

Design and Implementation of Component-based Adaptive Web Presentations

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Lohmen, 6. - 8. November 2003

Structure

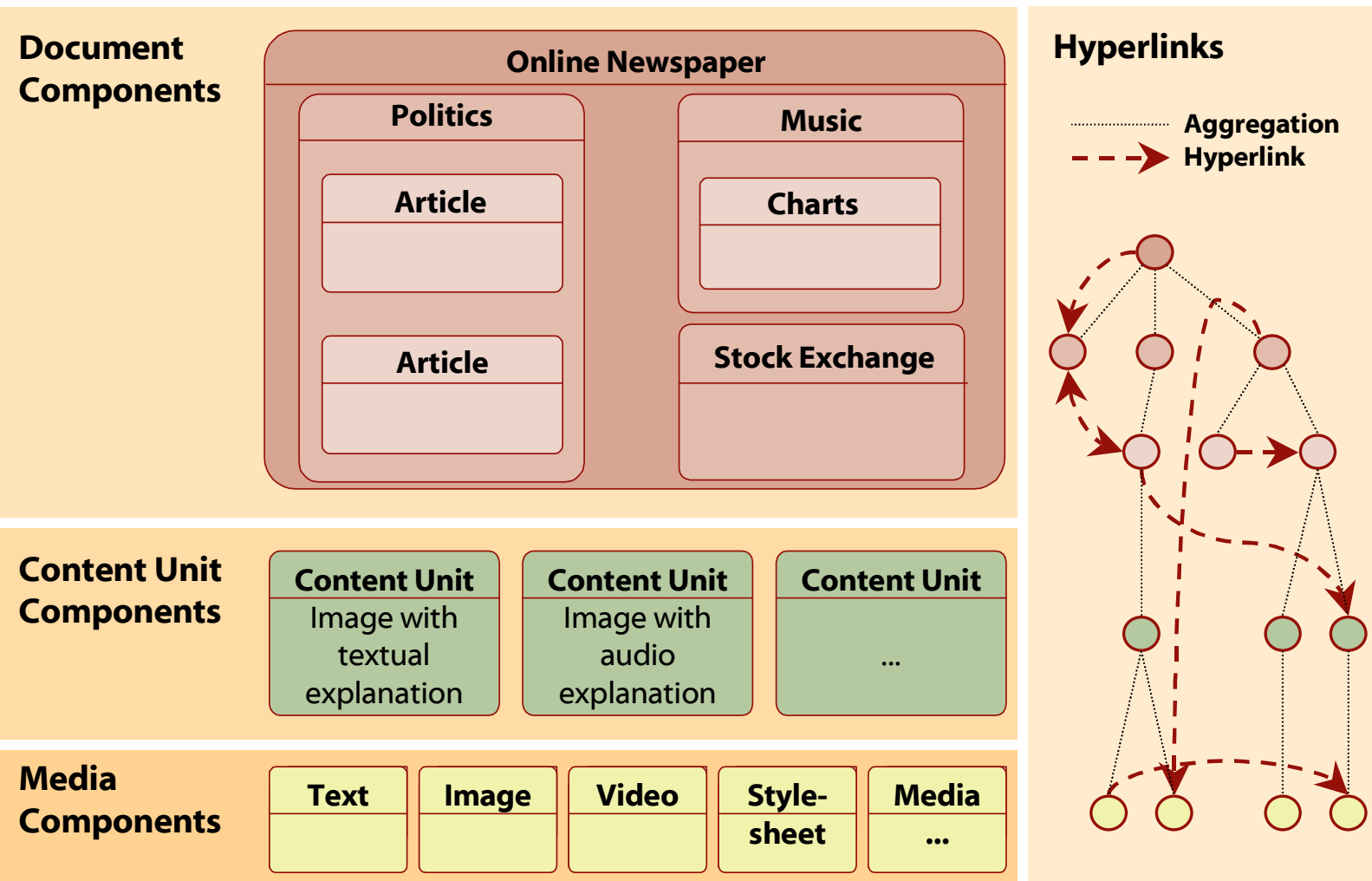
- Introduction
- A Component-based Document Format
 - Describing Adaptive Behavior
 - Describing Adaptive Layout
- Hera-based Development
 - Conceptual Design
 - Application Design
 - Presentation Design

Introduction

- Today's WWW
 - Personalized ubiquitous medium of communication/ cooperation
 - Need for quick generation/delivery of up-to-date information, adapted to both user preferences and client platforms
 - Conventional document formats hardly applicable
- AMACONT project
 - Component-based Development of Personalized Adaptive Web Presentations
 - Composition of adaptive Web applications by the aggregation and linkage of reusable document components
 - » Encapsulate adaptive content, behavior and layout on different abstraction levels
 - Here: Focus on the design and implementation process

