Digital Texts, XML, and TEI

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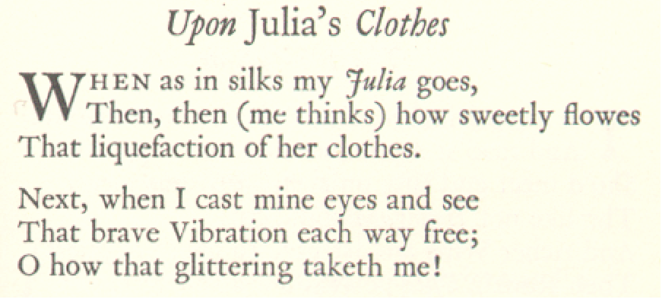
Questions we will try to answer on this course

1. What is mark-up for?
2. What is XML?
3. How do I do cool stuff with my digital texts?
4. How is the TEI system organized and what is it for?
5. How do I customize the TEI system to create digital texts the way I want them?

Questions we will (probably) not try to answer on this course

- Who can I get to do all this for me?
- How would I do all this using Word?
- How would I do all this using a database?
- How would I do all this using some other XML scheme?
- What is a digital text for anyway?

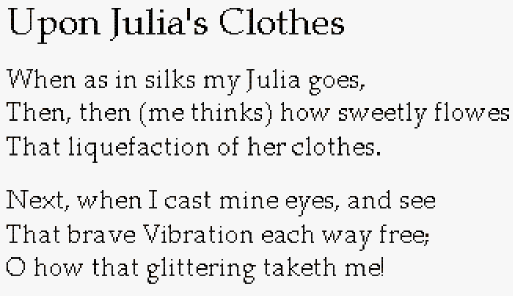
What’s in a text?



Upon Julia’s *Clothes*

WHEN as in silks my *Julia* goes,
Then, then (me thinks) how sweetly flowes
That liquefaction of her clothes.

Next, when I cast mine eyes and see
That brave Vibration each way free;
O how that glittering taketh me!

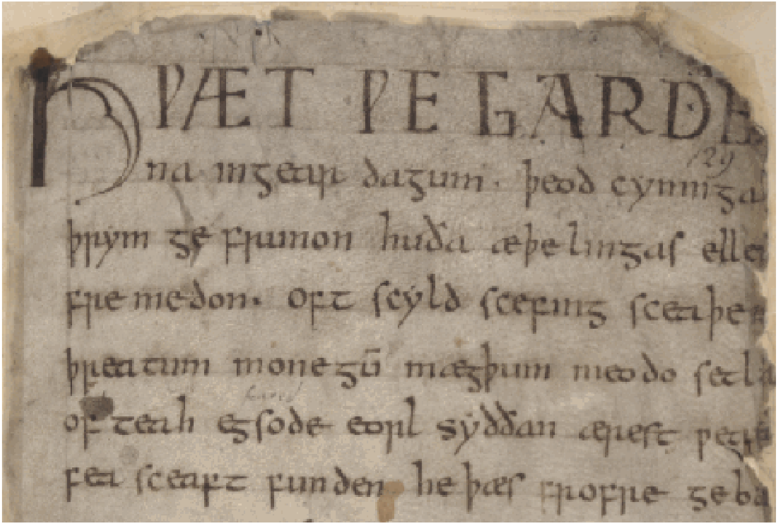


Upon Julia's Clothes

When as in silks my Julia goes,
Then, then (me thinks) how sweetly flowes
That liquefaction of her clothes.

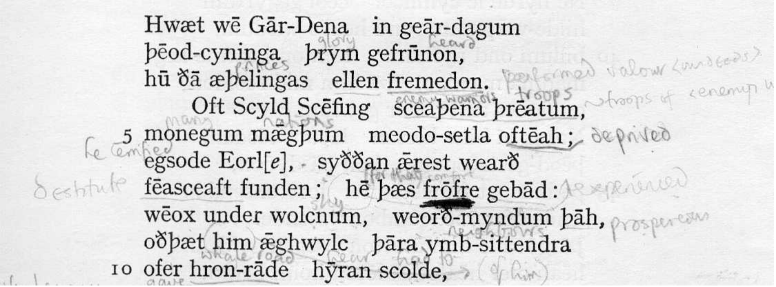
Next, when I cast mine eyes, and see
That brave Vibration each way free;
O how that glittering taketh me!

What’s in a text (2)?



