Restoring the Primacy of PCDATA

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Previously on jitts.org...

It was observed that:

#1. Markup is METADATA about PCDATA

#2. The recognition of what is and is not MARKUP—and from that the assertion of 'structure'—takes place during PROCESSING and not encoding (JITTs)

Corollary to Obs. #1

Markup is METADATA about PCDATA

- PCDATA should be primary and its metadata (the markup) secondary
- XML in its syntax, and particularly in the common processing methods, inverts this relationship—the metadata 'contains' or becomes the parent of the data itself.

Explorations from Obs. #2

Markup is asserted during PROCESSING

- Multiple trees can be recognized in encoding and a particular tree selected during processing (JITTs paradigm)

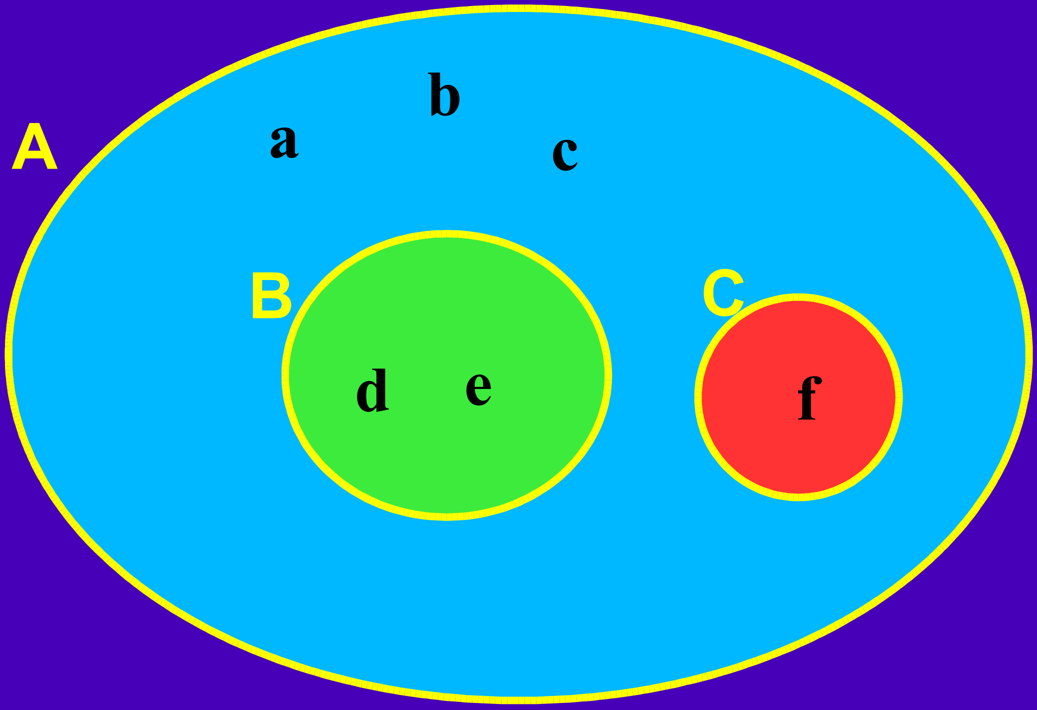
- It is not necessary to assert a tree at all!...

Set Theory offers alternative model

A Property of Simple Set Theory

- Objects that compose sets are treated as members of each set as they occur and we apply set operations to those members (and not the sets themselves)
- Enumerating a set always gives the atomic objects.

