



# ICWL 2010

## Learning Content Adaptation for m-Learning Systems : a Multimodality Approach

Ivan Madjarov and Omar Boucelma  
LSIS, WiCSi Project, Marseille, France

## Outline

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  - The problem
  - Interconnection of mobile devices with LCMS
    - Solution : Web Services Oriented Framework
  - A semantic pedagogical structure
  - XML content creation
    - Semantic editor, Plug-ins, NXDB storage
  - M-Learning Technologies
  - Mobile browser tests and comparison
  - Adaptation technique
  - System architecture
  - Conclusion and future work
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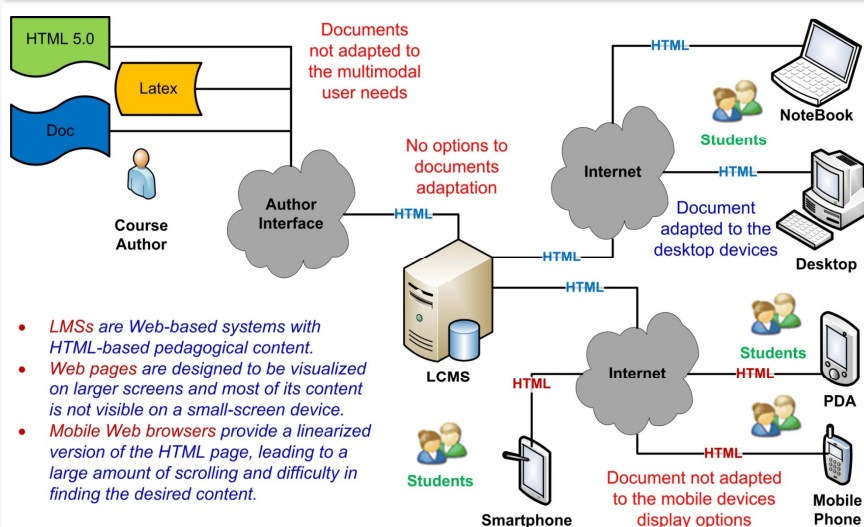


## Introduction

- Ubiquitous availability of mobile devices:
  - Connected to Internet (3G+, Wi-Fi, Bluetooth)
- Limited screen size and resolution :
  - Makes hard to visualize multifaceted Web pages.
- Adjustment in e-Learning means :
  - Contextualization of learning contents for m-Learning usage.
    - A speech solution allows learners to turn any written text into natural speech files.
    - Web service-based approach for adapting, displaying and manipulating learning objects on small handheld devices.

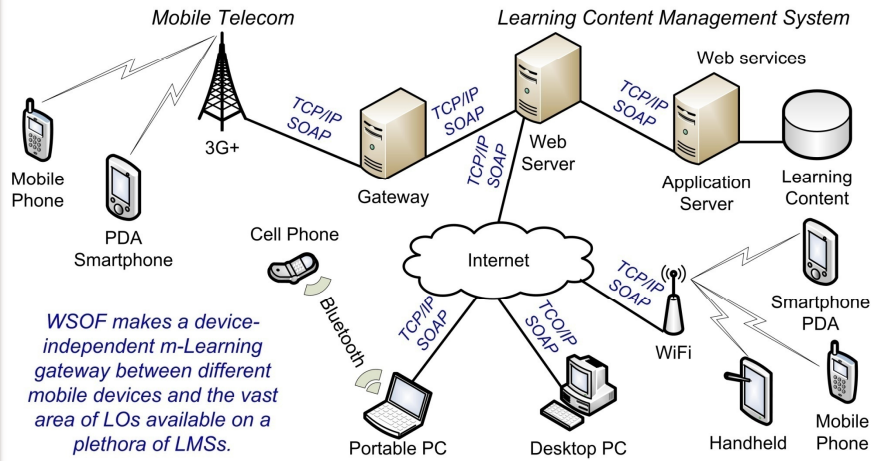


## What the problem is



# Web Services Oriented Framework

- Mobile devices are ideal tools to support the learning process, especially given their pervasive nature and personal use.