HƿÆT ƿE GARDE
na inᵹear daᵹum · þeod cyninᵹa
þrym ᵹe frunon hu ða æþelinᵹaſ elle
fremedon · oft ſcyld ſcefinᵹ ſceaþe
þreatum moneᵹū mæᵹþum meodo ſetl
of teah eᵹſode eorl ſyððan ærest ƿe
fea ſceaft funden he þæs frofre ᵹeba

What’s in a text (3)?



Hwæt wē Gār-Dena in geār-dagum
þēod-cyninga þrym gefrūnon,
hū ðā æþelingas ellen fremedon.
Oft Scyld Scēfing sceaþena þrēatum,
5 monegum mǣgþum meodo-setla oftēah;
egsode Eorl[*e*], syððan ǣrest wearð
fēasceaft funden; hē þæs frōfre gebād:
wēox under wolcnum, weorð-myndum þāh,
oðþæt him ǣghwylc þāra ymb-sittendra
10 ofer hron-rāde hȳran scolde,

glory
heard
princes
performed valour <wondeeds>
enemy warriors
troops
troops of <enemy> w
many
nations
deprived
he terrified
destitute
for that comfort
he experienced
sky
prosperous
neighbours
whale road
hear
had to
(of him)
gave

The ontology of text

Where is the text?

- in the shape of letters and their layout?
- in the original from which this copy derives?
- in the ideas it brings forth? in their format, or their intentions?

Texts are abstractions conjured up by readers.
Markup encodes those abstractions.

Encoding of texts

- Texts are more then sequences of encoded glyphs
  - They have structure and content
  - They also have multiple readings
- Encoding, or markup, is a way of making these things explicit
- Only that which is explicit can be reliably processed

Styles of markup

- In the beginning there was *procedural* markup

  ```
  RED INK ON; print balance; RED INK OFF
  ```

- which being generalised became *descriptive* markup

  ```
  <balance type=’overdrawn’>some numbers</balance>
  ```

- also known as encoding or annotation

descriptive markup allows for re-use of data

Some more definitions

- Markup makes explicit the distinctions we want to make when processing a string of bytes
- Markup is a way of naming and characterizing the parts of a text in a formalized way
- It’s (usually) more useful to markup what things *are* than what they *look like*

What does markup capture?

Compare

```
<head>Upon Julia’s Clothes</head>
<lg><l>Whenas in silks my <hi>Julia</hi> goes,</l>
<l>Then, then (me thinks) how sweetly flowes</l>
<l>That liquefaction of her clothes.</l>
</lg>
```

and

```
<s n="1" role="head">
     <w type="pp">Upon</w>
     <w type="np">Julia</w><w type="pos">’s </w>
     <w type="nn2">Clothes</w>
</s>
<s n="2" role="line">
     <w type="adv">Whenas</w>
     <w type="pp">in</w>
     <w type="nn2">silks</w>
     ...
</s>
```

Likewise..

Compare

```
 <hi rend="dropcap">H</hi>&WYN;ÆT WE GARDE
 <lb/>na in gear-dagum þeod-cyninga
 <lb/>þrym gefrunon, hu ða æþelingas
 <lb/>ellen fremedon.  oft scyld scefing sceaþe<add>na</add>
 <lb/>þreatum, moneg<expan>um</expan> mægþum
meodo-setl<add>a</add>
 <lb/>of<damage desc="blot"/>teah egsode <sic>eorl</sic>
 syððan ærest wear<add>þ</add>

 <lb/>fea sceaft funden...
```

and

```
 <lg>
  <l>Hwæt!  we Gar-dena in gear-dagum</l>
  <l>þeod-cyninga þrym gefrunon,</l>
  <l>hu ða æþelingas ellen fremedon,</l>
 </lg>
 <lg>
  <l>Oft Scyld Scefing sceaþena þreatum,</l>
  <l>monegum mægþum meodo-setla ofteah;</l>
  <l>egsode Eorle, syððan ærest wearþ</l>
```

What’s the point of markup?

- To make explicit (to a machine) what is implicit (to a person)
- To add value by supplying multiple annotations
- To facilitate re-use of the same material
  - in different formats
  - in different contexts
  - for different users

A useful mental exercise

Imagine you are going to markup several thousand pages of complex material....

- Which features are you going to markup?
- Why are you choosing to markup this feature?
- How reliably and consistently can you do this?

Now, imagine your budget has been halved. Repeat the exercise!

