

# Multimedia on the Semantic Web

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## 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

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## Multimedia on the Web

SMIL 2.0 (7<sup>th</sup> August 2001)

Synchronized Multimedia Integration Language

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

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## 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

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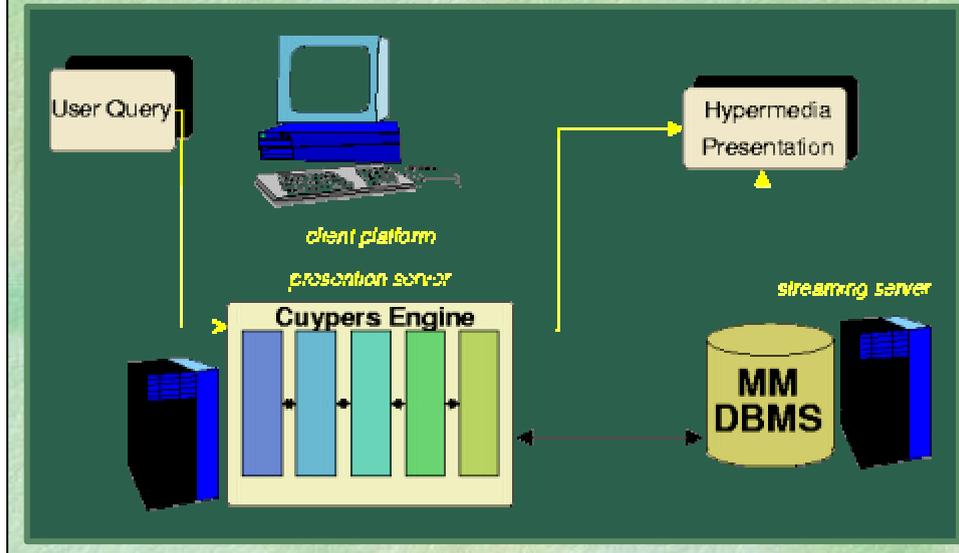
## Tailorable multimedia

- ✍ 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**

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# Cuypers multimedia generation engine



# Cuypers multimedia generation engine

 Demo time



RIJKS MUSEUM  
amsterdam

## ✧ 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**

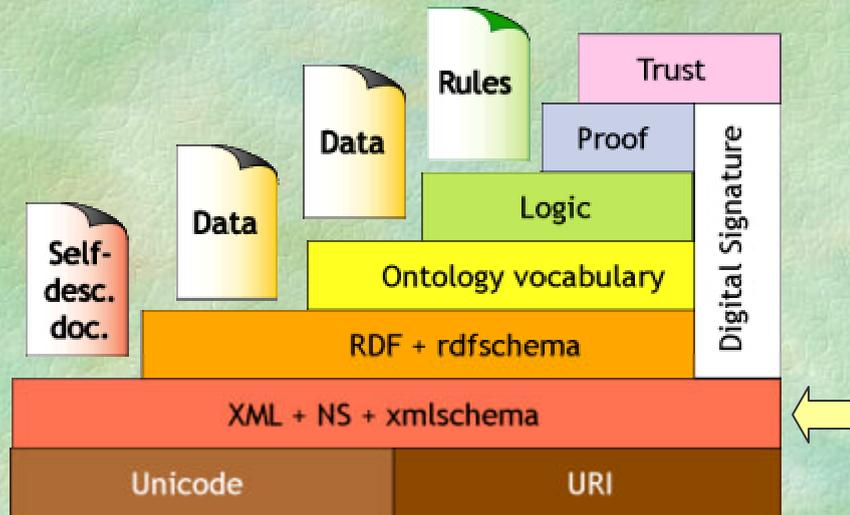
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## So what *is* the Semantic Web?