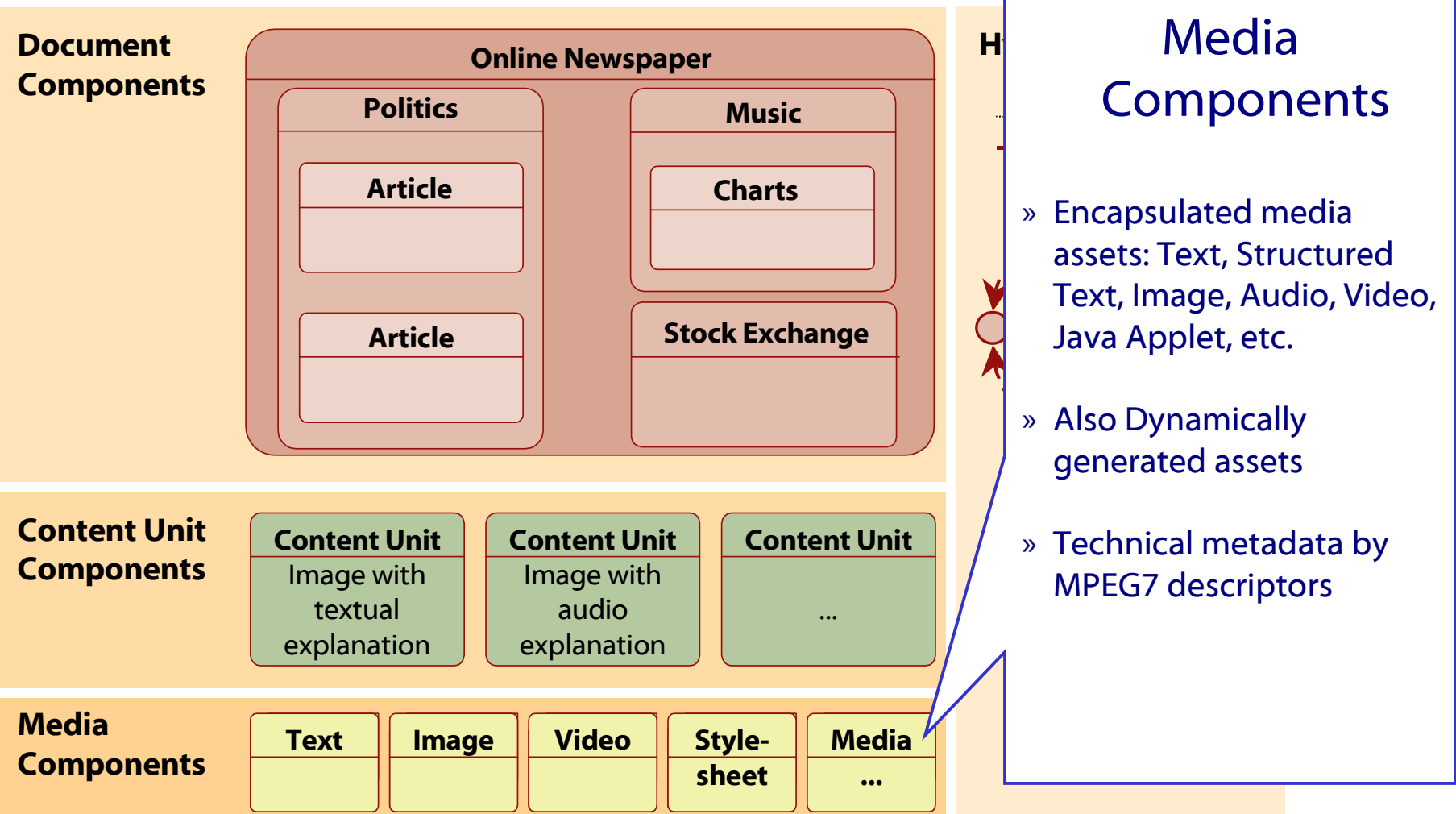
A Component-based Document Format

- Based on different abstraction levels



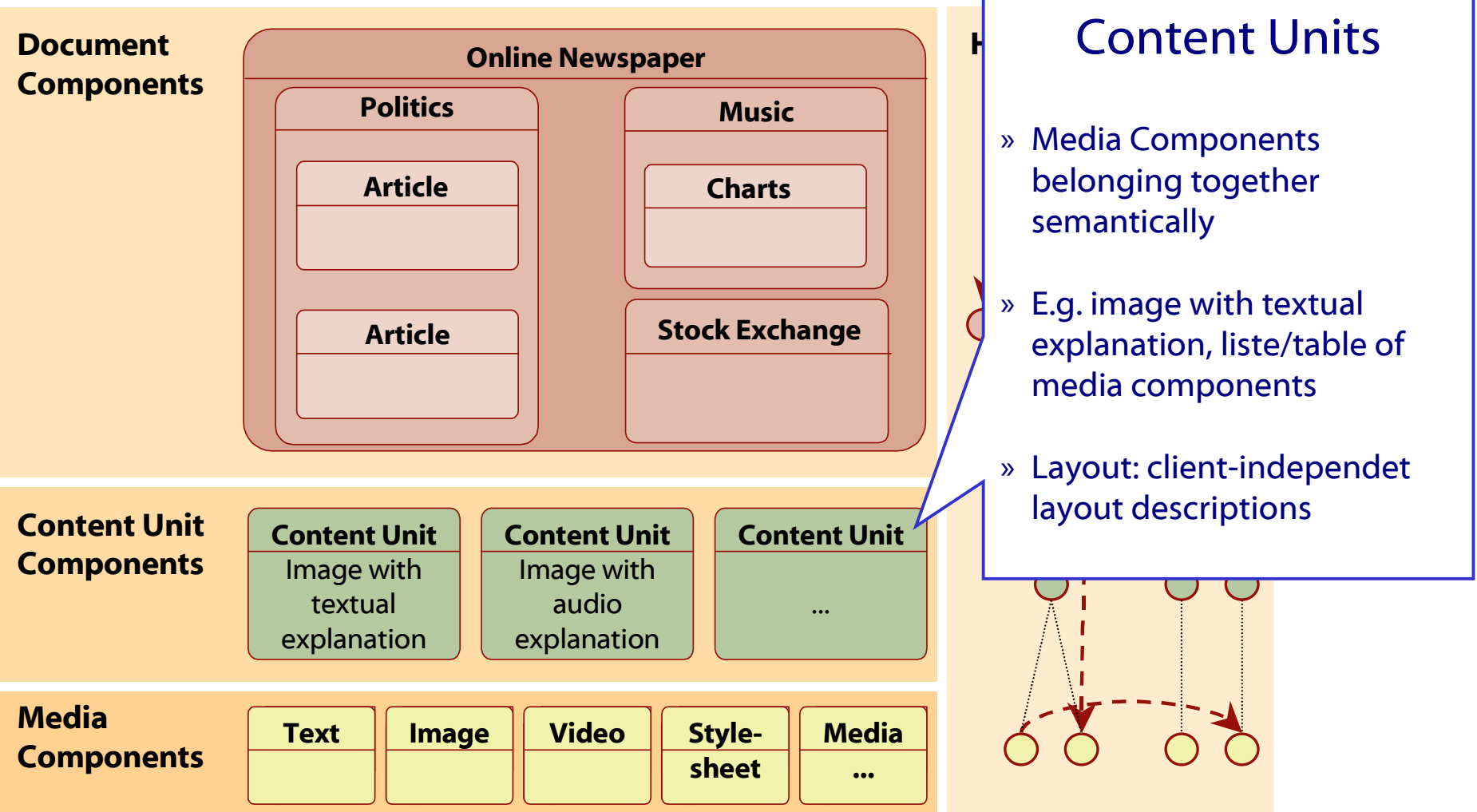
A Component-based Document Format

- Based on different abstraction levels



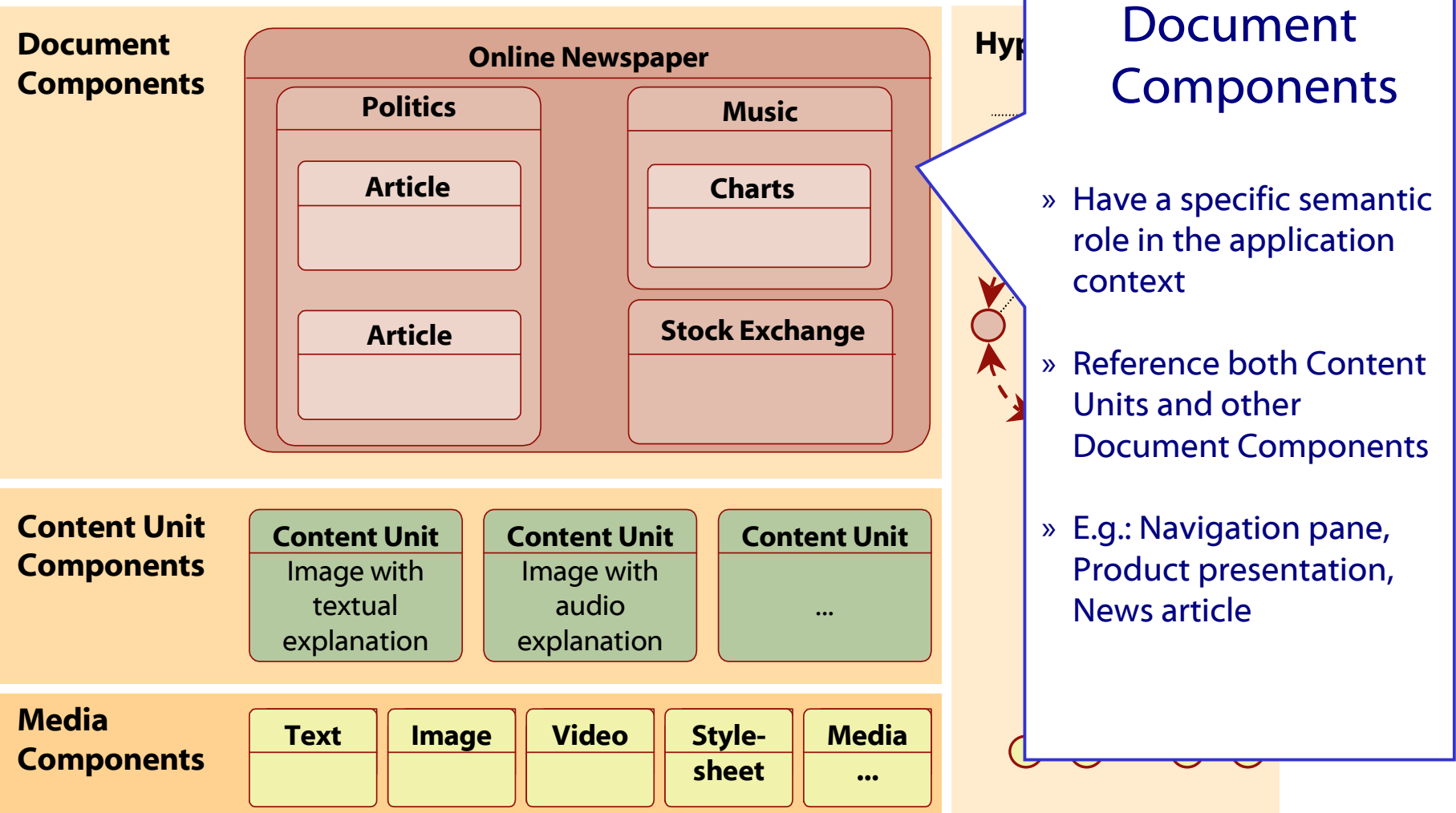
A Component-based Document Format

- Based on different abstraction levels



A Component-based Document Format

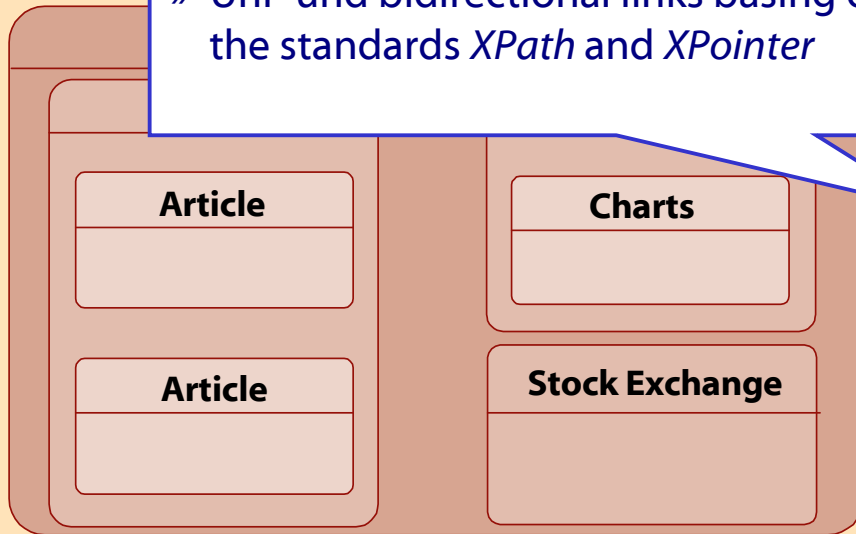
■ Based on different abstraction levels



■ Based on

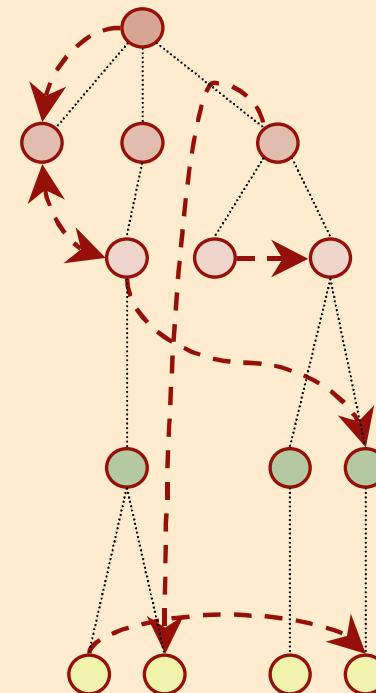
- » Separation of content and hyperlink structure