Some alphabet soup

SGML	Standard Generalized Markup Language
HTML	Hypertext Markup Language
W3C	World Wide Web Consortium
XML	eXtensible Markup Language
DTD	Document Type Definition (or Declaration)
CSS	Cascading Style Sheet
Xpath	XML Path Language
XSLT	eXtensible Stylesheet Language - Transformations
RelaxNG	Regular Expression Language for XML (New Generation)

Oh, and then there's also

TEI	Text Encoding Initiative

XML: what it is and why you should care

- XML is structured data represented as strings of text
- XML looks like HTML, except that:-
  - XML is extensible
  - XML must be well-formed
  - XML can be validated
- XML is application-, platform-, and vendor- independent
- XML empowers the content provider and facilitates data integration

An example XML document

```
 <?xml version="1.0" encoding="utf-8" ?>
   <cookBook>
   <recipe n="1">
     <head>Nail Soup</head>
     <ingredientList>
       <ingredient>an onion</ingredient>
       <ingredient>two carrots</ingredient>
       <ingredient>water</ingredient>
          ...
       <ingredient>a nail</ingredient>
       <ingredient>some gullible peasants</ingredient>
     </ingredientList>
     <procedure>
       <step>put the water on to boil</step>
        ....
       <step>take out the nail and serve</step>
     </procedure>
    </recipe>
    <recipe n="2">
            <!-- contents of second recipe here -->
   </recipe>
          <!-- hic desunt multa -->
</cookBook>
```

XML terminology

An XML document may contain:-

- elements, possibly bearing attributes
- processing instructions
- comments
- entity references
- marked sections (CDATA, IGNORE, INCLUDE)

An XML document must be well-formed and may be valid

XML is an international standard

- XML requires use of ISO 10646
  - a 31 bit character reportoire including most human writing systems
  - encoded as UTF8 or UTF16
- other encodings may be specified at the document level
- language may be specified at the element level using xml:lang

The rules of the XML Game

- An XML document represents a (kind of) tree
- It has a single root and many nodes
- Each node can be
  - a subtree
  - a single element (possibly bearing some attributes)
  - a string of character data
- Each element has a type or generic identifier
- Attribute names are predefined for a given element; values can also be constrained

Representing an XML tree

- An XML document is encoded as a linear string of characters
- It begins with a special processing instruction
- Element occurrences are marked by start- and end-tags
- The characters < and & are Magic and must always be "escaped"
- Comments are delimited by <!- - and - ->
- CDATA sections are delimited by <![CDATA[and]]>
- Attribute name/value pairs are supplied on the start-tag and may be given in any order
- Entity references are delimited by & and ;

XML syntax: the small print

What does it mean to be well-formed?

1. there is a single root node containing the whole of an XML document
2. each subtree is properly nested within the root node
3. names are always case sensitive
4. start-tags and end-tags are always mandatory (except that a combined start-and-end tag may be used for empty nodes)
5. attribute values are always quoted

Splot the mistake

```
<greeting>Hello world!</greeting>
<greeting>Hello world!</Greeting>

<greeting><grunt>Ho</grunt> world!</greeting>
<grunt>Ho <greeting>world!</greeting></grunt>
<greeting><grunt>Ho world!</greeting></grunt>

<grunt type=loud>Ho</grunt>
<grunt type="loud"></grunt>

<grunt type= "loud">
<grunt type ="loud"/>
```

Defining the rules

A valid XML document conforms to rules which are stated in an external schema of some sort.
A schema specifies:

- the name of the root element
- names for all elements used
- names and datatypes and (occasionally) default values for their attributes
- rules about how elements can nest
- and a few other things, depending on the schema language

n.b. A schema does *not* specify anything about what elements "mean"

Schema languages

Schemas can be written in:

- The W3C schema language
- Relax NG schema language
- XML DTD Language

In the TEI, we mostly use Relax NG

Parts of an XML document

```
<?xml version="1.0" ?>
<hello xmlns="http://www.greetings.org">
hello world
    </hello>
```

- The XML declaration
- Namespace declarations
- The root element of the document itself

The XML declaration

An XML document must begin with an XML declaration which does two things:

- specifies that this *is* an XML document, and which version of the XML standard it follows
- specifies which character encoding the document uses

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

```
<?xml version="1.0" encoding="iso-8859-1" ?>
```

The default, and recommended, encoding is UTF-8

Namespace declarations

An XML document can use elements declared in different name spaces.