A Property of Simple Set Theory

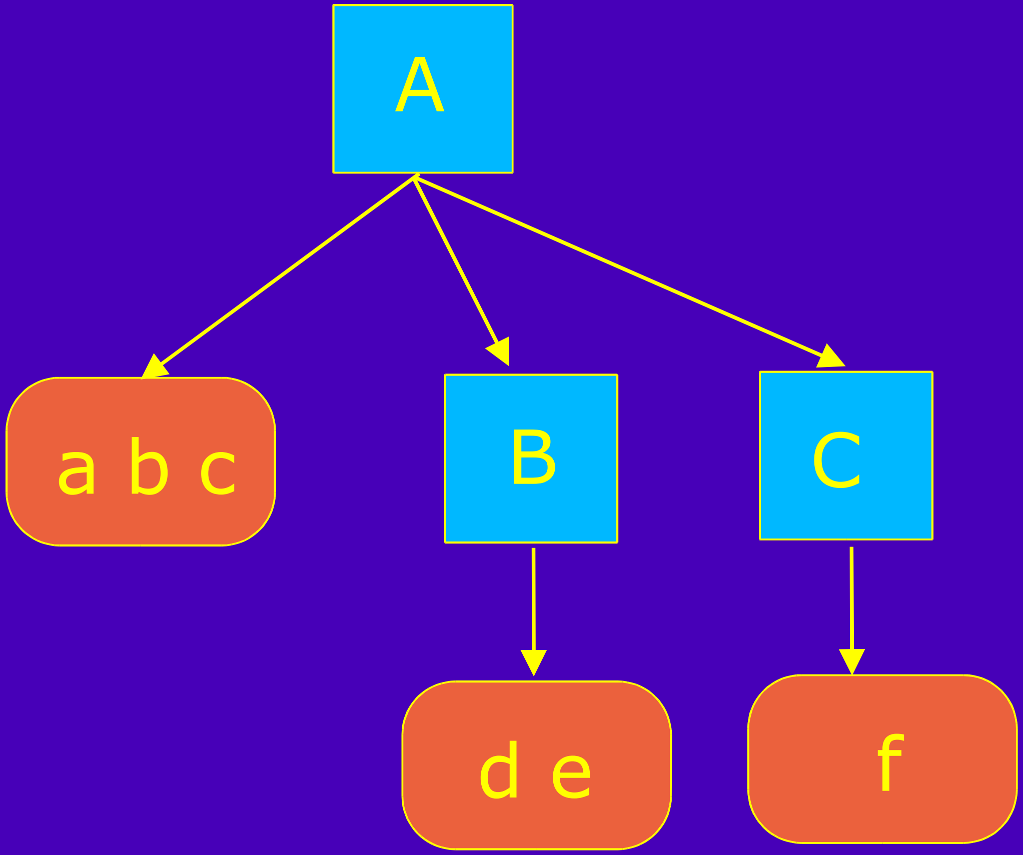


A = {a,b,c,d,e,f}
B = {d,e}
C = {f}

~~A = {a,b,c,B,C}~~

Compare DOM representation

```
<A>
      a b c
      <B>
          d e
      </B>
      <C>
          f
      </C>
</A>
```



In Set Theory…

- Set members may be members of multiple sets (ie. They are not constrained to be a member of only one set)

- Sets are created by *operations*:
  - union
  - intersection
  - complement

In Markup Theory...

- SGML/XML has promoted a 'hierarchical container' view of markup
- Questions as to how markup reflects the nature of 'text' have focused on:
  a) the hierarchical nature of text
  b) the container-like nature of its components
- OHCO thesis (Renear *et al.* 1995)

In Markup Theory…

<b>**Overlap** <i>***is***</b>
a</i> problem!

or

Using Set Theory...

- Hierarchy and containment are dynamic and optional
- Overlap is supported
- Set members can 'belong' to multiple sets that are unrelated (in terms of parent-child and sibling relationships)

An Example...

The assertion is that **PCDATA *should be*** *primary*.

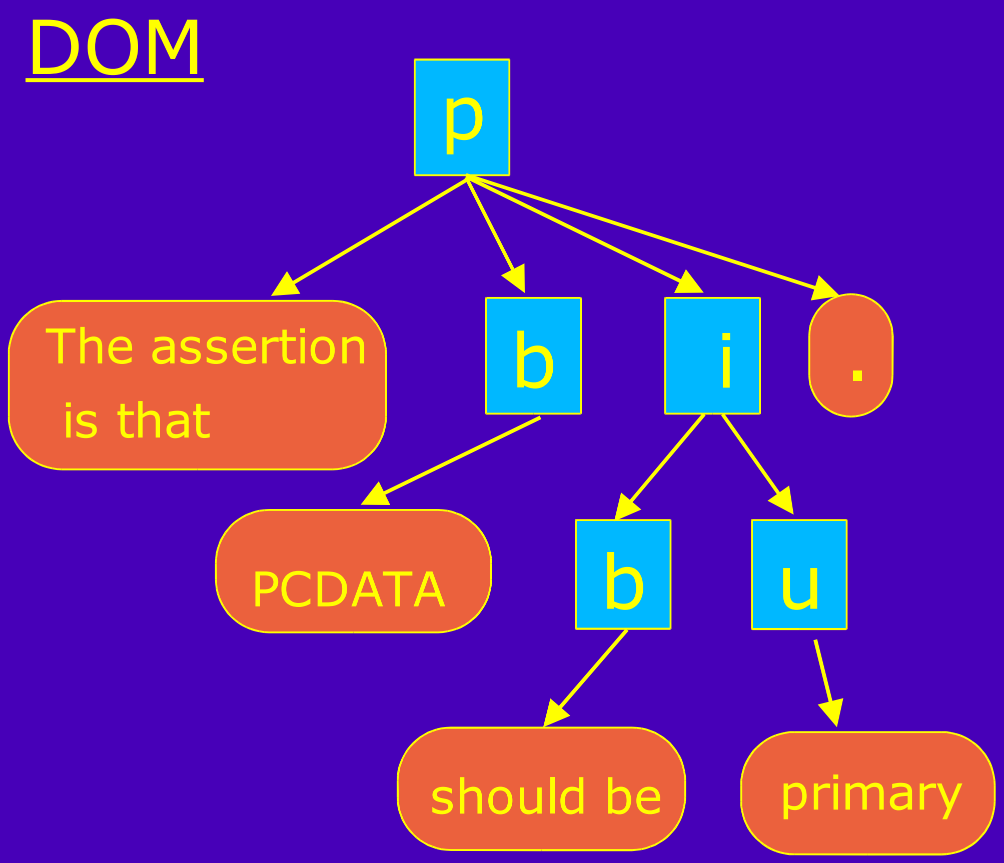
Naturally:

