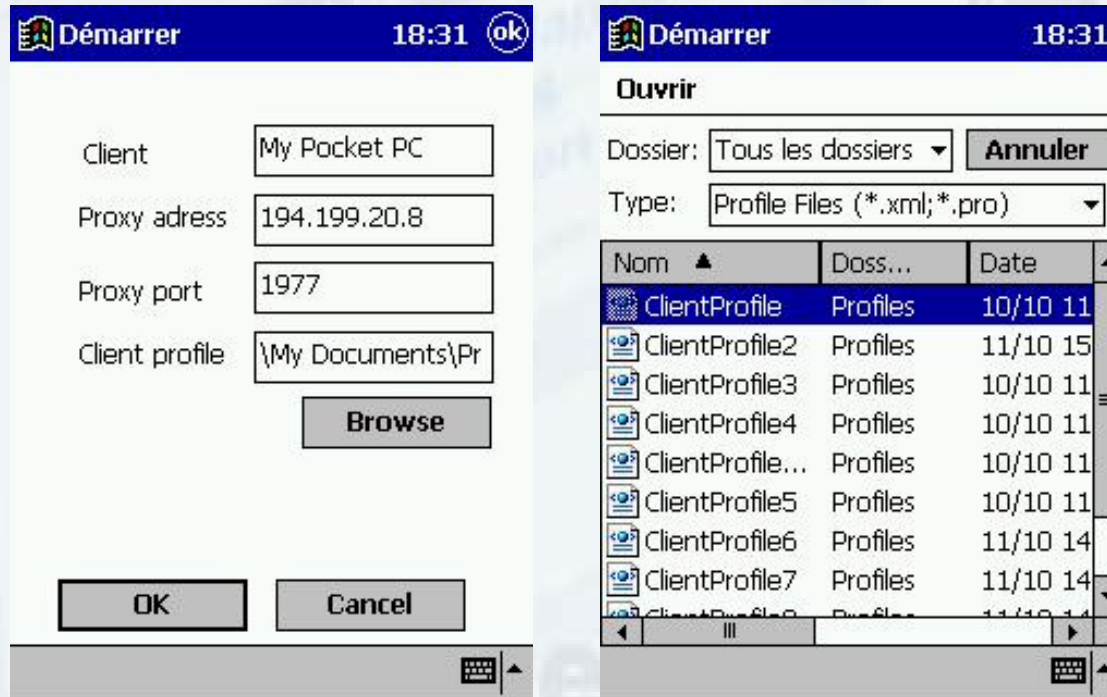
Media Adaptation: Example

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



Media Adaptation: Example

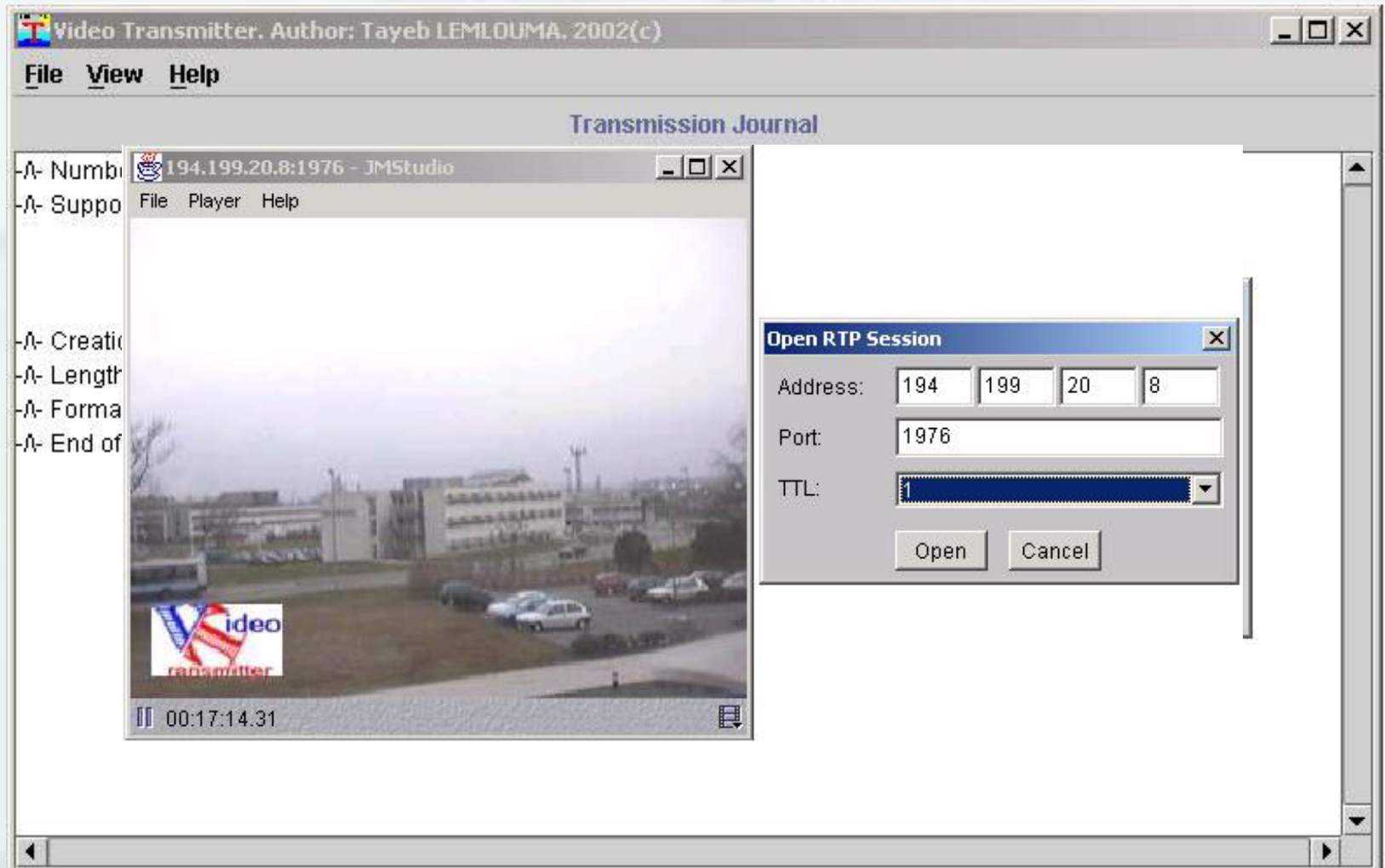
- The device (Pocket PC here) selects its profile:



- The client requests the content: a JPEG image

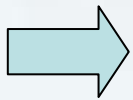


Real Time Video Adaptation



Media Adaptation for Preferences

- The client requests a SMIL 2.0 document



The proxy adapts the SMIL presentation with respect to the client profile: language

```
- <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>
```



