Implementing Concurrent Markup in XML

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Why Concurrent Hierarchies?

- Different Interpretations of Text
- Structures that do not “properly” nest in the XML sense
- Complex textual traditions with multiple witnesses and variants
- Recording physical layout of text and other analysis

Overlapping Example

Matthew 3:8 Bear fruit that befits repentance,

Matthew 3:9 and to not presume to say to yourselves, ‘We have Abraham as our father’; for I tell you, God is able from these stones to raise up children of Abraham.

Matthew 3:8-9 –First Choice

<verse id="Matt.3.8">

Bear fruit that befits repentance,

</verse>

<verse="Matt.3.9">

and to not presume to say to yourselves, ‘We have Abraham as our father’; for I tell you, God is able from these stones to raise up children of Abraham.

</verse>

Matthew 3:8-9 – Second Choice

<sentence>

Bear fruit that befits repentance, and to not presume to say to yourselves, ‘We have Abraham as our father’; for I tell you, God is able from these stones to raise up children of Abraham.

</sentence>

Matthew 3:8-9 – Verboten!

<verse id="Matt.3.8">

<sentence>

Bear fruit that befits repentance,

</verse>

<verse="Matt.3.9">

and to not presume to say to yourselves, 'We have Abraham as our father'; for I tell you, God is able from these stones to raise up children of Abraham.

</verse>

</sentence>

Design Principles: Part 1

- Formal simplicity
- Capacity to represent all occurring or imaginable kinds of structures
- Suitability for formal or mechanical validation
- Clear identity with the notations needed for simpler cases
- Allow for conditional indexing and processing

Design Principles: Part 2

- Allow for extraction of well-formed subtrees and documents
- Allow for query of the position of the element between two or more hierarchies
- Use standard XML syntax and mechanisms
- Validation and processing must be possible with standard XML software
- Can be used with existing documents encoded in XML markup

Bottom Up Virtual Hierarchies

- Membership of PCDATA in a particular hierarchy
- Record that information using XPath syntax
- Gather information from multiple document instances into a base file
- Query membership in and across hierarchies with BUVH

A Simple Example (1)

- Four separate (overlapping) hierarchies

1

This is

text[a]

---

[a] texs A

2

in a[b] base

file

---

[b] an C

A Simple Example (2)

1. Page view

```
<pages>
      <page id="p1">
            <line id="l1">This is</line>
            <line id="l2">text</line>
      </page>
      <page id="p2">
            <line id="l1">in a base</line>
            <line id="l2">file</line>
      </page>
</pages>
```

A Simple Example (3)

2. Text view

```
<text>
      <para id="p1">
            This is  text in a base  file
      </para>
</text>
```

A Simple Example (4)