- a namespace declaration associates a namespace prefix with an external identifier (which looks like an URL)
- the default namespace *may* be declared using a special `xmlns` attribute
- other name spaces must all use a special prefix, which is also declared

```
<TEI xmlns="http://www.tei-c.org/ns/1.0"> ... </TEI>
```

```
<TEI xmlns="http://www.tei-c.org/ns/1.0"
            xmlns:math="http://www.mathml.org">
     <p>... <math:expr>...</math:expr> ...</p>
     </TEI>
```

There is a special xml namespace, used by the TEI for global attributes xml:id and xml:lang

The Doctype Declaration

In DTD world, an optional "Document Type" declaration may appear:

```
<?xml version="1.0" ?>
<!DOCTYPE hello [<!ELEMENT hello (#PCDATA)>]>
<hello xmlns="http://www.greetings.org">
hello world
    </hello>
```

- The DTD is one way of associating the document with its schema (but is not used by W3C or Relax NG for this purpose)
- The DTD subset is used to provide declarations additional to those in the schema
- The DTD subset may be internal, external, or both

In XML a schema is optional!

XML allows you to make up your own tags, and doesn’t *require* a schema...

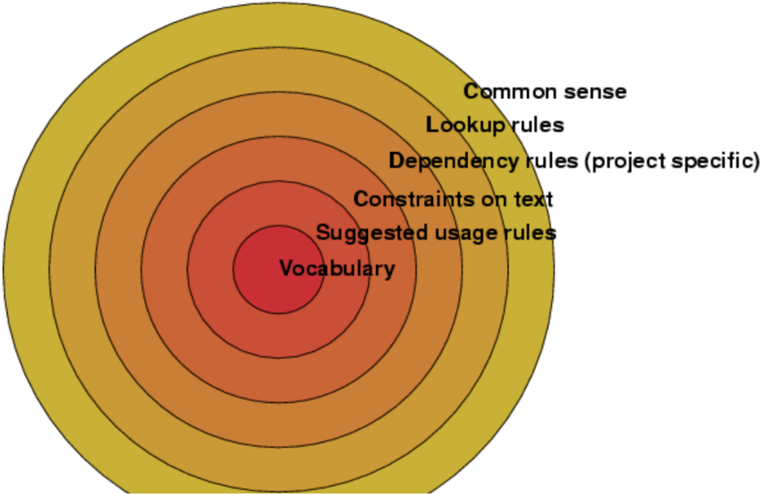
- The XML concept is dangerously powerful:
  - XML elements are light in semantics
  - one man’s <p> is another’s `<para>` (or is it?)
  - the appearance of interchangeability may be worse than its absence
- But XML is too good to ignore
  - mainstream software development
  - proliferation of tools
  - the language of the web

What can a schema (or DTD) do for you?

- ensure that your documents use only predefined elements, attributes, and entities
- enforce structural rules such as ‘every chapter must begin with a heading’ or ‘recipes must include an ingredient list’
- make sure that the same thing is always called by the same name

Schema languages vary in the amount of validation they support

What kinds of validation do we need?



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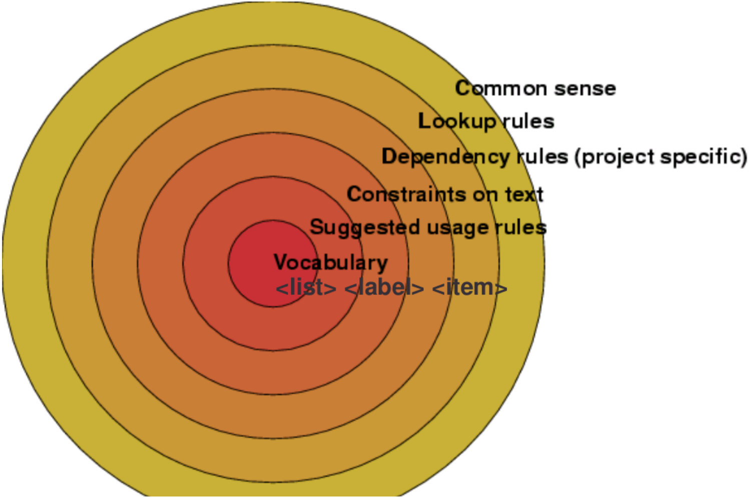