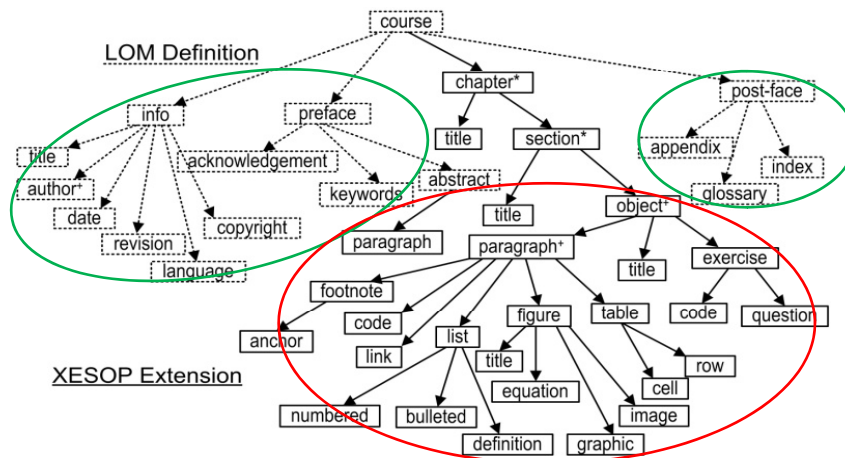
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# Course Semantics

- Our extension of the LOM definition



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# XML content creation

XML Semantic Editor with XML Schema grammar

XML

XSD

XSLT

XHTML

PDF

RTF

```
<imageobject>
<mediaobject>
<para>
Le SVG est un format graphique vectoriel permettant la production de figures et de diagrammes. SVG est un langage XML.
</para>
<para>
MathML est un langage basé sur XML donnant la possibilité l'affichage de symboles mathématiques. MathML ne s'occupe pas seulement de la présentation mais également du sens des différentes composantes des formules mathématiques. Exemple:
</para>
<inlineequation>

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

</inlineequation>
```



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# XML content creation

SVG and MatML plug-ins

Transformation de documents XML

XML

XSD

XSLT

XHTML

PDF

RTF

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$


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## XML content creation

**1. Images and binary data are stored into the edited content using Base64 encoding method**

**2. `<image height="66" name="fig3.gif" width="214">R0IGODlh1gBCALMAAA  
AAAAIAAAACAIACAAAAAGIAAgACA  
gMD .....  
</image>`**

**3. The integrated XML collection is stored in a native XML database**

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## M-Learning Technologies

- m-Learning is a mobile extension of e-Learning.
- Mobile device characteristics :
  - *Mobile units*: Cell phones, Smartphones, PDAs, Handheld PCs;
  - *Application platforms*: Java2ME, Symbian, iPhone, Windows Mobile, Android, etc.;
  - *Web browsers*: Opera Mobile and Mini, Safari, S60, Microsoft IE for Mobile, etc.;
  - *Mark-up languages*: XHTML MP, WML, XML, etc.;
  - *Script languages*: JavaScript, VBScript;
  - *Development tools*: Nokia's Ovi SDK, Samsung Bada SDK, Sweb Apps for iPhone, etc.;
  - *Screen resolution* : 320X240, 320X480, 480X360.

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## Mobile Browser tests

1. **Styled text**: XHTML MP text paragraph with WCSS;
2. **Tables**: XHTML MP page with Table and styled cells;
3. **Scripting**: XHTML MP form with JavaScript function;
4. **DOM and Ajax**: XHTML MP page with Ajax technique invocation;
5. **Device recognition**: Mobile user identification via HTTP headers: HTTP\_USER\_AGENT, HTTP\_X\_WAP\_PROFILE and HTTP\_ACCEPT;
6. **Object**: MathML page with formula equation example;
7. **Vector graphics**: XHTML MP page with SVG graphic;
8. **Video**: XHTML MP page with image and embedded sound file;
9. **Image**: Pages with an animated GIF graphic, PNG and JPEG images;
10. **Sound**: Pages with an WAV file and an embedded object with MP3;
11. **XML**: XML document with a XSLT definition for a presentation;
12. **Events**: XHTML MP page testing click events support;
13. **Acid3**: 100 subtests in six groups of selected elements from W3C standards. The result is expressed as a percentage.
14. Tests available : <http://valk.iut-gtr.univ-mrs.fr/mobile/testmobile.xhtml>



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## Mobile browsers comparison

