

Multimedia meets the Semantic Web

Lynda Hardman*, Jacco van Ossenbruggen, Frank Nack

Multimedia and Human-Computer Interaction
INS2

** also Technical University, Eindhoven*

- Semantic Web
- Multimedia and the Semantic Web
- Generating hypermedia presentations

The Web in three generations

First: Hand-coded (HTML) Web content

- easy access through uniform interface
- huge authoring and maintenance effort
- hard to deal with dynamically changing content

Second: Automated on-the fly content generation

- based on templates filled with database content
- later with XML extended document transformations

Third: Automated processing of content

- The Semantic Web
- explicit meta-data instead of “screen scraping”
- agreed upon semantics (RDFS, DAML+OIL)

Layers of the Semantic Web

Ontology (RDF Schema/DAML+OIL)

a painter is a person who makes paintings

Instances (RDF)

Rembrandt is a painter

Annotation (XLink, XPointer)

this text is about Rembrandt

XML data

Where the Semantic Web and Multimedia meet

Ontology (RDF Schema/OIL)

a painter is a person who makes paintings

MM specific primitives

Co-ordinate space?

Instances (RDF)

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MM specific ontologies

scene, sequence, frame defn.

Annotation (XPointer)

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MM annotations

this is a painting of Rembrandt

XML data

SMIL

Multimedia data

MPEG2

Mixing RDF and SMIL

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Example Presentation



Using an existing museum ontology

For details see <http://www.cwi.nl/~media/semantics/>

```
<?xml version="1.0"?>
<!-- taken from http://www.ics.forth.gr/proj/isst/RDF/RQL/rql.html -->

<rdf:RDF xml:lang="en" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
        xmlns:rdfs="http://www.w3.org/TR/2000/CR-rdf-schema-20000327#"
        xmlns="">

  <rdfs:Class rdf:ID="Artist"/>
  <rdfs:Class rdf:ID="Artifact"/>
  <rdfs:Class rdf:ID="Museum"/>
  <rdfs:Class rdf:ID="Sculptor">
    <rdfs:subClassOf rdf:resource="#Artist"/>
  </rdfs:Class>
  <rdfs:Class rdf:ID="Painter">
    <rdfs:subClassOf rdf:resource="#Artist"/>
  </rdfs:Class>
  <rdfs:Class rdf:ID="Sculpture">
    <rdfs:subClassOf rdf:resource="#Artifact"/>
  </rdfs:Class>
  <rdfs:Class rdf:ID="Painting">
    <rdfs:subClassOf rdf:resource="#Artifact"/>
  </rdfs:Class>

  ...
</rdf:RDF>
```

Embedding RDF in SMIL - I

```
<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#"
        xmlns:oil="http://www.ontoknowledge.org/oil/rdf-schema/2000/11/10-oil-
standard"
        xmlns:museum="http://ics.forth.gr/.../museum.rdf"
        xmlns:token="http://www.token2000.nl/ontologies/additions" >

        <rdf:Property rdf:about="http://www.token2000.nl/ontologies/additions#painted-by">
          <oil:inverseRelationOf rdf:resource="http://ics.forth.gr/.../museum.rdf#paints"/>
        </rdf:Property>

        <museum:Museum rdf:ID="Rijksmuseum" />

        <museum:Painter rdf:ID="Rembrandt">
          <museum:fname>Rembrandt</museum:fname>
          <museum:lname>Harmenszoon van Rijn</museum:lname>
        </museum:Painter>

        <museum:Painting rdf:about="#apostlePaul">
          <museum:exhibited rdf:resource="#Rijksmuseum" />
          <museum:technique>chiaroscuro</museum:technique>
          <token:painted-by rdf:resource="#Rembrandt" />
        </museum:Painting>

      </rdf:RDF>
    </metadata>
  </head>
</smil>
```


Embedding RDF in SMIL - II



```

...
<museum:Painting rdf:about="#apostlePaul">
  <museum:exhibited rdf:resource="#Rijksmuseum" />
  <museum:technique>chiaroscuro</museum:technique>
  <token:painted-by rdf:resource="#Rembrandt" />
</museum:Painting>

</rdf:RDF>
</metadata>
...
</head>
<body>
  <par>
    <text region="title" src="...query to multimedia da
    <text region="descr" src="..."/>
    <seq>
      <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">
        
        <text region="ptitle" src="..."/>
      </par>
    </seq>
  </par>
</body>
</smil>

```

Schemas for Multimedia

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Schemas for Multimedia

RDF Schema allows the definition of application specific schemas

- is it sufficiently powerful for describing multimedia specific schemas?
- or do we need multimedia specific modeling primitives in RDFS (e.g. time)?

RDF/XML Schema provide generic data types

- e.g. strings, integers, dates
- We need to specify data types geared to multimedia content
 - sample rates and sizes, colour spaces (rgb, hsv, cmyk), loudness levels (dB)
- Media-specific data types, e.g. video
 - scene, sequence, shot, frame

In either case, for interoperability multimedia needs a common schema as a basis for application specific schemas

- “Dublin Core” for multimedia

This is not easy...