- ✍ 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)

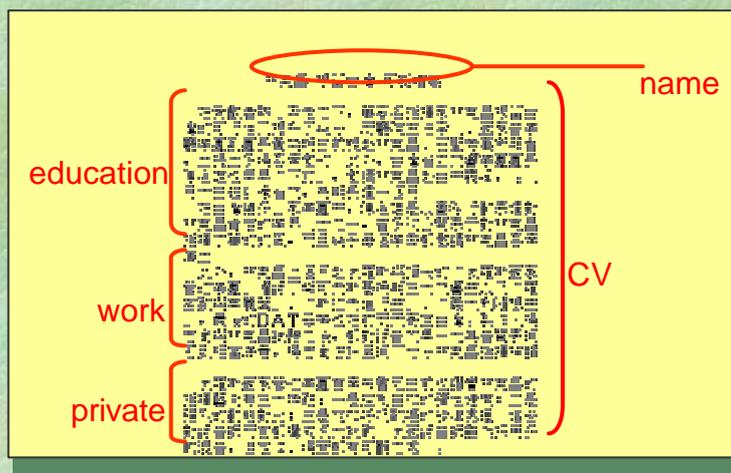
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## Tim Berners-Lee talk at XML 2000



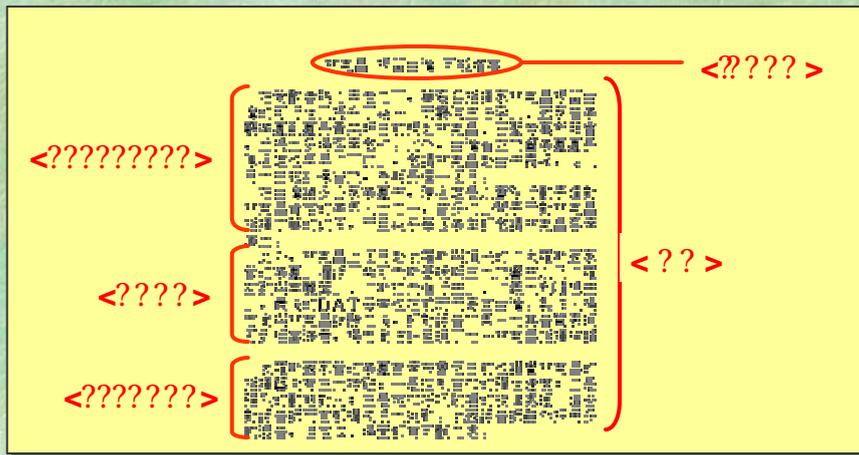
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## Machine accessible meaning *(What it's like to be a machine)*



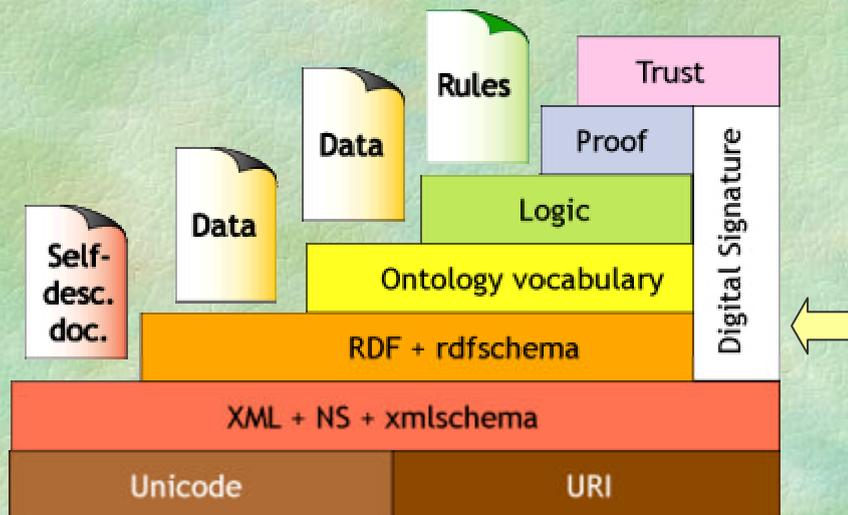
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# XML ? machine accessible meaning



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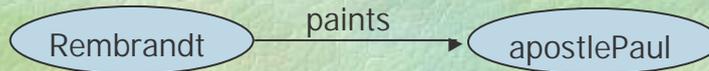
# The semantic pyramid again



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## RDF: graphs of triples

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



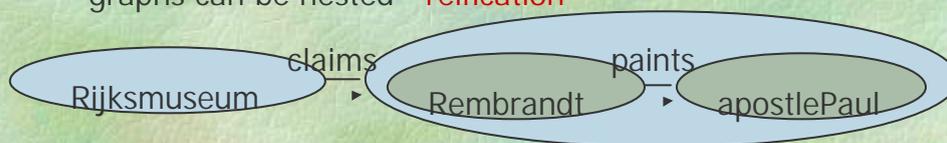
- Triples can be linked
- data-model = graph



