Valid XML Documents

- an XML document is called a *valid* one, if
  - it is well-formed and
  - the prologue of the document contains a document type declaration that again contains or refers to a document type definition (DTD); the xml document corresponds to the content and structure defined within the DTD; or
  - the XML document corresponds to the content and structure of an XML schema; the latter one existing as a separate file

What are the benefits of valid XML documents?

DTD Examples

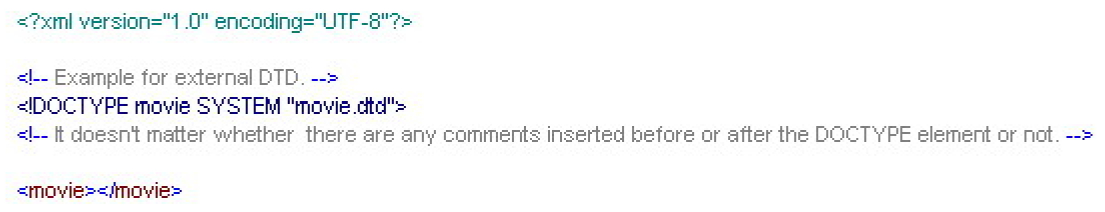
- XHTML strict DTD
  - http://www.w3.org/TR/2000/REC-xhtml1-20000126/DTD/xhtml1-strict.dtd
- XML specification DTD
  - http://www.w3.org/XML/1998/06/xmlspec-v21.dtd
- Docbook XML DTD
  - http://www.oasis-open.org/docbook/xml/4.2/docbookx.dtd

The Document Type Declaration

- the document type declaration must be inserted between the xml declaration and the root element by using the `<!DOCTYPE>` tag
- the tag `<!DOCTYPE>` is an XML keyword and therefore has to be written in capital letters
- the correct syntax is `<!DOCTYPE` *`name [DTD]`*`>` for internal DTDs and `<!DOCTYPE` *`name`* `SYSTEM "`*`filename`*`">` for external DTDs where *`name`* has to be exactly the name of the document's root element and `SYSTEM` is an XML keyword too

Example: External / Internal DTD

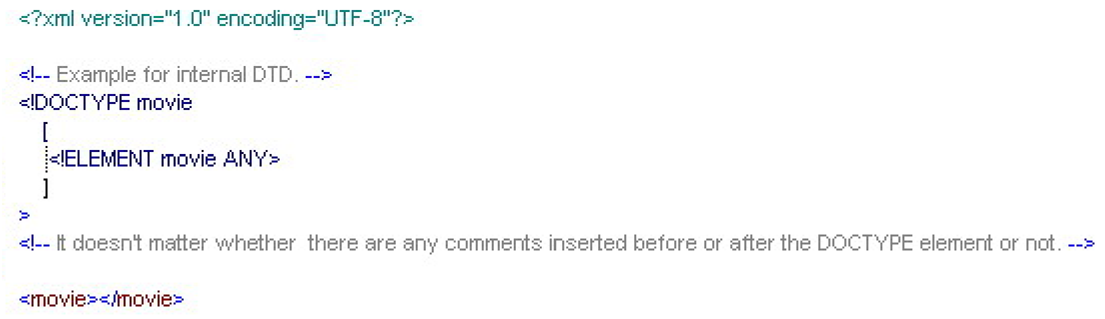
- files_02/external_dtd_declaration.xml
- files_02/internal_dtd_declaration.xml



```
<?xml version="1.0" encoding="UTF-8"?>

<!-- Example for external DTD. -->
<!DOCTYPE movie SYSTEM "movie.dtd">
<!-- It doesn't matter whether  there are any comments inserted before or after the DOCTYPE element or not. -->

<movie></movie>
```



```
<?xml version="1.0" encoding="UTF-8"?>

<!-- Example for internal DTD. -->
<!DOCTYPE movie
    [
    <!ELEMENT movie ANY>
    ]
>
<!-- It doesn't matter whether  there are any comments inserted before or after the DOCTYPE element or not. -->

<movie></movie>
```