- » Uni- und bidirectional links basing on the standards *XPath* and *XPointer*

Document Components

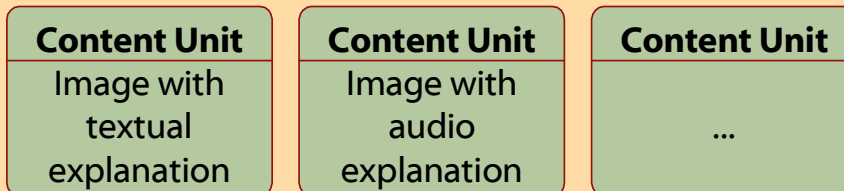


Hyperlinks

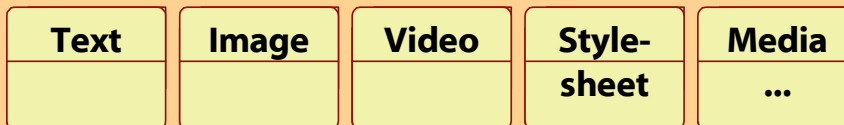
Aggregation Hyperlink



Content Unit Components



Media Components



Describing Adaptive Behavior

```
<AmaDocumentComponent name="TVProgram">
  <MetaInformation>
    ...
    ...
    ...
  </MetaInformation>
  <Variants>
    <Variant name="Adult_Program">
      ...
    </Variant>
    <Variant name="Child_Program">
      ...
    </Variant>
  </Variants>
</AmaDocumentComponent>
```

