Multimedia on the Semantic Web

Lynda Hardman  
Information Systems, TU/e  
Multimedia and Human-Computer Interaction, CWI

Jacco van Ossenbruggen  
Multimedia and Human-Computer Interaction, CWI

With Semantic Web contributions from  
Frank van Harmelen  
AI Department  
Vrije Universiteit Amsterdam

Talk overview

- Multimedia on the Web
  - SMIL
- Generating multimedia presentations
  - Cuypers
- Semantic Web technology
  - XML, RDF and DAML+OIL
- Multimedia on the Semantic Web
Multimedia scenario

User is taking an art class on Rembrandt and wants to know about the “chiaroscuro” technique.

System responds with a textual and audio explanation of the technique and a number of example images of its application in Rembrandt’s paintings.

Multimedia on the Web

SMIL 2.0 (7th August 2001)
Synchronized Multimedia Integration Language

SMIL is about timing, not just graphics, combining Web resources in an XML syntax.
SMIL in a nutshell

- Content
  - (part of) media item
- Spatial layout
  - regions
- Temporal layout
  - 100 pages of 300 page spec.
  - par, seq, excl
- Links
- Semantic annotations
- Alternative content

Tailorable multimedia

- Adapt to end-user’s platform capabilities
  - PC, PDA, mobile, voice-only, …
- Adapt to the network resources available
  - bandwidth and other quality of service parameters
- Personalization
  - language, abilities, level of expertise, …

Problem: current document processing Web tools
do not work for multimedia
Cuypers multimedia generation engine

Demonstration

Acknowledgements:
- Demonstrator developed in the context of the ToKeN2000 project
- Media database used with permission, courtesy Rijksmuseum Amsterdam.
Cuypers - the bad news

Currently all our design knowledge is:
- implicit and hidden in the generation rules
- lost in the generated Web presentation
- not reusable for other Web applications/sites

We need the Semantic Web

So what is the Semantic Web?
- It is not about “blue sky” researchers trying to model the entire world...
- Instead, the Semantic Web
  - proposes explicit meta-data rather than “screen scraping”
  - by using agreed upon semantics (ontologies)
  - building on proven Web technology (XML, RDF, DAML+OIL)
Tim Berners-Lee talk at XML 2000

Machine accessible meaning
(What it’s like to be a machine)
XML?
machine accessible meaning

The semantic pyramid again
RDF: graphs of triples

- Object -> Attribute -> Value triples
- objects and values are web-resources

Rembrandt → paints → apostlePaul

- Triples can be linked
- data-model = graph

Rembrandt → paints → apostlePaul → Rijksmuseum

Any statement can be an object
- graphs can be nested - reification

Rijksmuseum → claims → Rembrandt → paints → apostlePaul

```
<rdf:Description rdf:about="#Rijksmuseum">
  <claims>
    <rdf:Description rdf:about="#Rembrandt">
      <paints>#apostlePaul</paints>
    </rdf:Description>
  </claims>
</rdf:Description>
```
What does RDF Schema add?

- Defines small **vocabulary** for RDF:
  - Class, subClassOf, type
  - Property, subPropertyOf
  - domain, range
- Vocabulary can be used to define other vocabularies for your application domain

```
<table>
<thead>
<tr>
<th>Artist</th>
<th>Painter</th>
<th>Painting</th>
</tr>
</thead>
<tbody>
<tr>
<td>subClassOf</td>
<td>domain</td>
<td>paints</td>
</tr>
<tr>
<td>Rembrandt</td>
<td>type</td>
<td></td>
</tr>
<tr>
<td>ApostlePaul</td>
<td>range</td>
<td>type</td>
</tr>
</tbody>
</table>
```

The semantic pyramid again
WebOnt and OntoWeb

- W3C WebOnt working group set up 1 Nov 2001
  Work continuing where DAML+OIL left off
  http://www.w3.org/2001/sw/WebOnt/charter

- WebOnt is part of W3C Semantic Web activity
  which also includes RDF

- OntoWeb
  EU funded thematic network
  > 80 partners, including CWI, VU and UvA
  http://www.ontoweb.org