Browser / Test item	Opera Mobile	S60 WebKit	Safari	Opera Mini	IE Mobile	BOLT WebKit	Blazer
XHTML MP	√	√	√	√	√	√	√
WCSS	√	√	√	x	√	√	x
Tables	√	√	√	√	√	√	√
JavaScript	√	√	√	√	√	√	√
Image	√	√	√	√	√	√	√
Sound	√	√	√	√	√	√	√
Video	√	√	√	x	√	√	√
XML	√	x	√	√	x	√	x
XSLT	√	x	√	√	x	√	x
MathML	√	x	√	x	x	√	x
SVG 1.1	√	x	√	x	x	√	x
AJAX	√	√	√	√	x	√	x
Java2ME	√	√	√	√	√	√	x
Events	√	√	√	x	√	√	x
Acid3	99/100	47/100	100/100	64/100	20/100	100/100	73/100



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## Adaptation technique

- **Short modules:** Authors should prepare flexible learning materials that can be accessed across contexts.
- **Simple functionality:** Authors should create pages with simple interactions to avoid the complexity of the rich multimedia content.
- **Summarize:** Authors may divide pages into smaller chunks and putting them on multiple hyperlinked pages surrounded by an index to facilitate the access to a requested content.
- **Browser profile:** Authors should adapt the displayed page in a format according to the browser's profile.
- **Text-to-speech:** Authors should propose this feature for easing learning access to users on move and/or with small display capabilities of mobile devices.



## Contextualization

- The content adaptation schema



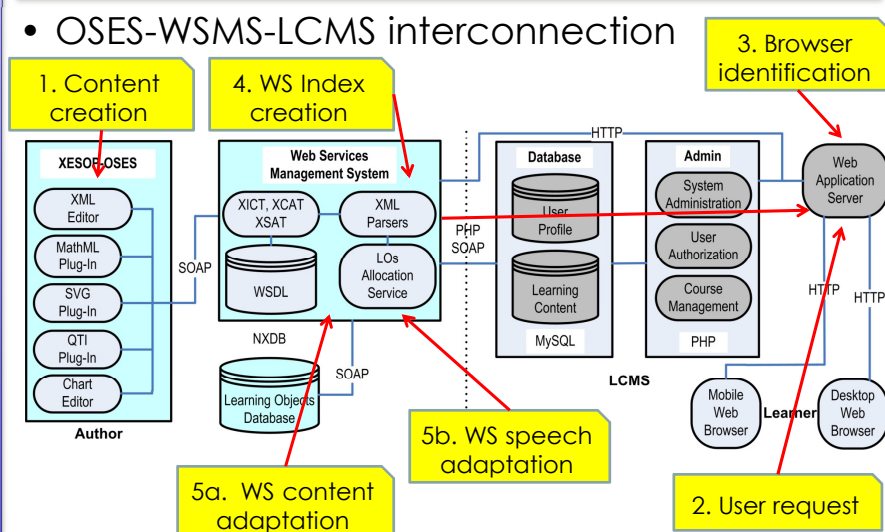
## Authoring system

- We developed a Web service-based semantic authoring system :
  - An Web Services Oriented Framework (WSOF) witch combines :
    - An Open Semantic Editor Suite (OSES):
      - XML semantic editor
      - Plug-Ins: MathML, SVG, Chart, Graph, DB, ...
    - A set of Web services for mobile browser identification and content adaptation :
      - XML index creation tool (XICT)
      - XML content adaptation tool (XCAT)
      - XML speech adaptation tool (XSAT)



## System architecture

- OSES-WSMS-LCMS interconnection





## Conclusion and future work

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- We presented a Web service-based approach of an integrated Web-based learning and mobile learning environment
- We introduced a Web Service-based framework that utilizes the hierarchical displaying multimedia units with index extraction and content summarization.
- Future work : The development of a generic Web service-based architecture integration with AJAX technique.
- Demo : <http://valk.iut-gtr.univ-mrs.fr/mobile/ivan/test/>



## Questions ..

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Ivan Madjarov and Omar Boucelma

Laboratoire des Sciences de l'Information et des Systèmes  
(LSIS) - UMR CNRS 6168, Aix-Marseille Université  
Avenue Escadrille Normandie-Niemen  
F-13397 Marseille Cedex 20 France

{ivan.madjarov, omar.boucelma}@lsis.org