Describing Adaptive Behavior

```
<AmaDocumentComponent name="T
  <MetaInformation>
    ...
    ...
    ...
  </MetaInformation>
  <Variants>
    <Variant name="Adult_Program">
      ...
    </Variant>
    <Variant name="Child_Program">
      ...
    </Variant>
  </Variants>
</AmaDocumentComponent>
```



```
<AdaptiveProperties>
  <If>
    <Expr operator="greaterThan">
      <UserParam>UserAge</UserParam>
      <Const>18</Const>
    </Expr>
    <Then res="Adult_Program"/>
    <Else res="Child_Program"/>
  </If>
</AdaptiveProperties>
```

Describing Adaptive Layout

„Layout Managers“

- BorderLayout
- BoxLayout
- OverlayLayout
- GridLayout

- Transformers for
 - XHTML
 - cHTML
 - WML



Describing Adaptive Layout

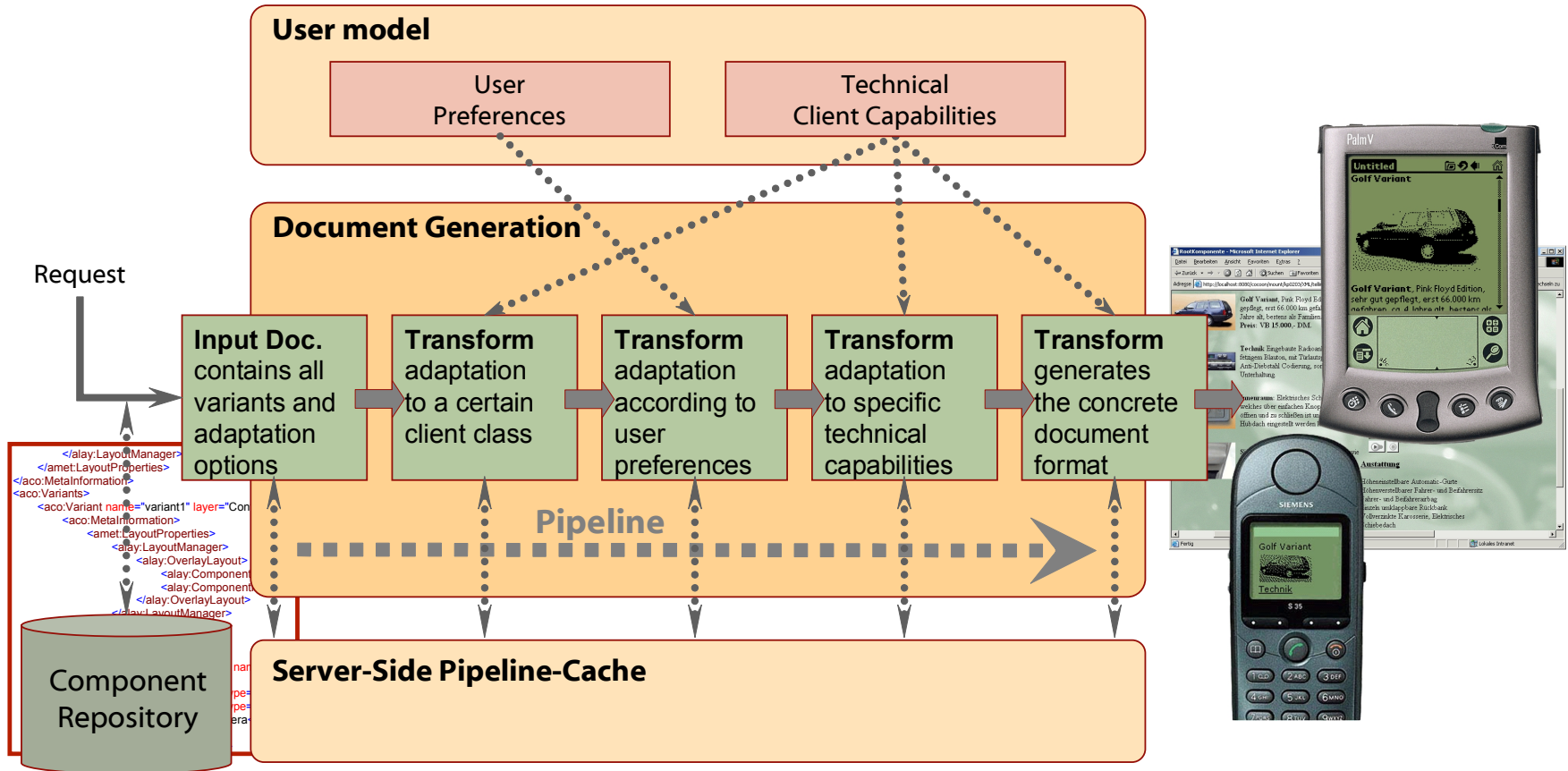
Layout Managers

Box-Layout

```
<LayoutProperties>  
  <alay:LayoutManager>  
    <alay:BoxLayout orientation="yAxis">  
      <alay:ComponentRef ratio="30%">  
        PictureObject1  
      </alay:ComponentRef>  
      <alay:ComponentRef ratio="70%">  
        TextObject1  
      </alay:ComponentRef>  
    </alay:BoxLayout>  
  </alay:LayoutManager>  
</LayoutProperties>
```



