

## DTD (Document Type Definition)

In simple cases, **DTD** is used to describe the syntax of a data structure stored in XML. This DTD can be saved in a file with a `.dtd` extension, but it can also be part of the XML document itself.

### Basic Properties of DTD

- Allows for simple **syntactic validation**.
- A descriptive language similar to **extended Backus-Naur form**.
- You can define structures, required sequences, type constraints, and cardinality.

If an XML document has a document type declaration, it must be indicated in the file with a special declaration starting with `<!DOCTYPE>`. The type declaration can be **internal** or **external** (referenced via **URI** or a **file**).

### Internal declaration

```
<!DOCTYPE uzenet [  
    ....  
>
```

### External URI

```
<!DOCTYPE html PUBLIC "-//W3//DTD XHTML 1.0 Strict//EN"  
"http://www.w3.org/TR/.....dtd">
```

### External file

```
<!DOCTYPE uzenet SYSTEM "filename.dtd">
```

The DTD defines the structure and rules that an XML document must follow to be considered valid.

## DTD Through Examples

Here is a DTD file named `message_syntax.dtd` and the corresponding XML on the right:

```
<!ELEMENT message ( text )>  
<!ELEMENT text ( #PCDATA )>
```

```
<?xml version = "1.0" encoding = "UTF-8"?>  
<!DOCTYPE message SYSTEM "message_syntax.dtd">  
  
<message>  
  <text>Hello XML</text>  
</message>
```

In the XML structure, a **comma** indicates the required order of elements:

```
<!DOCTYPE studygroup [  
  <!ELEMENT group (teacher, student)>  
  <!ELEMENT teacher ( #PCDATA ) >  
  <!ELEMENT student ( #PCDATA ) >  
>
```

```
<studygroup>  
  <teacher>Kiss Janos</teacher>  
  <student>Gipsz Jakab</student>  
</studygroup>
```

The **pipe symbol** `|` expresses an **either-or** relationship. For example, the storage device can be either a **pendrive** or an **SSD**, but not both:

```
<!DOCTYPE datastore [  
  <!ELEMENT datastorage (pendrive | SSD)>  
  <!ELEMENT pendrive ( #PCDATA ) >  
  <!ELEMENT SSD ( #PCDATA ) >  
>
```

```
<datastorage>  
  <pendrive>64MB</pendrive>  
</datastorage>
```

There are three ways to express **frequency**:

Symbol	Meaning
+	The element appears at least once.
*	The element can appear any number of times, including zero.
?	The element appears zero or one time.

### Example: A music CD contains **\*\*tracks\*\***:

```
<!DOCTYPE datastorage [
  <!ELEMENT CD (recording + )>
  <!ELEMENT recording ( #PCDATA ) >
]>
```

```
<CD>
  <felvetel>Song 1</felvetel>
  <felvetel>Song 2</felvetel>
</CD>
```

### Example: An album has at least one title, followed by at least one **\*\*track title\*\*** and **\*\*duration\*\***:

```
<!DOCTYPE datastorage [
  <!ELEMENT album (title+, (tracktitle, duration)+)>
  <!ELEMENT title ( #PCDATA ) >
  <!ELEMENT tracktitle ( #PCDATA ) >
  <!ELEMENT duration ( #PCDATA ) >
]>
```

### Syntactically correct XML:

```
<album>
  <title>Title 1</title>
  <title>Subtitle</title>
  <tracktitle>Track Title 1</tracktitle>
  <duration>3.42</duration>
  <tracktitle>Track Title 2</tracktitle>
  <duration>2.32</duration>
</album>
```

## Example: A library may contain **\*\*books\*\*** (zero or more)

```
<!DOCTYPE datastorage [  
  <!ELEMENT library (book*) >  
  <!ELEMENT book (author, title) >  
  <!ELEMENT author ( #PCDATA ) >  
  <!ELEMENT title ( #PCDATA ) >  
>
```

### Syntactically correct XML:

```
<library>  
  <book >  
    <author>Orwell, George</author>  
    <title >1984</title >  
  </book>  
  <book>  
    <author>Brown, Dan</author>  
    <title >The Da Vinci Code</title >  
  </book >  
</library>
```

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Last update: **2024/10/07 17:47**