- five MPEG committee members results in 7 different schemas

Annotating Multimedia

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Assigning semantic annotations to media

To what do we need to attach the annotations?

- specific player in football match
- audio fragment of gun shot
- third character out of shot
- specified bounding box in frame smpte=13:21:33:20
- video currently playing in active window
- the last viewed video

Requires media-dependent descriptions of media fragments

- “XPointer” for media types other than text/xml

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Generating Hypermedia Presentations

A large collection of multimedia information of potential interest to the user

User may have one of several devices

- screen aspect ratio
- different fonts look better
- different media appropriate (e.g., speech vs. text)

Network conditions may vary

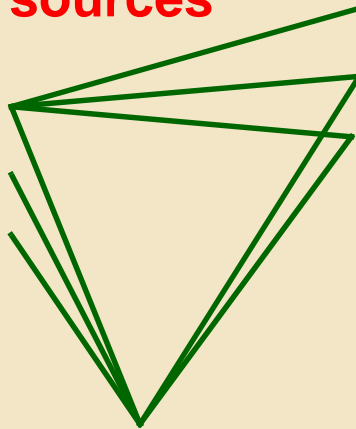
Want to provide a style of presentation to suit the user

Insufficient human resources to prepare presentations for all circumstances

The pieces of the puzzle

ontologies:
shared knowledge sources

domain
user profile
device profile



generation process
presentation rhetoric
graphics design

media repository
fragments
semantic annotation
MM information retrieval

final