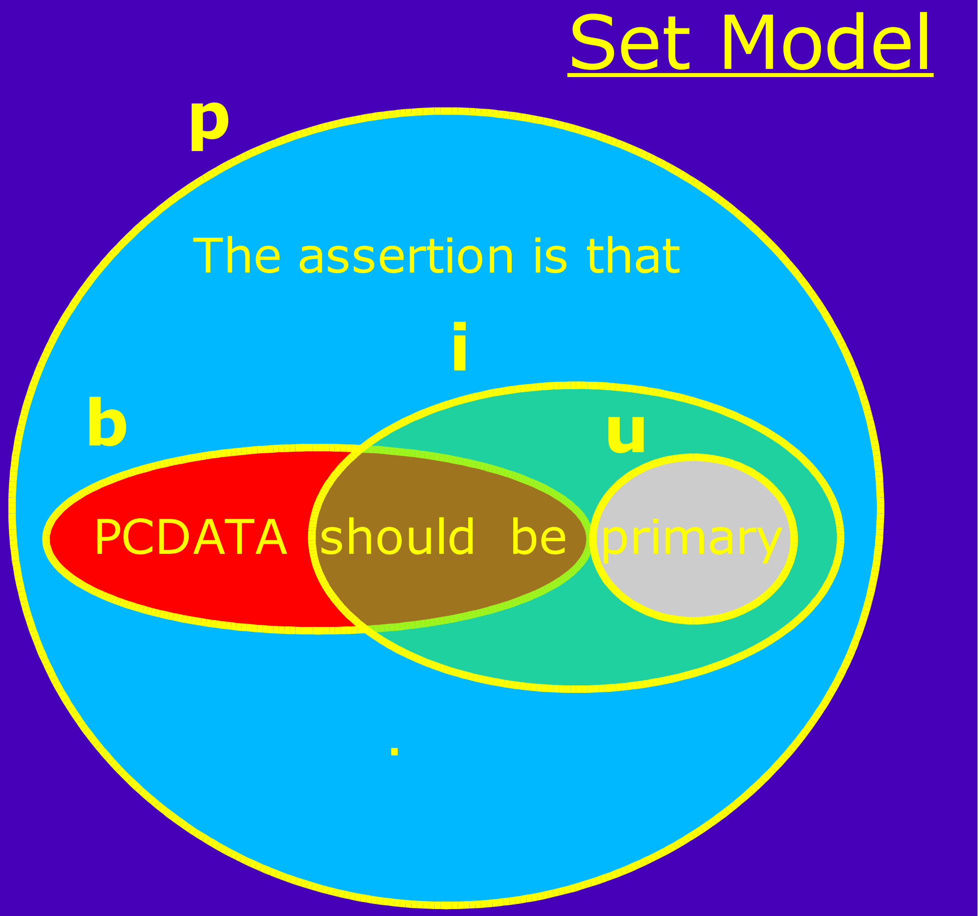
- <p>The assertion is that <b>PCDATA <i>should be</b> <u>primary</i></u>.</p>

In XML:

- <p>The assertion is that <b>PCDATA</b><i><b>should be</b><u>primary</u></i>.</p>

An Example...





5 PCDATA nodes on 3 levels, extra b node required to avoid overlap

PCDATA on 1 level, metadata overlaid

Some observations...

- Under tree model:
  - PCDATA is governed by metadata providing convenient method of recording membership
  - Metadata has a single structure
  - Range of membership limited to containing ancestors
- Under set model:
  - PCDATA is independent of metadata, membership must be recorded independently
  - Metadata may have multiple structures
  - No restrictions on membership

BUVH: Back around again…

- Bottom-Up Virtual Hierarchies (BUVH) – Durusau & O’Donnell (2001)
  - From initial observation of markup as metadata re. PCDATA
  - PCDATA atoms (tokenization of PCDATA)
  - Full XPath membership of each PCDATA atom in each hierarchy marked on every atom

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

BUVH: Back around again…

- Designed for multiple independent hierarchies (OHCO)
    - e.g. page/line v. section/sentence analysis of text
- Highly verbose (redundant)
- Querying depends on string functions
- In most cases overlap is LOCAL and therefore not best treated as separate hierarchy
- BUT… fundamental insight of attaching memberships at PCDATA atom level is sound

Processing Example…

1. Input document (not well-formed)

```
<p>The assertion is that
  <b>PCDATA
    <i>should be
  </b>
  <u>primary
    </i>
  </u>
  .
</p>
```

Processing Example...