Semantic Web: main players

Academic in Europe:
- VU, Amsterdam
- Karlsruhe
- Manchester
- INRIA
- SWI@UvA

Academic in US:
- Stanford
- Maryland
- MIT/W3C
- Florida
- CMU

Industrial:
- Lucent
- Philips
- Nokia
- HP
- lots of start-ups (NL, UK, G, N, US)

Not (yet?)
- IBM
- Microsoft
- Sun

**SW isn’t just KR in XML/ RDF**

- the Web is large
- it’s even larger
- no referential integrity
- many authors, distributed authority, trust
- high variety in quality of knowledge
- diverse vocabularies
- decentralized
- high change rate, time-dependent content
- local containment of inconsistencies
- justifications as first order citizens

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**Cuypers revisited**
Embedding RDF in SMIL - I

```xml
<smil xmlns="http://www.w3.org/2000/SMIL20/CR">
    <head>
        <meta name="generator" content="CWI/Cuypers 1.0"/>
        <metadata>
            <rdf:RDF xml:lang="en"
                xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
                <museum:Museum rdf:ID="Rijksmuseum"/>
                <museum:Painter rdf:ID="Rembrandt">
                    <museum:fname>Rembrandt</museum:fname>
                    <museum:lname>Harmenszoon van Rijn</museum:lname>
                    <museum:paints rdf:resource="#apostlePaul"/>
                </museum:Painter>
                <museum:Painting rdf:about="#apostlePaul">
                    <museum:exhibited rdf:resource="#Rijksmuseum"/>
                    <museum:technique>chiaroscuro</museum:technique>
                </museum:Painting>
            </rdf:RDF>
        </metadata>
    </head>
    <body>
        <par>
            <text region="title" src="...query to MM DBMS..."/>
            <text region="descr" src="...">
                <par dur="10">... 1st painting+title ...
                </par>
                <par dur="10">... 2nd painting+title ...
                </par>
                <par dur="10">... 3rd painting+title ...
                </par>
                <par dur="10">... 4th painting+title ...
                </par>
                <par dur="10" id="apostlePaul">
                    <img region="img" src="...">
                    <text region="ptitle" src="...">
                        <par>
                            ...
                        </par>
                        <par>
                            ...
                        </par>
                    </text>
                </par>
            </text>
        </par>
    </body>
</smil>
```

Embedding RDF in SMIL - II

```xml
<smil xmlns="http://www.w3.org/2000/SMIL20/CR">
    <head>
        <meta name="generator" content="CWI/Cuypers 1.0"/>
        <metadata>
            <rdf:RDF xml:lang="en"
                xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
                <museum:Museum rdf:ID="Rijksmuseum"/>
                <museum:Painter rdf:ID="Rembrandt">
                    <museum:fname>Rembrandt</museum:fname>
                    <museum:lname>Harmenszoon van Rijn</museum:lname>
                    <museum:paints rdf:resource="#apostlePaul"/>
                </museum:Painter>
                <museum:Painting rdf:about="#apostlePaul">
                    <museum:exhibited rdf:resource="#Rijksmuseum"/>
                    <museum:technique>chiaroscuro</museum:technique>
                </museum:Painting>
            </rdf:RDF>
        </metadata>
    </head>
    <body>
        <par>
            <text region="title" src="...query to MM DBMS..."/>
            <text region="descr" src="...">
                <par dur="10">... 1st painting+title ...
                </par>
                <par dur="10">... 2nd painting+title ...
                </par>
                <par dur="10">... 3rd painting+title ...
                </par>
                <par dur="10">... 4th painting+title ...
                </par>
                <par dur="10" id="apostlePaul">
                    <img region="img" src="...">
                    <text region="ptitle" src="...">
                        <par>
                            ...
                        </par>
                        <par>
                            ...
                        </par>
                    </text>
                </par>
            </text>
        </par>
    </body>
</smil>
```
Conclusions

XML technology is commonplace, but

- insufficient for multimedia generation
  - CWI’s Cuypers enables tailorable multimedia

- insufficient for machine understandable metadata
  - RDF(S) provides basic KR primitives
  - WebOnt is developing an ontology language for the Web

“Semantic Multimedia” focus of current research

- reusing knowledge available on the Semantic Web
- generating annotated multimedia