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## RDF can be nested

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

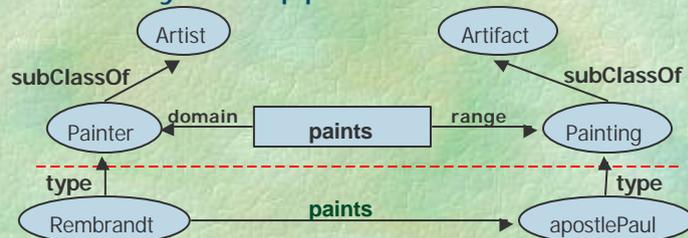


```
<rdf:Description rdf:about="#Rijksmuseum">
  <claims>
    <rdf:Description rdf:about="#Rembrandt">
      <paints>#apostlePaul</paints>
    </rdf:Description>
  </claims>
</rdf:Description>
```

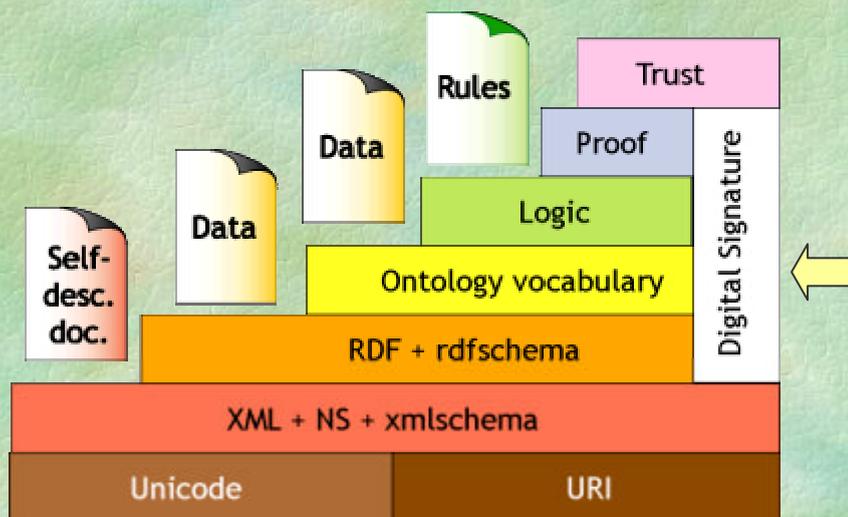
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## What does RDF Schema add?

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



## The semantic pyramid again



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## 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>

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## Semantic Web: main players

### Academic in Europe:

- † VU, Amsterdam
- † Karlsruhe
- † Manchester
- † INRIA
- † SWI@UvA

### Academic in US:

- † Stanford
- † Maryland
- † MIT/W3C
- † Florida
- † CMU

### Not ✍ (yet?)

- † IBM
- † Microsoft
- † Sun

### Industrial:

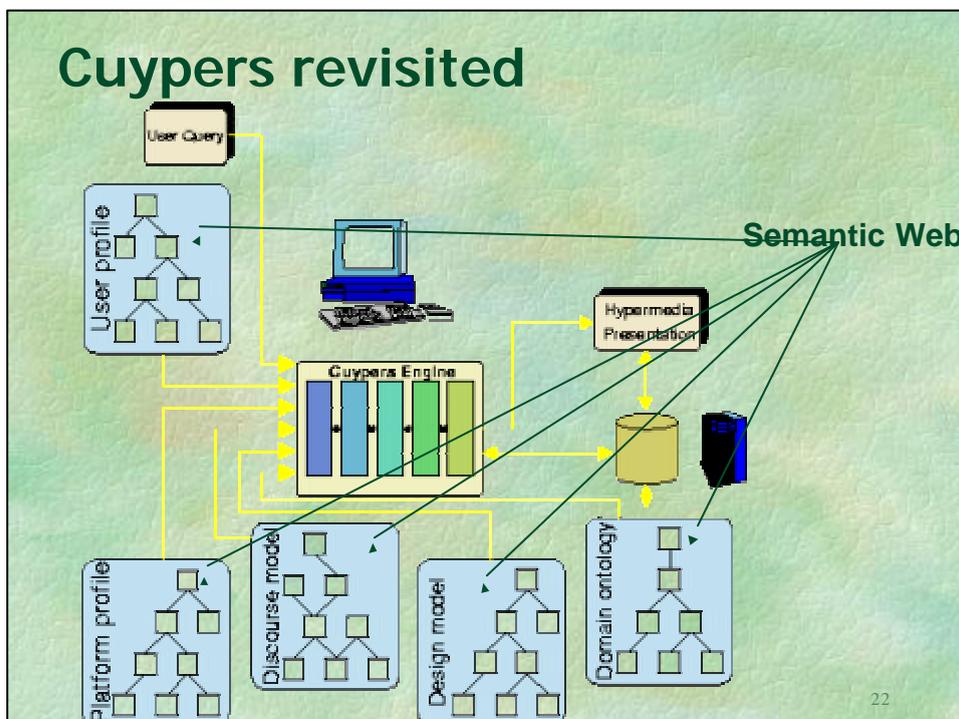
- Lucent
- Philips
- Nokia
- HP
- Intel
- Daimler-Chrysler
- Fujitsu
- lots of start-ups (NL, UK, G, N, US)