1. Input document (not well-formed)
2. JITTs filter

- Recognise all markup
- Output milestones

```
<p>The assertion is that
   <b>PCDATA
      <i>should be
   </b>
   <u>primary
      </i>
   </u>
   .
</p>
```

Processing Example...

1. Input document (not well-formed)
2. JITTs filter

- Recognise all markup
- Output milestones

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion is
  that
    <b_start/>PCDATA
       <i_start/>should be
    <b_end/>
    <u_start/>primary
       <i_end/>
    <u_end/>
    .<p_end/>
</root>
```

Processing Example...

1. Input document (not well-formed)
2. JITTs filter
   - Recognise all markup
   - Output milestones
3. SAX filter to record set memberships on PCDATA atoms

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion is
  that
    <b_start/>PCDATA
       <i_start/>should be
    <b_end/>
    <u_start/>primary
       <i_end/>
    <u_end/>
    .<p_end/>
</root>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

```
<?xml version="1.0"?>


<root>
```

Active sets:

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The
   assertion is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

startElement('p_start')

Active sets:

p

```
<?xml version="1.0"?>


<root>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The
   assertion is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

endElement('p_start')

```
<?xml version="1.0"?>


<root>
```

Active sets:

p

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The
   assertion is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('The assertion is that')

```
<?xml version="1.0"?>


<root>
```

Active sets:

p

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The
   assertion is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('The assertion is that')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
```

Active sets:

p

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The
   assertion is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('The assertion is that')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
```

Active sets:

p

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('The assertion is that')

Active sets:

p

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
         <i_start/>should
   be
     <b_end/>
     <u_start/>primary
         <i_end/>
     <u_end/>
    .<p_end/>
</root>
```

Events:

character('The assertion is that')

Active sets:

p

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
    <b_start/>PCDATA
          <i_start/>should
   be
    <b_end/>
    <u_start/>primary
          <i_end/>
    <u_end/>
    .<p_end/>
</root>
```

Events:

startElement('b_start')

Active sets:

p, b

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
    <b_start/>PCDATA
         <i_start/>should
   be
    <b_end/>
    <u_start/>primary
         <i_end/>
    <u_end/>
    .<p_end/>
</root>
```

Active sets:

p, b

Events:

endElement('b_start')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Active sets:

p, b

Events:

character('PCDATA')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('PCDATA')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
```

Active sets:

p, b

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

startElement('i_start')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
```

Active sets:

p, b, i

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Active sets:

p, b, i

Events:

endElement('i_start')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
  is that
    <b_start/>PCDATA
    <i_start/>should be
    <b_end/>
    <u_start/>primary
        <i_end/>
    <u_end/>
    .<p_end/>
</root>
```

Events:

character('should be')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
```

Active sets:

p, b, i

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
     <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('should be')

Active sets:

p, b, i

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" I="1">should</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
     <i_start/>should be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('PCDATA')

Active sets:

p, b, i

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

startElement('b_end')

Active sets:

p, i

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

endElement('b_end')

Active sets:

p, i

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

startElement('u_start')

Active sets:

p, i, u

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

endElement('u_start')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
```

Active sets:

p, i, u

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
     <i_start/>should be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('primary')

Active sets:

p, i, u

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
     <i_start/>should be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

character('primary')

Active sets:

p, i, u

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

startElement('i_end')

Active sets:

p, u

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

endElement('i_end')

Active sets:

p, u

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

startElement('u_end')

Active sets:

p

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

endElement('u_end')

Active sets:

p

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
         <i_start/>should
   be
     <b_end/>
     <u_start/>primary
         <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

characters('.')

Active sets:

p

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" I="1">should</w>
   <w p="1" b="1" I="1">be</w>
   <w p="1" I="1" u="1">primary</w>
   <w p="1">.</w>
```

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
          <i_start/>should
   be
     <b_end/>
     <u_start/>primary
          <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

startElement(‘u_end’)

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
   <w p="1">.</w>
```

Active sets:

SAX Process

```
<?xml version="1.0"?>
<root>
<p_start/>The assertion
   is that
     <b_start/>PCDATA
         <i_start/>should
   be
     <b_end/>
     <u_start/>primary
         <i_end/>
     <u_end/>
     .<p_end/>
</root>
```

Events:

endElement('u_end')

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
   <w p="1">.</w>
</root>
```

Active sets:

Set-based queries...

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
   <w p="1">.</w>
</root>
```

- Simple XPath expressions for presence of attributes

Set-based queries...