Document Generation



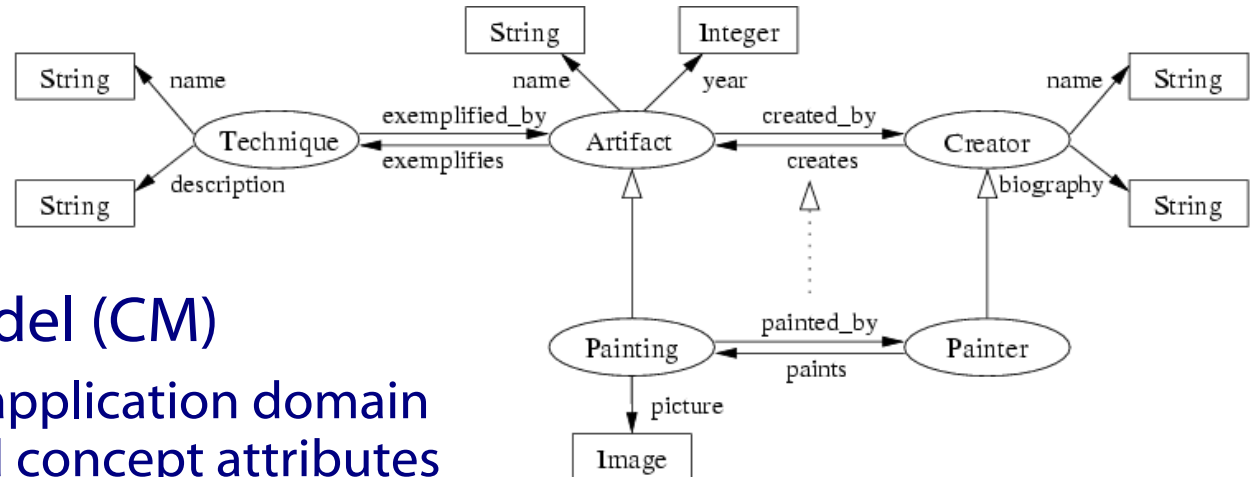
Current State

- Implemented...
 - Document Format
 - Transformation Stylesheets performing adaptation
 - Document Generator Architecture
- Problem
 - Manually creating components too time-intensive
 - Complex process necessitating disciplined design methodologies
- Ongoing Work: Authoring Process of CBWA
 - Utilizing Hypermedia Design Models
 - Graphical Tool(-Kit) for Creating Components and Defining Adaptation Processes
 - Content Management Aspects

Hera-based Development

- Hypermedia Design Models
 - Identify Crucial phases of Web development
 - Allow specifying hypermedia applications in an appropriate level of abstraction
 - Help designers/programmers to proceed in a structured way
 - Already significant research on design and process models
 - » OOHDM, RMM
 - » Aspects of adaptation: Hera, extension of OOHDM
- Idea
 - Instead of suggesting yet another methodology-> Adoption of existing methods for developing component-based adaptive applications
 - Focus: Model driven Hera methodology
 - » Creating Web components according to the design phases identified by Hera
 - Vision: automatic translation of Hera schemas to AMACONT components

Conceptual Design



■ Conceptual Model (CM)

- Represents the application domain by concepts and concept attributes
- Typed concept attributes (Integer, String, Image, Audio, etc.)
- Based on RDFS

■ Component Development

- Creation/retrieval of media instances representing concept attributes
- Encapsulating media instances to components
 - » Additional metadata, MPEG7 descriptors
- Providing alternative media instances with different quality

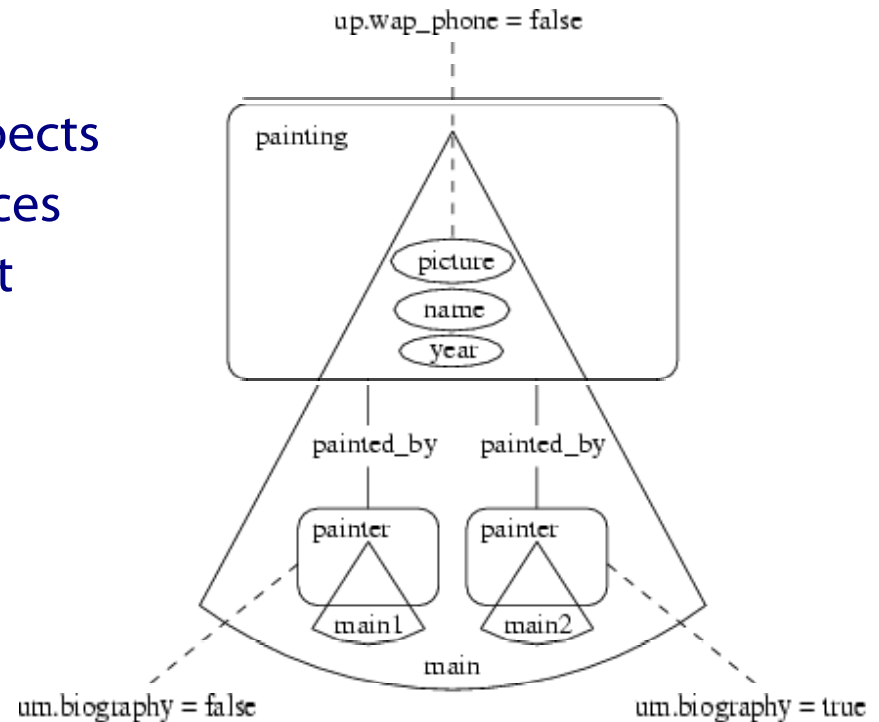
Application Design

■ Application Model

- Logical, structural, navigational aspects
- Grouping concept attributes to slices
- Slice: meaningful presentation unit of some media items
 - » Slice navigation
 - » Slice composition

■ Adaptation Design

- Targeting different adaptation aspects in the AM
 - » Adjusting the coarse navigational structure
 - » Population of slices with media items
 - » Dynamic Adaptation
- Assigning appearance conditions to slice references



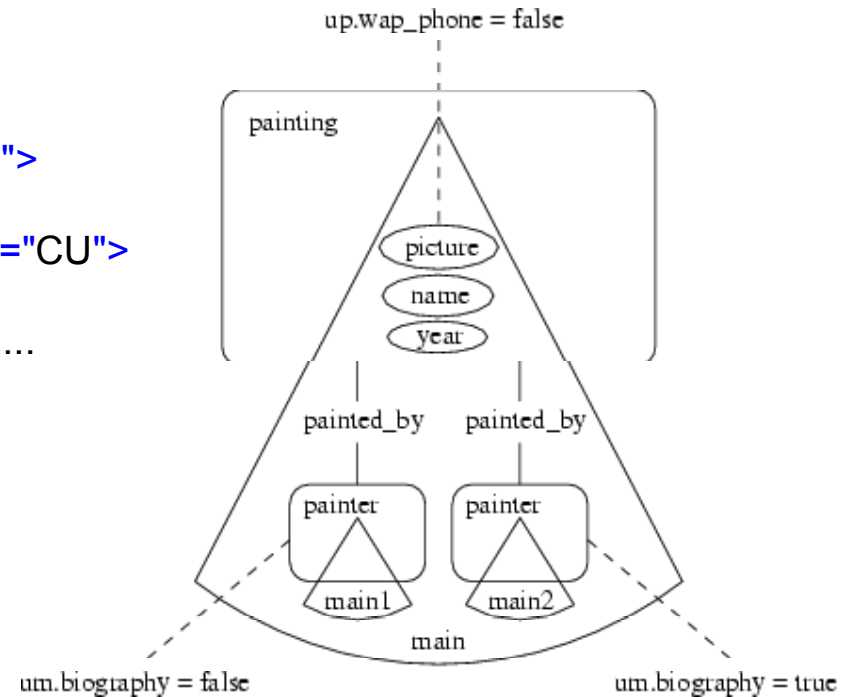
Application Design

- Realization with AMACONT components
 - Analogies between Hera slices and components:
 - » Meaningful presentation units bearing some semantic role
 - » Both top-level slices and top-level document components correspond to pages to be shown on the user's display
 - » Contain adaptation issues
 - Difference:
 - » Slices do not contain any layout information
 - » Slices on the schema level vs. components on the instance level
 - » Introduction of component templates
- Straightforward mapping process
 - Concept attributes → Media Components
 - Slices containing attributes from a single concept → Single Document Components
 - Slices containing concept attributes and subslices from different concepts → Composite Document Components
 - » Same (recursive) mapping process for each aggregated subslice