NAC: Negotiation and Adaptation Core

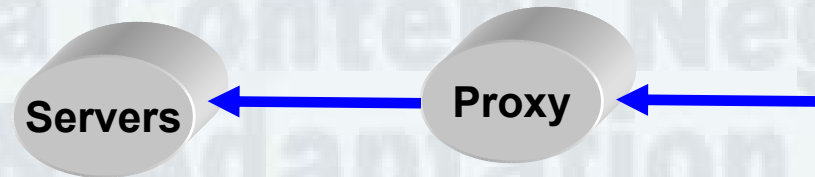
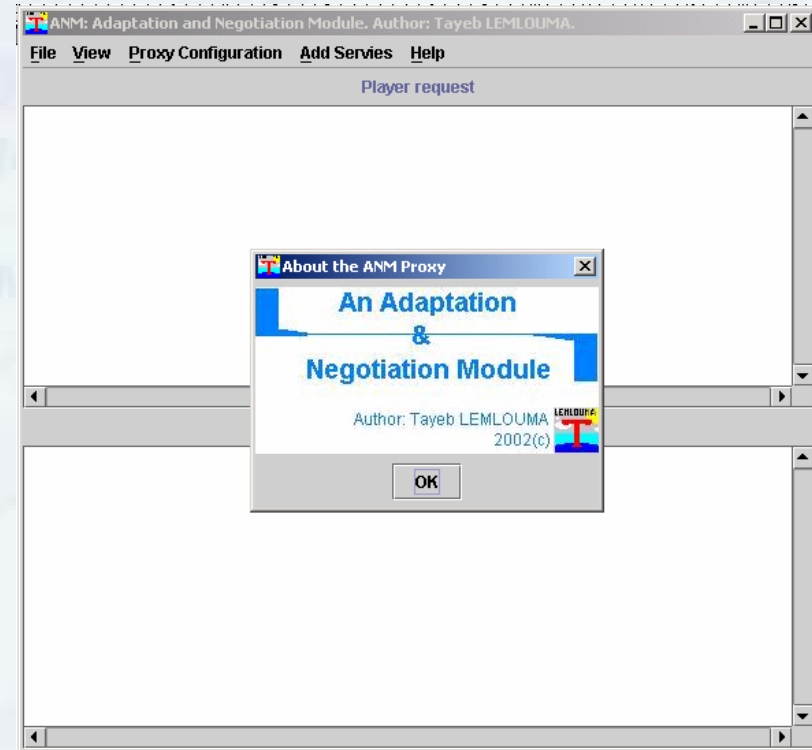
- **A basic solution for multimedia content negotiation and adaptation for heterogeneous systems.**
- **Based on several recent technologies: XML, RDF, CC/PP, SMIL ...**
- **Matching and negotiation algorithms are flexible and so the solution can be enriched at any time to meet particular needs**



Content Adaptation and Negotiation (ANM Proxy)

The Adaptation & Negotiation Module allows:

- Handling directly client requests
- Client and server profiles processing
- Services deliverance
- Support of adaptation enrichment
- Cooperation with the contextual module
- Adding links to other services.

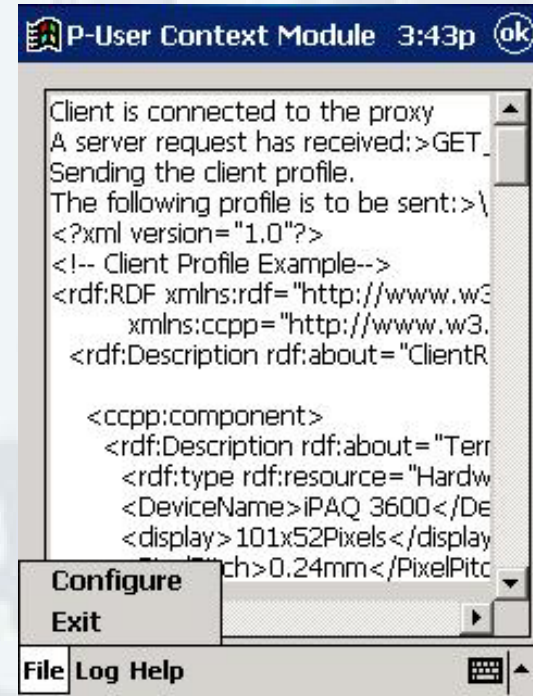


User Context Transmission

- **UCM Module + Profiles Repository**
- **UCM Module**

Allows:

- **Selecting the intermediate proxy or a negotiation-enable server**
- **Selecting the user context**
- **Application of the negotiation protocol:**
 - Client profile transmission to the proxy
 - Replying to proxy request if the client context changes
- ...



The PocketSMIL Player

- Represents a part of the global architecture
- Playing SMIL Basic multimedia services
- SMIL is suitable for Multimedia presentation and content adaptation and personalization.



**SMIL Multimedia +
HTML content**



Adaptation methods & techniques of the architecture

- **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 media:**

Example:

- 1- **Image Transcoding**
- 1- **A method that transforms text to speech**
- 2- **Text to SMS messages**



Media Adaptation: Example