3. Linguistic view

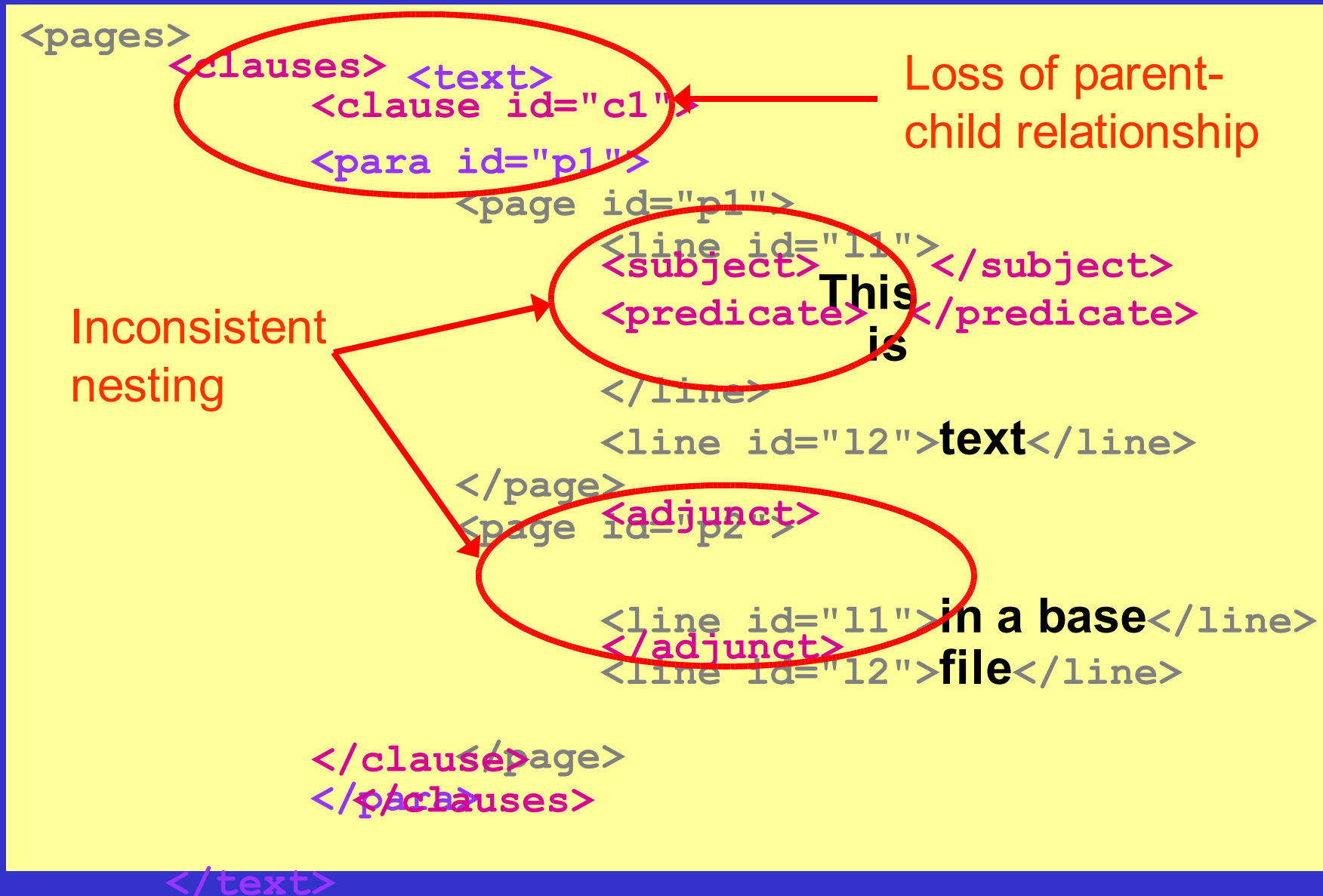
```
<clauses>
      <clause id="c1">
            <subject>This</subject>
            <predicate>is</predicate>
            <complement>text</complement>
            <adjunct>in a base file</adjunct>
      </clause>
</clauses>
```

A Simple Example (5)

4. Textual variant view (using out-of-line markup)

```
<variants xmlns:xlink="http://www.w3.org/1999/XLink">
      <app id="tv1">
            <rdg  xlink:href="base.xml#id(w3)"
                  wit="A" val="texs"/>
      </app>
      <app id="tv2">
            <rdg  xlink:href="base.xml#id(w5)"
                  wit="C" val="an"/>
      </app>
</variants>
```

A Simple Example (6)



A Simple Example (7)

- BUVH Approach

1. Create common base file with divisions for *Atomic PCDATA* (here word divisions)

```
<baseFile>
      <w id="w1">This</w>
      <w id="w2">is</w>
      <w id="w3">text</w>
      <w id="w4">in</w>
      <w id="w5">a</w>
      <w id="w6">base</w>
      <w id="w7">file</w>
</baseFile>
```

A Simple Example (7)

- BUVH Approach

1. Create common base file with divisions for *Atomic PCDATA* (here word divisions)

2. For each *Atomic PCDATA* element:

   a. Locate in each hierarchy

   b. Construct *XML Membership XPath Expression* describing its position within the hierarchy

   c. Add *Tree Structure Position Attribute* for element's position in hierarchy to element in base file

A Simple Example (7)

- BUVH Approach

c. Add TSP Attribute

```
<clauses>
   <clause id="c1">
      <subject>This</subject>
      <predicate>is</predicate>
      <complement>text</complement>
      <adjunct>in a base file</adjunct>
```

```
<baseFile>
   <w id="w1"
      pg:pages="/pages/page[1][@id='p1']/line[1][@id='l1']/*[1]"
      tx:text="/text/para[1]/[@id='p1']/*[1]"
      sn:clauses="/clauses/clause[1][@id='c1']/subject[1]/*[1]">
      This
   </w>
```