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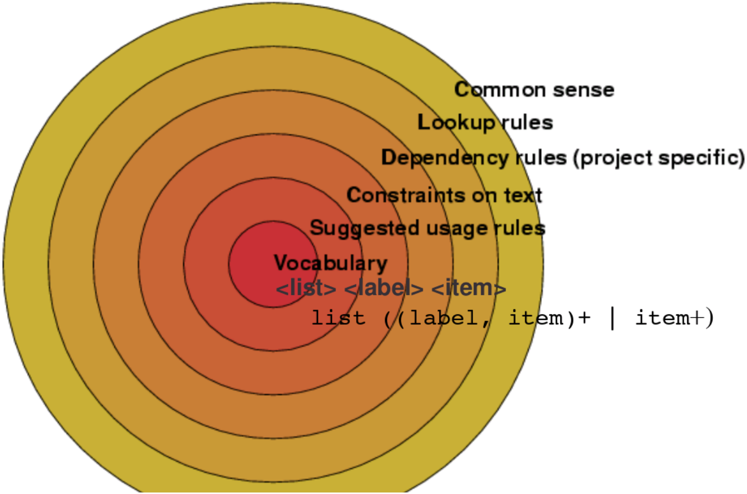

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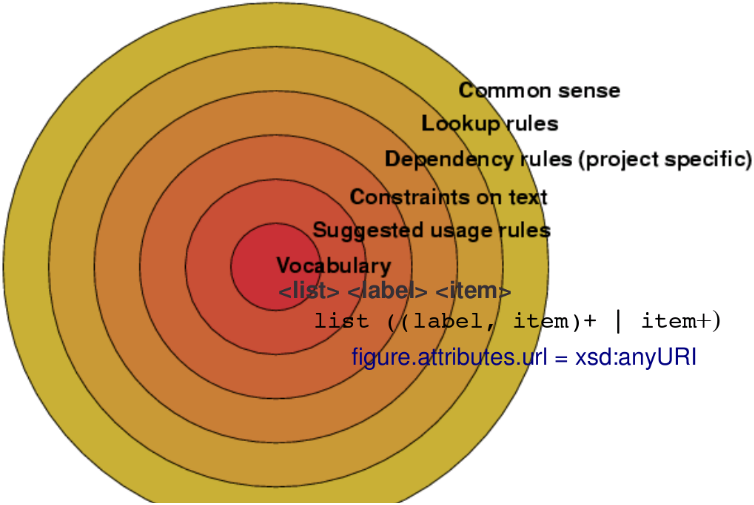
Common sense
Lookup rules
Dependency rules (project specific)
Constraints on text
Suggested usage rules
Vocabulary
<list> <label> <item>
list ((label, item)+ | item+)
figure.attributes.url = xsd:anyURI

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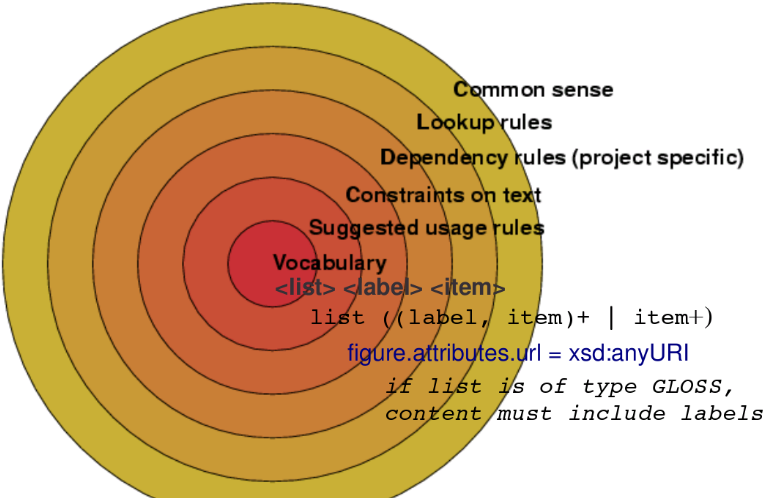