Application Design

■ Mapping Example

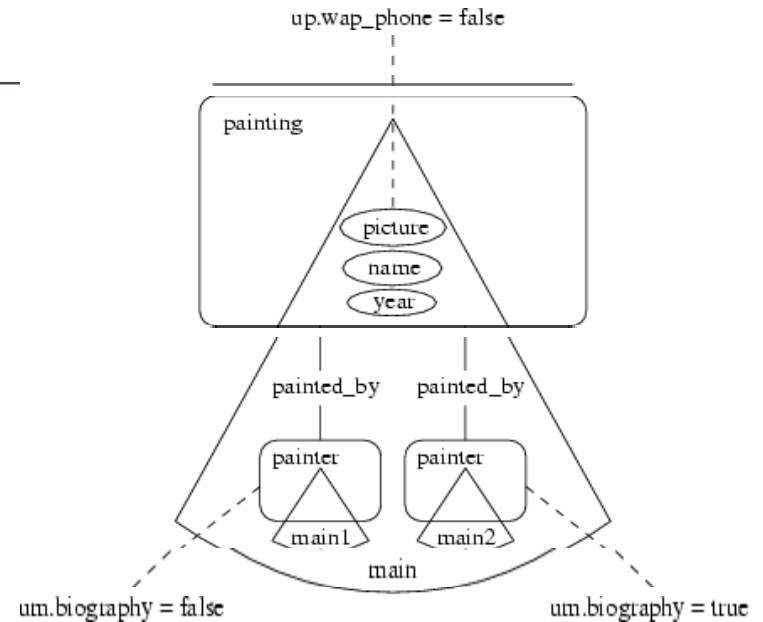
```
<PaintingComp name="Painting" layer="DC">
...
  <PaintingInfoComp name="PaintingInfo" layer="DC">
...
    <ImageAndTextComp name="PaintingAttr" layer="CU">
...
      <ImageComp name="PPicture" layer="MC"> ...
      <TextComp name="PName" layer="MC"> ...
      <TextComp name="PYear" layer="MC"> ...
    </ImageAndText>
  </PaintingInfoComp>
  <PainterComp name="Painter" layer="DC">
...
</PainterComp>
</PaintingComp>
```



Application Design

■ Realization of Adaptation

- Mapping slice appearance conditions to component variants with corresponding selection methods

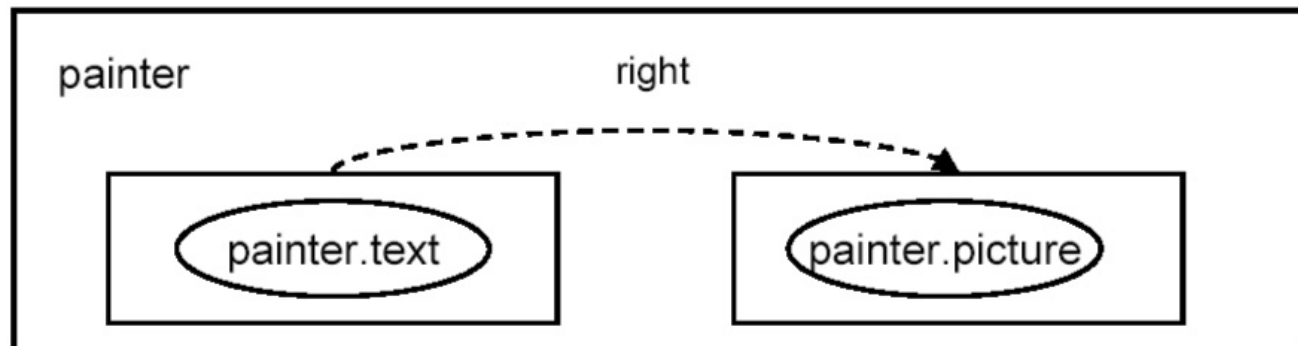


```
<PainterComp name="Painter" layer="DC">
  <MetaInformation>
    ...
  </MetaInformation>
  <Variants>
    <Variant name="Bio_Seen">...</Variant>
    <Variant name="Bio_NotSeen">...</Variant>
  </Variants>
</PainterComp>
```

```
<MetaInformation>
  <AdaptiveProperties>
    <If>
      <Expr operator="equals">
        <UserParam>um.biography</UserParam>
        <Const>true</Const>
      </Expr>
      <Then res="Bio_Seen"/>
      <Else res="Bio_NotSeen"/>
    </If>
  </AdaptiveProperties>
</MetaInformation>
```

Presentation Design

- Presentation Model (PM)
 - Bridges the logical level and the actual implementation
 - Defines how and when the identified subslices should be displayed
- Presentation Diagram (PD)
 - Slices from the AM are mapped to regions
 - The PD specifies the organization of regions in a graphical way
 - » Navigational, spatial, temporal relations



Presentation Design

- Realization with Components
 - Aggregation hierarchy of component templates was determined at application design
 - Top-Down mapping of the PD to layout attributes of component templates

```
<MetaInformation>
```

```
...
```

```
<LayoutProperties>
```

```
  <BoxLayout orientation="xAxis">
```

```
    <ComponentRef ratio="30%" name="PainterText">
```

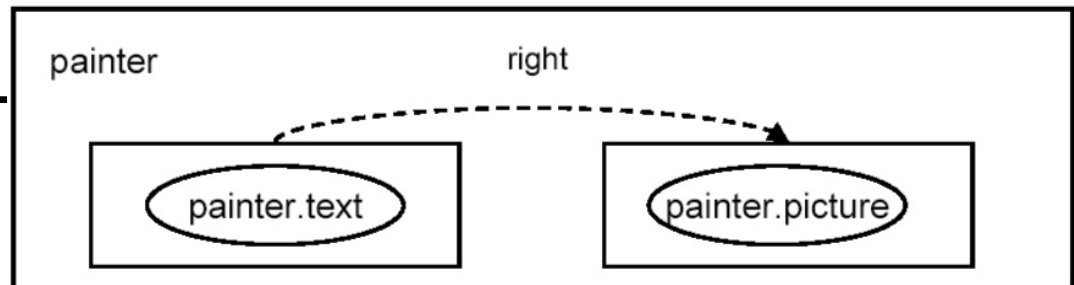
```
    <ComponentRef ratio="70%" name="PainterImage">
```

```
  </BoxLayout>
```

```
</LayoutProperties>
```

```
...
```