## 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



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## 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/..."
        xmlns:museum="http://ics.forth.gr/.../museum.rdf"

        <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>

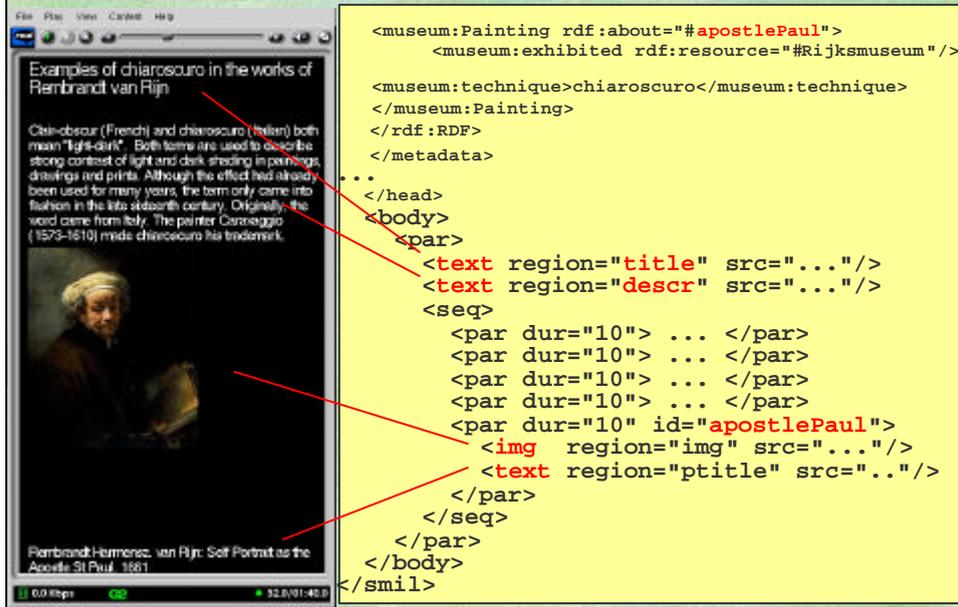
        <museum:Painting rdf:about="#apostlePaul">
          <museum:exhibited rdf:resource="#Rijksmuseum" />
          <museum:technique>chiaroscuro</museum:technique>
        </museum:Painting>
      </rdf:RDF>
    </metadata>
    . . .
  </head>
  <body>
    . . .
  </body>
</smil>
```

## Embedding RDF in SMIL - II

```
<museum:Painting rdf:about="#apostlePaul">
  <museum:exhibited rdf:resource="#Rijksmuseum" />
  <museum:technique>chiaroscuro</museum:technique>
  <token:painting-by rdf:resource="#Rembrandt" />
</museum:Painting>
</rdf:RDF>
</metadata>
...
</head>
<body>
  <par>
    <text region="title" src="...query to MM DBMS..."/>
    <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>
```

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## Marked-up presentation



```
<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="..."/>
    <text region="descr" src="..."/>
  </par>
  <seq>
    <par dur="10"> ... </par>
    <par dur="10"> ... </par>
    <par dur="10"> ... </par>
    <par dur="10"> ... </par>
    <par dur="10" id="apostlePaul">
      
      <text region="ptitle" src="..."/>
    </par>
  </seq>
</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