3. Linguistic hierarchy:

```
/clauses/clause[1][@id="c1"]/subject[1]/*[1]
```

A Simple Example (8)

```
<baseFile   xmlns:sn="urn:clause"
            xmlns:tx="urn:text"
            xmlns:pg="urn:pages"
            xmlns:vr="urn:variants">

  <w id="w1"
     sn:clauses="/clauses/clause[1][@id='c1']/s[1]/*[1]"
     tx:text="/text/para[1][@id='p1']/*[1]"
     pg:pages="/pages/page[1][@id='p1']/line[1][@id='l1']/*[1]"
  >This</w>

  <w id="w2"
     sn:clauses="/clauses/clause[1][@id='c1']/p[1]/*[1]"
     tx:text="/text/para[1][@id='p1']/*[2]"
     pg:pages="/pages/page[1][@id='p1']/line[1][@id='l1']/*[2]"
  >is</w>

  <w id="w3"
     sn:clauses="/clauses/clause[1][@id='c1']/c[1]/*[1]"
     tx:text="/text/para[1][@id='p1']/*[3]"
     pg:pages="/pages/page[1][@id='p1']/line[2][@id='l2']/*[1]"
     vr:variants="/variants/app[1][@id='tv1']/rdg[1][@wit='A'][@val='texs']"
  >text</w>
```

A Simple Example (8)

```
<w   id="w4"
     sn:clauses="/clauses/clause[1][@id='c1']/a[1]/*[1]"
     tx:text="/text/para[1][@id='p1']/*[4]"
     pg:pages="/pages/page[2][@id='p2']/line[1][@id='l1']/*[1]"
>in</w>

<w   id="w5"
     sn:clauses="/clauses/clause[1][@id='c1']/a[1]/*[2]"
     tx:text="/text/para[1][@id='p1']/*[5]"
     pg:pages="/pages/page[2][@id='p2']/line[1][@id='l1']/*[2]"
     vr:variants="/variants/app[2][@id='tv2']/rdg[1][@wit='C'][@val='an']"
>a</w>

<w   id="w6"
     sn:clauses="/clauses/clause[1][@id='c1']/a[1]/*[3]"
     tx:text="/text/para[1][@id='p1']/*[6]"
     pg:pages="/pages/page[2][@id='p2']/line[1][@id='l1']/*[3]"
>base</w>

<w   id="w7"
     sn:clauses="/clauses/clause[1][@id='c1']/a[1]/*[4]"
     tx:text="/text/para[1][@id='p1']/*[7]"
     pg:pages="/pages/page[2][@id='p2']/line[2][@id='l2']/*[1]"
>file</w>

</baseFile>
```

A Simple Example (9)

- Queries across different hierarchies can be carried out using XPath expressions, e.g. using XSLT

  Example 1:

  - Locate words that have textual variants and are found on page 2

    XPath query:

```
//w[@vr:variants][contains(@pg:pages,'p2')]
```

    Result:

```
<w  id="w5"
    sn:clauses="/clauses/clause[1][@id='c1']/a[1]/*[2]"
    tx:text="/text/para[1][@id='p1']/*[5]"
    pg:pages="/pages/page[1][@id='p2']/line[@id='l1']/*[2]"
    vr:variants="/variants/app[2][@id='tv2']/rdg[1][@wit='C'][@val='an']"
>a</w>
```

A Simple Example (9)

- Queries across different hierarchies can be carried out using XPath expressions, e.g. using XSLT

  Example 2:

  - Locate words in the first clause that do not occur on the first line of their page

    XPath query:

```
//w[contains(@sn:clauses,'clause[1]')]      [not
    (contains(@pg:pages,'line[1]'))]
```

    Result:

```
<w  id="w3"
    sn:clauses="/clauses/clause[1][@id='c1']/c[1]/*[1]"
    tx:text="/text/para[1][@id='p1']/*[3]"
    pg:pages="/pages/page[1][@id='p1']/line[2][@id='l2']/*[1]"
    vr:variants="/variants/app[1][@id='tv1']/rdg[1][@wit='A'][@val='texs']"
>text</w>
<w  id="w7"
    sn:clauses="/clauses/clause[1][@id='c1']/a[1]/*[4]"
    tx:text="/text/para[1][@id='p1']/*[7]"
    pg:pages="/pages/page[2][@id='p2']/line[2][@id='l2']/*[1]"
>file</w>
```

Summary: BUVH Approach

- Authoring of XML occurs within a single hierarchy (any XML editor)
- Automatic construction of base file with any XSLT processor
- Query with any XSLT processor
- Unlimited hierarchies

Future Plans

- Development of XSLT Extensions to process BUVH Base File
- Base file format (possible use of Xalan's DTM format?)
- Testing of BUVH against more complex examples
- Use of XLink with BUVH for read-only or large corpora

<partingThought>

Markup is metadata about #PCDATA

</partingThought>