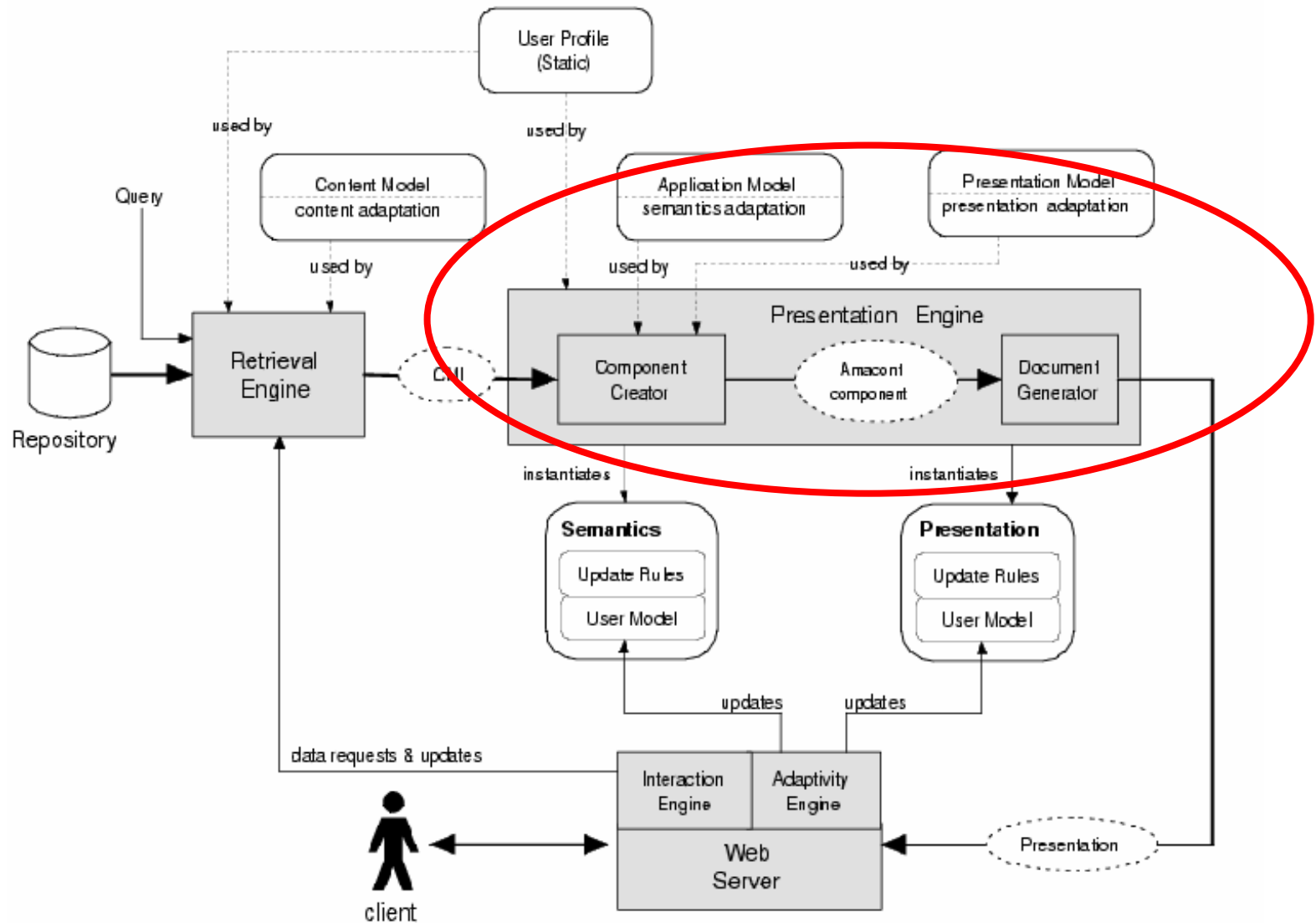
```
</MetaInformation>
```



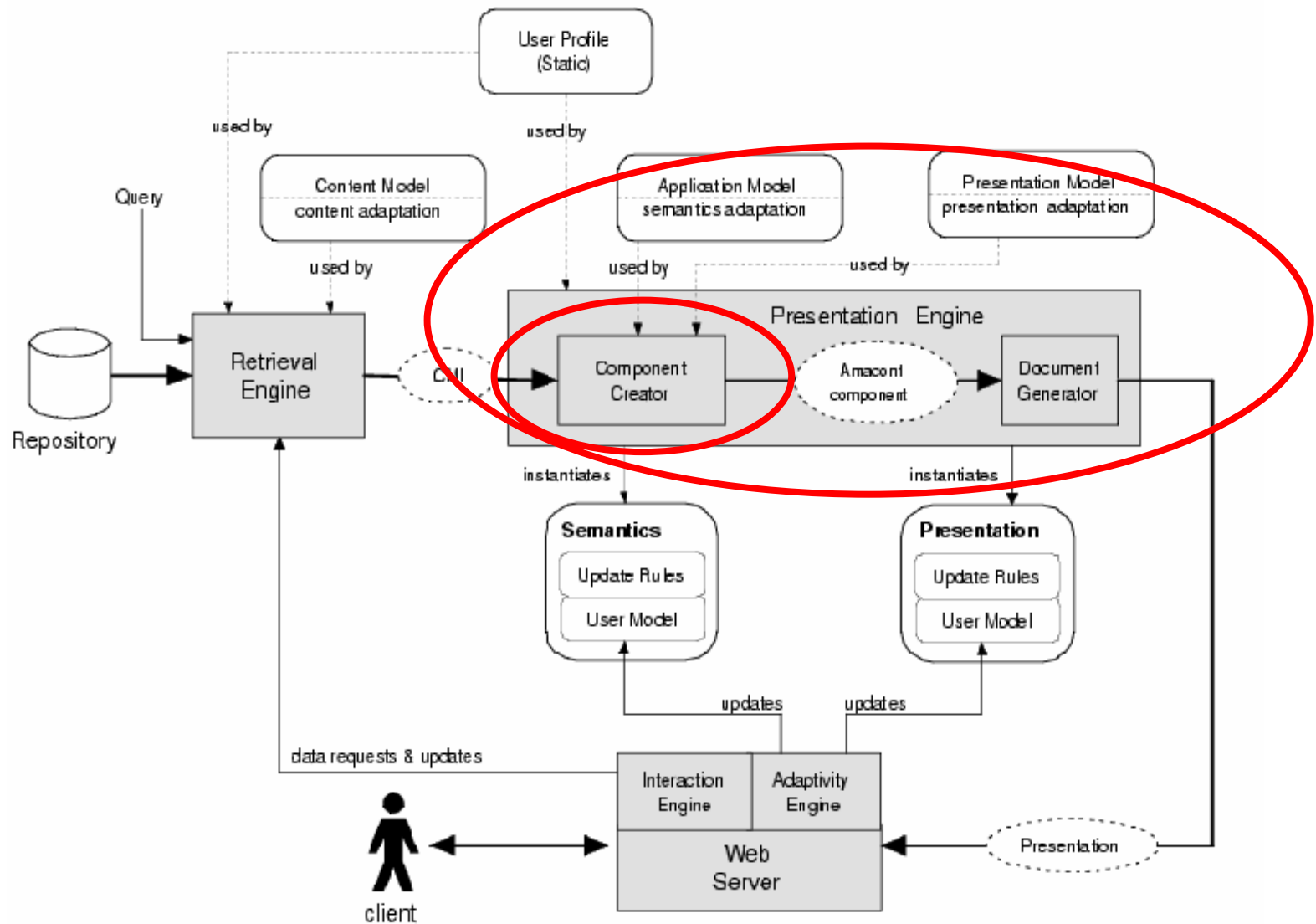
Adaptation at Presentation Design

- Adaptation aspects in the PM
 - Large diversity of client devices
 - » Adjusting media components concerning their quality (bit rate, color depth, resolution, etc.)
 - Varying Layout preferences of user stereotypes
 - » Children adults, visually impaired users
 - » Different layout elements determining the corporate design of a Web presentation (logos, font sizes, etc.)
- Component-based Implementation
 - Defining additional variants to media components

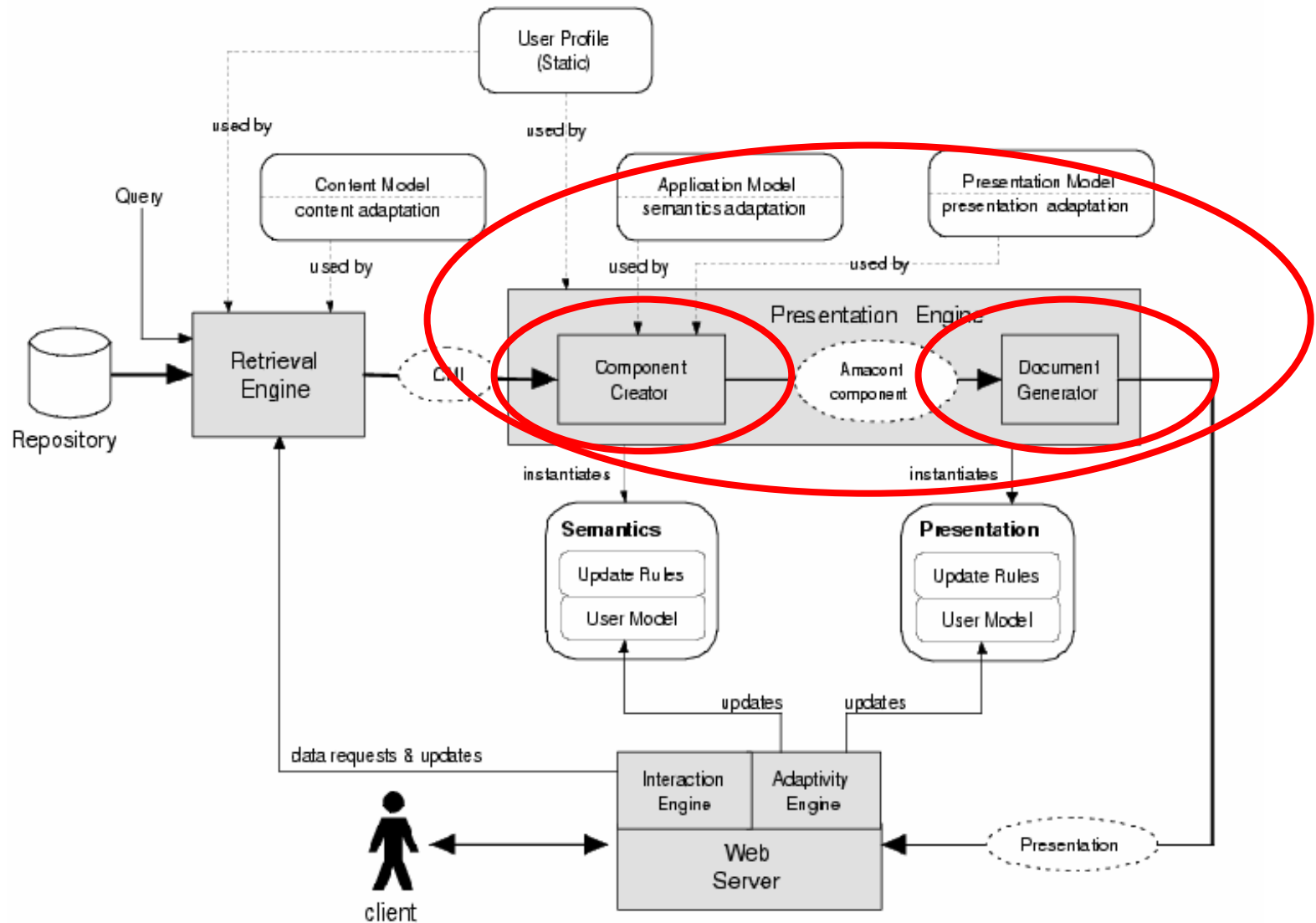
Putting it all together



Putting it all together



Putting it all together



Literatur

- [1] Fiala, Z., Hinz, M., Meissner, K., Wehner, F.: A Component-based Approach for Adaptive, Dynamic Web Documents. Journal of Web Engineering, September 2003
- [2] F. Frasincar, G. J. Houben, and R. Vdovjak. Engineering Semantic Web information Systems in Hera. Journal of Web Engineering, September 2003
- [3] Fiala, Z., Hinz, M., Houben, G.J., Frasincar, F.: Design and Implementation of Component-based Adaptive Web Applications. Web Technologies and Applications Special Track of the 19th ACM Symposium on Applied Computing (SAC 2004) March 14-17 2004, Nicosia, Cyprus