presentation

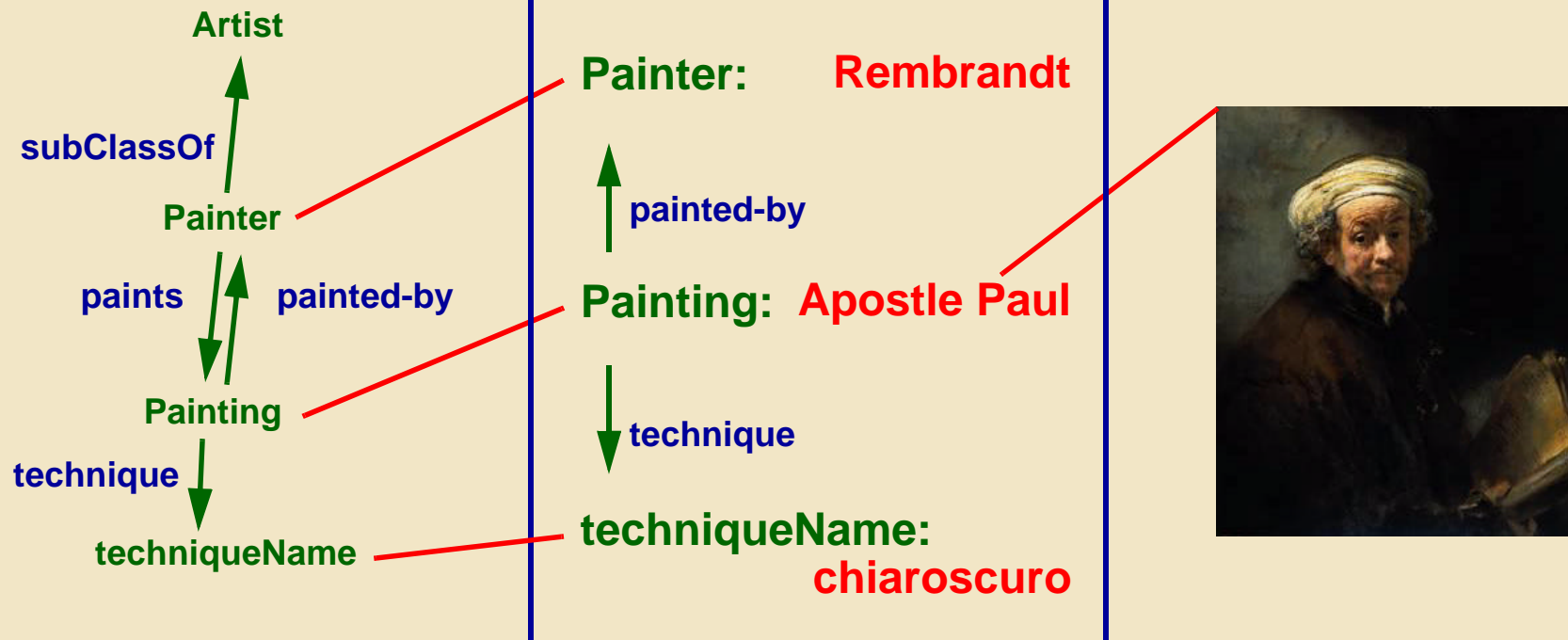


Ontology—Media connection

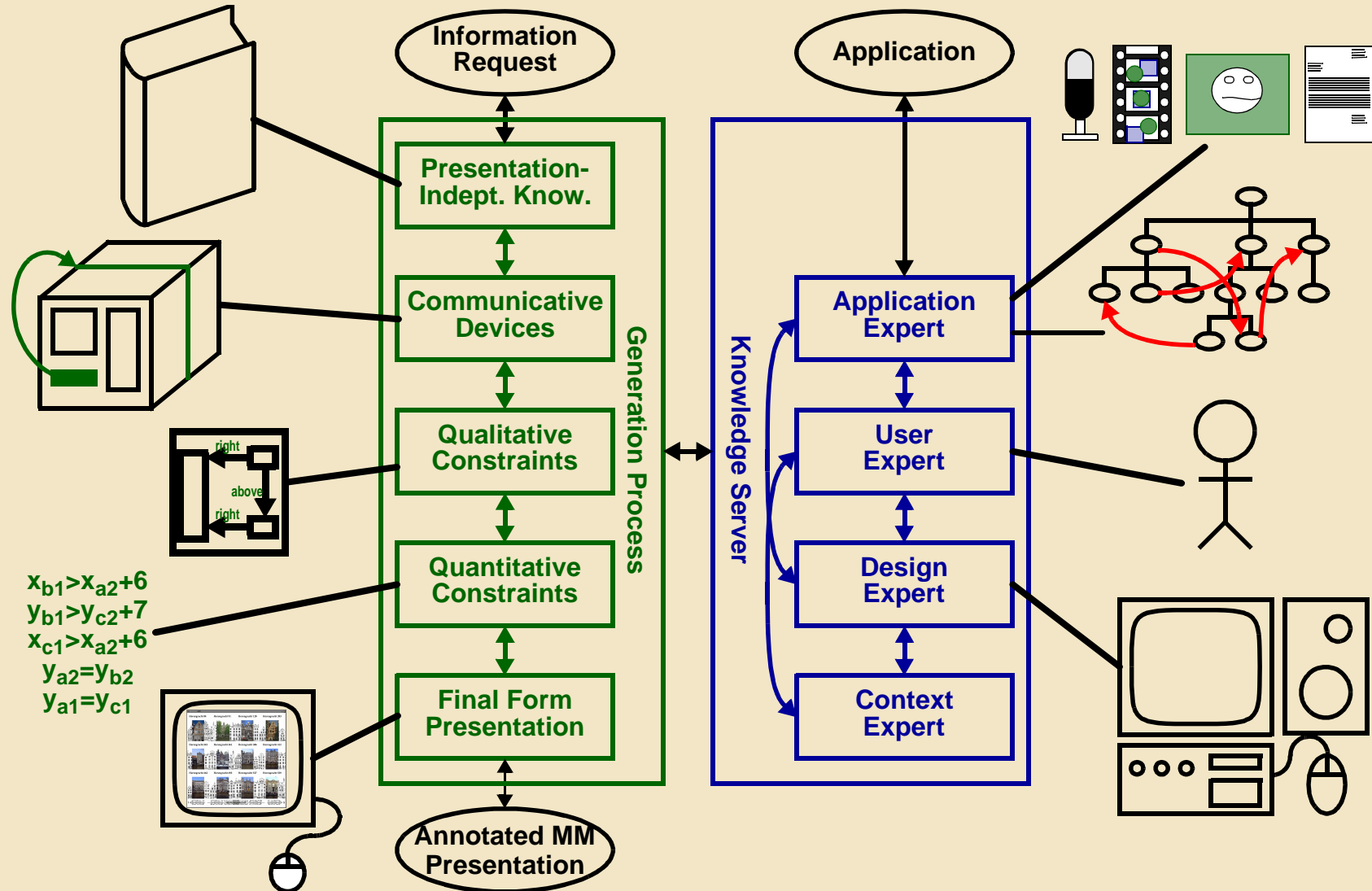
ontology

meta-data

media repository



Generating Presentations — Architecture



Summary

A large amount of work is already going on in the Semantic Web

- W3C RDF(S), DAML+OIL
- OntoWeb has 80 international participants (including CWI)

Multimedia is partially integrated using mix RDF and SMIL

Semantic annotations for multimedia presentation generation

- collecting annotations as part of the input to the generation process
- generating better annotations as part of the output

Some of the hard problems are:

- how to link down into the media-specific level
- how to come up with agreed-upon media-specific descriptions
- do schema languages need built-in multimedia modelling primitives
- collecting high quality annotations

INS2 research directions

Contribute to the development of the multimedia Semantic Web

Use the developing Semantic Web for generating hypermedia presentations

Current projects include

- **ToKeN2000**
 - use of multimedia semantics for user-centred design
- **RTIPA**
 - use of semantics for optimal quality of service and deployment of network resources
- **Dynamo**
 - use of semantics for automating hypermedia front-ends to multimedia databases