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
   <w p="1">.</w>
</root>
```

- Simple XPath expressions for presence of attributes
- All bold-italic:

  `//w[@b][@i]`

  b ∩ i

Set-based queries…

```
<?xml version="1.0"?>


<root>
   <w p="1">The</w>
   <w p="1">assertion</w>
   <w p="1">is</w>
   <w p="1">that</w>
   <w p="1" b="1">PCDATA</w>
   <w p="1" b="1" i="1">should</w>
   <w p="1" b="1" i="1">be</w>
   <w p="1" i="1" u="1">primary</w>
   <w p="1">.</w>
</root>
```

- Simple XPath expressions for presence of attributes
- All bold-italic:

  `//w[@b][@i]`

  `b ∩ i`
- non-italic bold:

  `//w[@b][not (@i)]`

A more complex example…

‘When Jesus saw their faith, he spoke to the paralyzed man…’ (Mk. 2.5)

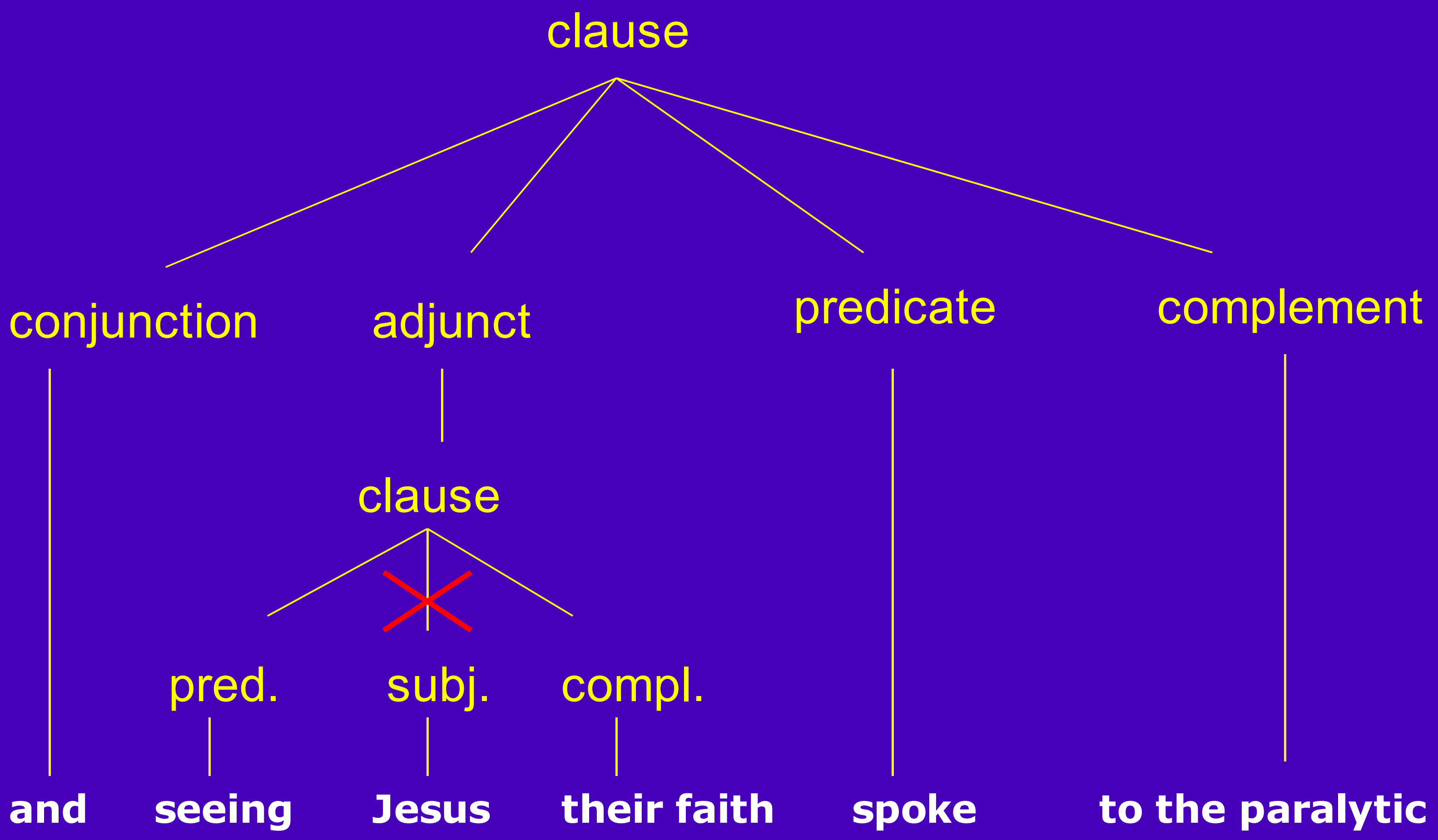
Literal rendering of Greek word order:

‘and seeing Jesus their faith spoke to the paralytic’

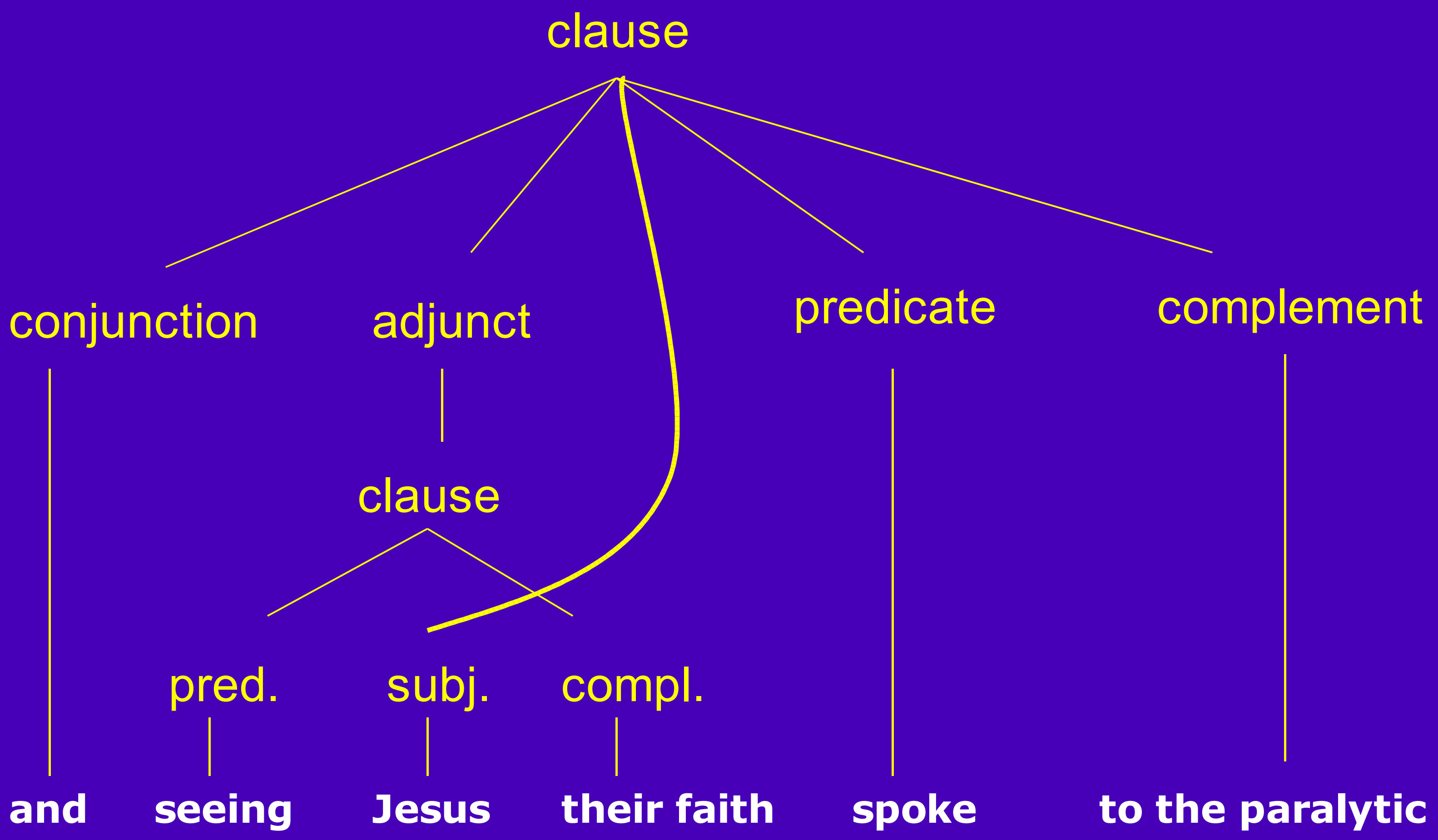
A more complex example…