Declaring Element Types

- within the XML document only element types declared in the DTD may be used, otherwise the validation will fail
- the correct syntax is `<!ELEMENT` *`name specification`*`>` where *`name`* is the element type
- allowed specifications are
  - `EMPTY` – element may not have content
    - `<!ELEMENT` *`name`* `EMPTY>`
  - `ANY` – element may include character data and other elements without limitations or even nothing at all
    - `<!ELEMENT` *`name`* `ANY>`
  - element content
  - mixed content

Element Content I

- defined as a sequence
  - the element contains subordinated elements in a specified, comma-separated sequence; others than the specified sequence will cause a validation error
  - `<!ELEMENT` *`name`* `(subelement1, subelement2, subelement3)>`
- defined as a selection
  - the element may contain one of the given subordinated elements
  - `<!ELEMENT` *`name`* `(subelement1 | subelement2 | subelement3)>`
- modifications
  - '?' – once the previous or no element
  - '+' – one or several of the previous elements
  - '*' – none or several of the previous elements
  - in specified order: `<!ELEMENT` *`name`* `(sub1?, sub2+, sub3*)>`
  - in unspecified order: `<!ELEMENT` *`name`* `(sub1 | sub2 | sub3)+>`

Element Content II

- What does it mean?
  - `<!ELEMENT test (sub1+, sub2, sub3)>`
  - `<!ELEMENT test (sub1, sub2, sub3)?>`
- Is that useful?
  - `<!ELEMENT test (sub1 | sub2+ | sub3)>`
- Is that correct?

  -
    ```
    <!ELEMENT test (sub1* | sub2 | sub3)>
    …
    <test />
    ```
- Specify an element type that shall include in a certain order: sub1, sub2 and one of sub3, sub4 and sub5, where sub3 is optional.

Element Content III

- solution:
  - `<!ELEMENT test (sub1, sub2, (sub3* | sub4 | sub5))>`

Mixed Content

- only character data
  - `<!ELEMENT *name* (#PCDATA)>`
  - the XML keyword `#PCDATA` (parsed character data) means, that the XML processor parses the content of the specified element, looking for XML markup code; if you want to include character data that would be interpreted as being markup code, use `<![CDATA[ ]]>` sections for the element's content
- character data and subordinated elements
  - `<!ELEMENT *name* (#PCDATA, (sub1 | sub2)?)>`
  - this element must include character data and either the element sub1 or the element sub2 or no subordinated element

Declaring Attributes

- all attributes used within a valid XML document must be declared in the DTD
- the correct syntax is:
  - `<!ATTLIST` *`element_name att_name att_type standard_declaration`*`>`
- the `ATTLIST` contains all attributes for the corresponding element

  -
    ```
    <!ATTLIST movie
        category CDATA "horror"
        year CDATA #REQUIRED>
    ```

Attribute Types

- type character data → `CDATA`
- type token
- type enumeration

- see the file files_02/dtd_full.xml for examples

Type Token

- `ID`
  - the attribute must have a unique identifier for each element, the first character of the value may not be a number
- `IDREF`
  - the attribute refers to another element's attribute with type `ID`
- `IDREFS`
  - same as `IDREF`, but can refer to several other elements
- `ENTITY`
  - refers to a declared external unparsed entity
- `ENTITIES`
  - can refer to several declared external unparsed entities
- `NMTOKEN`
  - name token (letters, numbers, ., -, _, : (not as first character))
- `NMTOKENS`
  - several name tokens, divided by space