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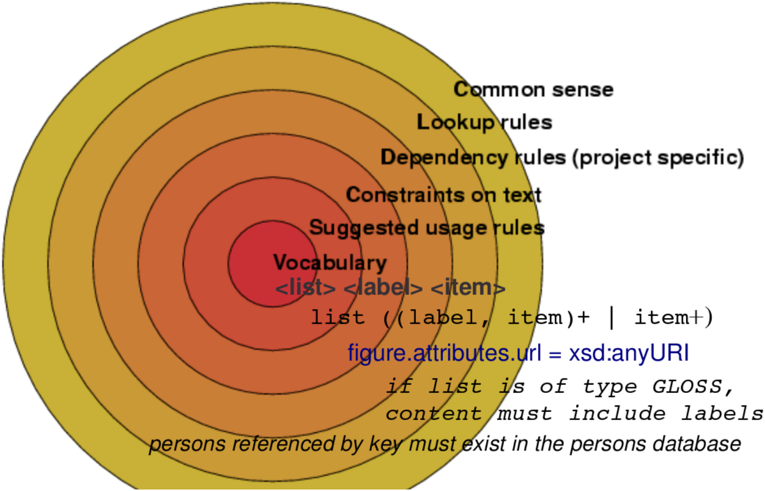
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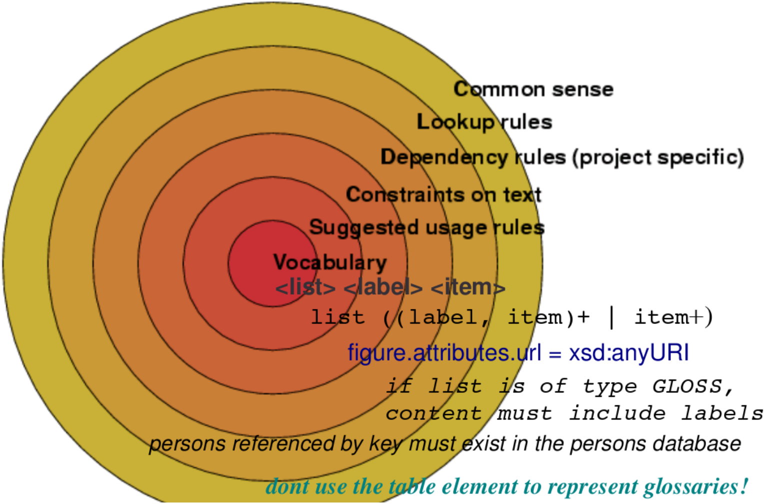
Lookup rules
Dependency rules (project specific)
Constraints on text
Suggested usage rules
Vocabulary
<list> <label> <item>
list ((label, item)+ | item+)
figure.attributes.url = xsd:anyURI
if list is of type GLOSS, content must include labels
persons referenced by key must exist in the persons database

What kinds of validation do we need?


Common sense
Lookup rules
Dependency rules (project specific)
Constraints on text
Suggested usage rules
Vocabulary
<list> <label> <item>
list ((label, item)+ | item+)
figure.attributes.url = xsd:anyURI
if list is of type GLOSS,
content must include labels
persons referenced by key must exist in the persons database
dont use the table element to represent glossaries!

What can the TEI do for you?

The TEI provides a framework for the definition of multiple schemas

- it defines and names several hundred useful textual distinctions
- it provides a set of modules that can be used to define schemas making those distinctions
- it provides a customization mechanism for modifying and combining those definitions with new ones using the same conceptual model

Where did the TEI come from?

- Originally, a research project within the humanities
    - Sponsored by three professional associations
    - Funded 1990-1994 by US NEH, EU LE Programme et al
- Major influences
    - digital libraries and text collections
    - language corpora
    - scholarly datasets
- International consortium established June 1999 (see http://www.tei-c.org/)

Goals of the TEI

- better interchange and integration of scholarly data
- support for all texts, in all languages, from all periods
- guidance for the perplexed: what to encode — hence, a user-driven codification of existing best practice
- assistance for the specialist: how to encode — hence, a loose framework into which unpredictable extensions can be fitted

These apparently incompatible goals result in a highly flexible, modular, environment

TEI Deliverables

- A set of recommendations for text encoding, covering both generic text structures and some highly specific areas based on (but not limited by) existing practice
- A very large collection of element definitions with associated declarations for various schema languages
- a modular system for creating personalized schemas or DTDs from the foregoing

for the full picture see http://www.tei-c.org/TEI/Guidelines/

Legacy of the TEI

- a way of looking at what ‘text’*really* is
- a codification of current scholarly practice
- (crucially) a set of shared assumptions and priorities about the digital agenda:
  - focus on content and function (rather than presentation)
  - identify generic solutions (rather than application-specific ones)