```
<clause>
  <conj>and</conj>
  <adjunct>
  <clause>
      <predicate>seeing</predicate>
      <subject>Jesus</subject>
      <complement>their faith</complement>
  </clause>
  </adjunct>
  <predicate>spoke</predicate>
  <complement>to the paralytic</complement>
</clause>
```

A more complex example...



A more complex example...



clause

conjunction

adjunct

predicate

complement

clause

pred.

subj.

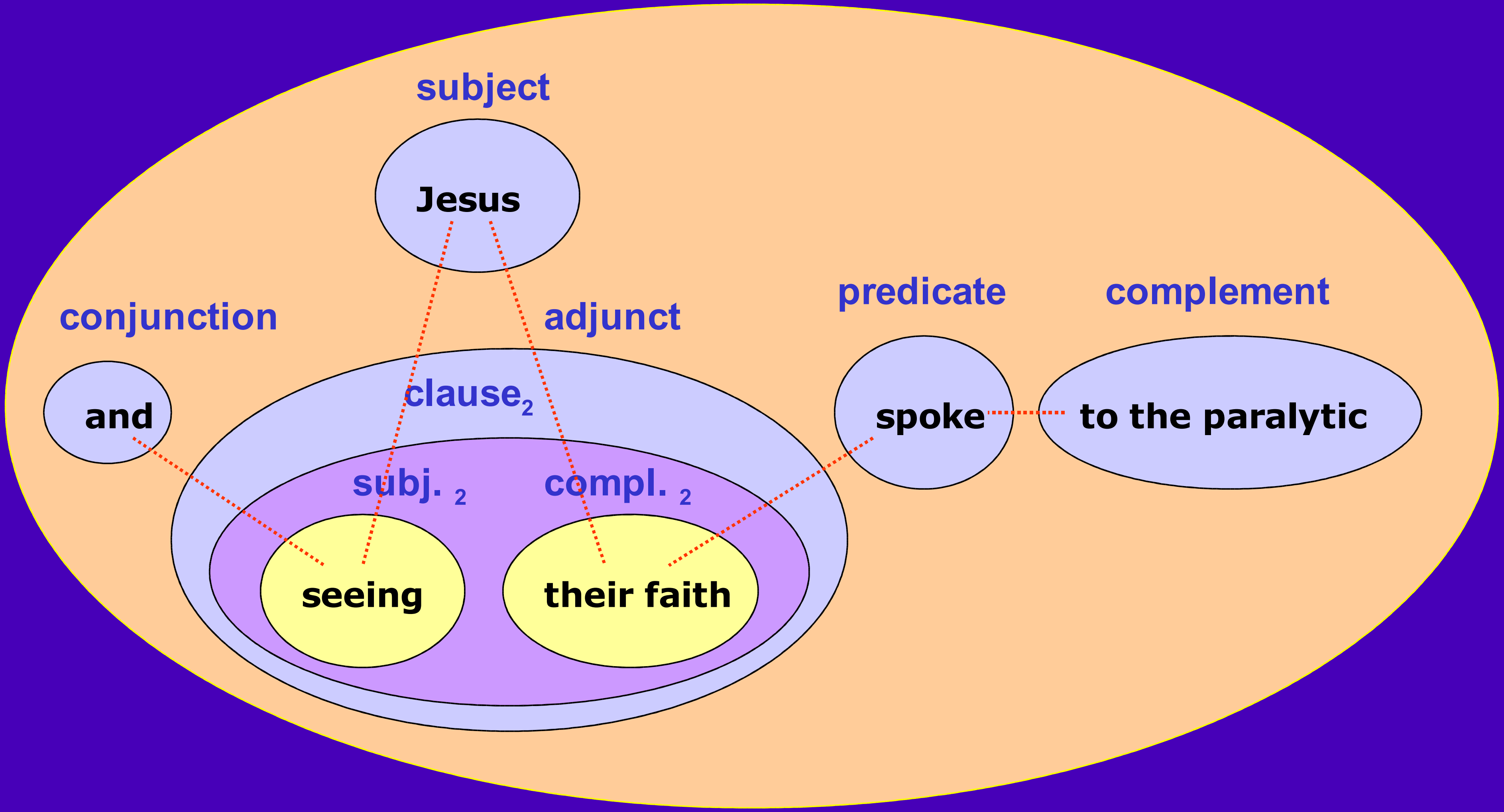
compl.

and **seeing** **Jesus** **their faith** **spoke** **to the paralytic**

Segmentation...