Type Enumeration

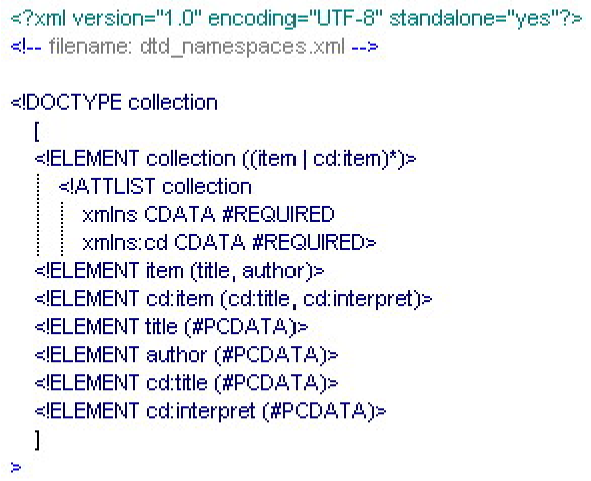
- by defining name tokens
  - the value of the attribute must be one of the given words within the brackets
  - `<!ATTLIST movie category (horror | fiction | documentation) #REQUIRED>`
- by defining a `NOTATION`
  - a notation must be defined in the DTD; it describes a (file) format or identifies a program that processes a certain format
  - empty elements may not contain a `NOTATION`
  - other elements may only contain one `NOTATION`
  - `<!ATTLIST document format NOTATION (HTML | DOC | RTF) #REQUIRED>`

Standard Declarations

- `#REQUIRED`
  - the attribute's value for the corresponding element must be specified, there's no pre-set value
- `#IMPLIED`
  - the attribute's value for the corresponding element may be specified, there's no pre-set value (the value is optional)
- *`AttValue`*
  - stands for a pre-set value which is used if no value is specified by the user
- `#FIXED` *`AttValue`*
  - only a pre-set value may be specified which is used either; this makes only sense as it increases the legibility of the XML document when creating it

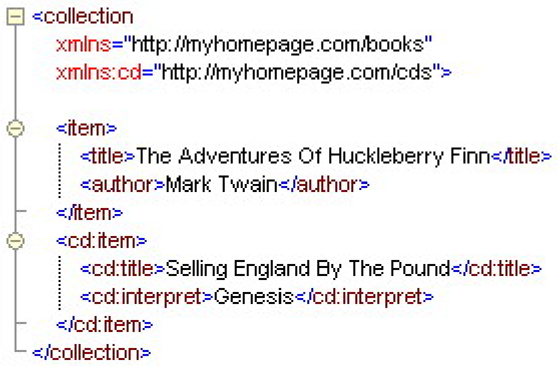
Declaring Namespaces

- explicit and standard namespaces for a specific element are declared the following way (files_02/dtd_namespaces.xml):



```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!-- filename: dtd_namespaces.xml -->

<!DOCTYPE collection
  [
  <!ELEMENT collection ((item | cd:item)*)>
    <!ATTLIST collection
      xmlns CDATA #REQUIRED
      xmlns:cd CDATA #REQUIRED>
  <!ELEMENT item (title, author)>
  <!ELEMENT cd:item (cd:title, cd:interpret)>
  <!ELEMENT title (#PCDATA)>
  <!ELEMENT author (#PCDATA)>
  <!ELEMENT cd:title (#PCDATA)>
  <!ELEMENT cd:interpret (#PCDATA)>
  ]
>
```



```
<collection
  xmlns="http://myhomepage.com/books"
  xmlns:cd="http://myhomepage.com/cds">

  <item>
    <title>The Adventures Of Huckleberry Finn</title>
    <author>Mark Twain</author>
  </item>
  <cd:item>
    <cd:title>Selling England By The Pound</cd:title>
    <cd:interpret>Genesis</cd:interpret>
  </cd:item>
</collection>
```

Combining DTDs

- it is possible to combine external and internal DTDs
- if there exists an element, attribute, entity or notation which is declared in both internal and external DTD under the same name, only the internal declaration is used
- the correct syntax is:

  -
    ```
    <!DOCTYPE name SYSTEM "filename.dtd"
    [
    <!ELEMENT test (#PCDATA)>
    …
    ]
    >
    ```

`<![IGNORE[` and `<![INCLUDE[`

- for deactivating a block with markup code temporarily (e.g. when developing) use the XML keyword `<![IGNORE[    ]]>`
- for activating a block with markup code temporarily (e.g. when developing) use the XML keyword `<![INCLUDE[    ]]>`