```
<clause>
  <conj>and</conj>
  <adjunct id=“a1”>
  <clause id=“c1”>
     <predicate>seeing</predicate>
  </clause>
  </adjunct>
  <subject>Jesus</subject>
  <adjunct ref=“a1”>
  <clause ref=“c1”>
     <complement>their faith</complement>
  </clause>
  </adjunct>
  <predicate>spoke</predicate>
  <complement>to the paralytic</complement>
</clause>
```

The Set Representation...



The Set Representation...

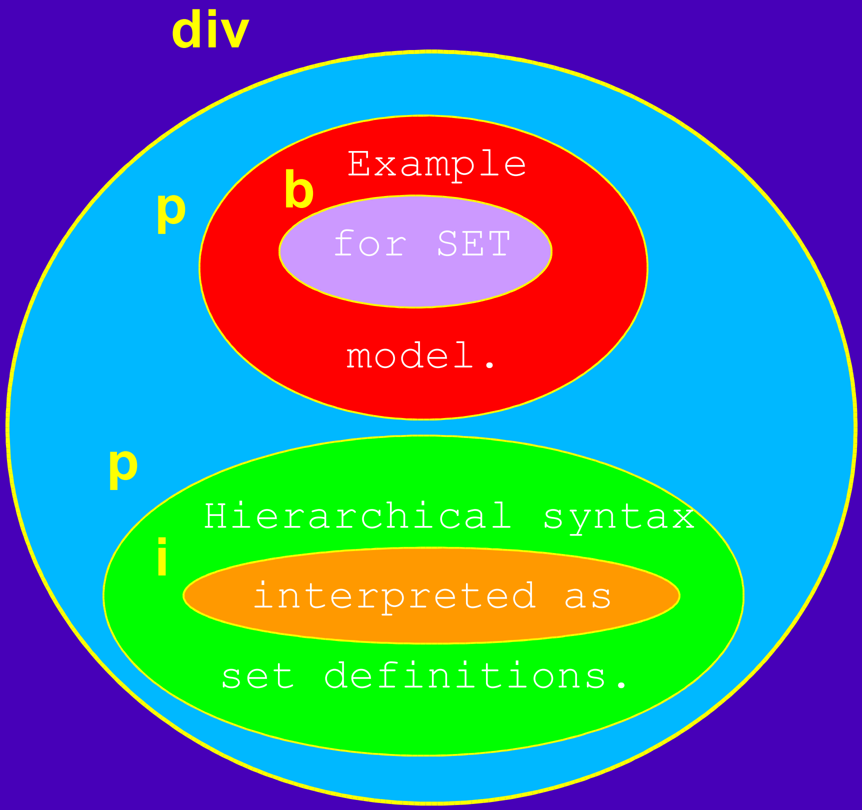
```xml
<?xml version="1.0"?>

<clause>
   <w conjunction="1">and</w>
   <w adjunct="1" clause="2" predicate="2">seeing</w>
   <w subject="1">Jesus</w>
   <w adjunct="1" clause="2" complement="2">their faith</w>
   <w predicate="1">spoke</w>
   <w complement="1">to</w>
   <w complement="1">the</w>
   <w complement="1">paralytic</w>
</clause>
```

Using Syntactical Containment...

- By default interpret markup at processing time as:
  - Elements = set boundaries
  - PCDATA = set members
  - Contained elements = subsets

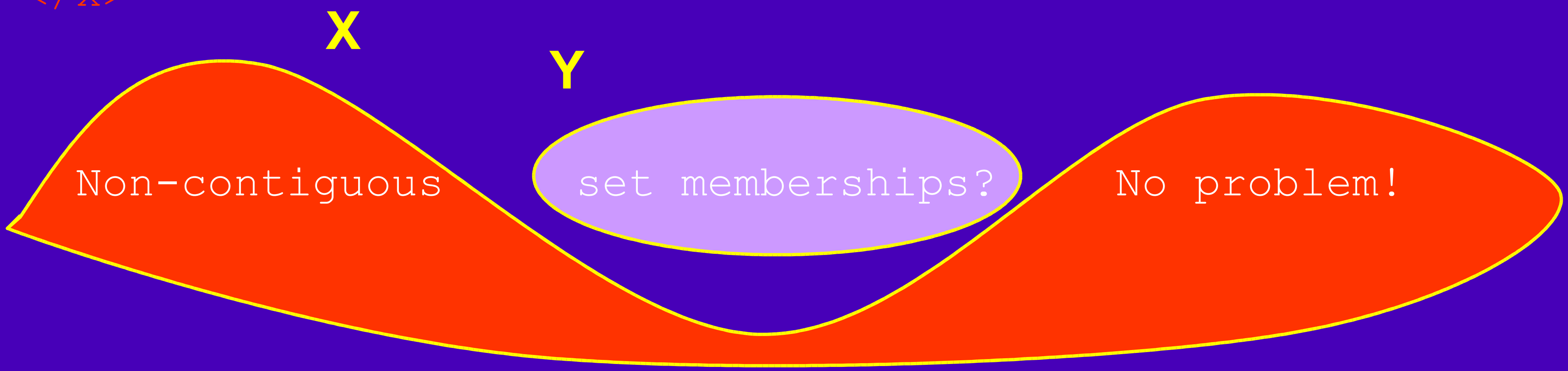
```
<div>
    <p>Example
       <b>for SET</b>
       model.
    </p>
    <p>Hierarchical syntax
    <i>interpreted as</i>
    set definitions.
    </p>
</div>
```



Using Syntactical Containment...

- Membership of contained PCDATA and elements assumed unless exemption stated

```
<x>Non-contiguous
  <y notSubsetOf="x">set memberships?</y>
  No problem!
</x>
```



Using Syntactical Containment...

- Hierarchies are used to address places where set interpretation is imposed upon markup
  - don’t need to transform to a completely flat representation
  - overlap is usually local
- Attributes on atomized elements turned into metadata empty elements

Some use cases…

- Offshore conversion services often return ill-formed XML which requires interactive correction. Using a set-based interpretation well-formed XML created which can be queried to locate problems of overlap and unclosed elements.

```
<p>
    <b>Missing</b>
    closing
    <i>italic
    tag
</p>
```

```
<root>
    <w p="1" b="1">Missing</w>
    <w p="1">closing</w>
    <w p="1" i="1">italic</w>
    <w p="1">tag</w>
    <opensets i="1"/>
</root>
```

Some use cases...

- Multiple and overlapping interpretations of text
- `e.g. Page/line and sentence/segment analysis`
- `chapter/verse and linguistic clause analysis`
- Discontinuous phenomena
- Reordering

Conclusions…

- Just as markup is a particular view of a text, the parsing of markup should represent only one particular view of the markup (i.e. NO canonical view of the markup)

- Parsing of markup should serve the user’s needs and not an abstract definition of acceptable parsing