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XML Schema

- W3C developed it to address many of the shortcomings of DTD
- It is occasionally called
  - XML Schema Definition (XSD)
  - XML Schema Definition Language (XSDL) (with version 1.1)
- It is deeper and more powerful than a DTD
  - Data types
  - Namespaces
  - ...
- It gives you much more control over the contents of an XML document
Working with XML Schema

- **XML Schema specifies the structure of valid XML documents** by defining
  - Elements
  - Relationships
  - Attributes

- **XML element types**
  - **Simple type**: describes the *text*
    - string, integer, date, ...
  - **Complex type**: describes its structure
    - Contains child elements
    - Contains both child elements and text
    - Contains only text
    - Contains nothing (empty)

→ more information in Chapter 11
Beginning a Simple XML Schema

- Be saved with an .xsd
- Root element must be schema

```xml
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="wonder">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="name" type="xs:string"/>
        <xs:element name="location" type="xs:string"/>
        <xs:element name="height" type="xs:string"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

- XML declaration: XML Schema is also an XML document
- Namespace prefix
- Root element
- Complex type: defines the wonder element as containing a sequence of elements
- Built-in simple data types
This XML file does not appear to have any style information associated with it. The document tree is shown below.

- `<xs:schema elementFormDefault="qualified" xml:lang="EN" targetNamespace="http://www.w3.org/2001/XMLSchema" version="1.0">
  - `<xs:annotation>
    - `<xs:documentation>
      Part 1 version: structures.xsd (rec-20120405) Part 2 version: datatypes.xsd (rec-20120405)
    </xs:documentation>
  </xs:annotation>
  - `<xs:annotation>
    - `<xs:documentation source="structures/structures.html">
        The schema corresponding to this document is normative, with respect to the syntactic constraints it expresses in the XML Schema Definition Language. The documentation (within 'documentation' elements) below, is not normative, but rather highlights important aspects of the W3C Recommendation of which this is a part. See below (at the bottom of this document) for information about the revision and namespace-versioning policy governing this schema document.
      </xs:documentation>
    </xs:annotation>
  - `<xs:annotation>
    - `<xs:documentation>
        The simpleType element and all of its members are defined towards the end of this schema document.
      </xs:documentation>
    </xs:annotation>
    - `<xs:annotation>
      - `<xs:documentation>
          Get access to the xml: attribute groups for xml:lang as declared on 'schema' and 'documentation' below
        </xs:documentation>
      </xs:annotation>
    </xs:import>
  - `<xs:complexType name="openAttrs">
    - `<xs:annotation>
      - `<xs:documentation>
        This type is extended by almost all schema types to allow attributes from other namespaces to be added
      </xs:documentation>
    </xs:annotation>
  </xs:complexType>`
<!-- DTD for XML Schema Definition Language Part 1: Structures
Public Identifier: "-//W3C//DTD XSD 1.1//EN"

<!-- Id: structures.dtd,v 1.1 2003/08/28 13:30:52 ht Exp -->
<!-- With the exception of those with multiple namespace
prefixes for the XSD namespace, any XML document which is
not valid per this DTD given redefinitions in its internal subset of the
'p' and 's' parameter entities below appropriate to its namespace
declaration of the XSD namespace is almost certainly not
a valid schema document. -->

<!-- See below (at the bottom of this document) for information about
the revision and namespace-versioning policy governing this DTD. -->

<!-- The simpleType element and its constituent parts
are defined in XML Schema Definition Language Part 2: Datatypes -->

<!--ENTITY % xs-datatypes PUBLIC '-//W3C//DID XSD 1.1 Datatypes//EN' 'datatypes.dtd' -->

<!--ENTITY % p 'xs:' -->
<!-- can be overridden in the internal subset of a
schema document to establish a different
namespace prefix -->

<!--ENTITY % s ':xs' -->
<!-- if %p is defined (e.g. as foo:) then you must
also define %s as the suffix for the appropriate
namespace declaration (e.g. :foo) -->

<!--ENTITY % nds 'xmlns:s:' -->

<!-- Define all the element names, with optional prefix -->

<!--ENTITY % schema "%p:schema" -->
<!--ENTITY % defaultOpenContent "%p:defaultOpenContent"> -->
<!--ENTITY % complexType "%p:complexType"> -->
<!--ENTITY % complexContent "%p:complexContent"> -->
<!--ENTITY % openContent "%p:openContent"> -->
<!--ENTITY % simpleContent "%p:simpleContent"> -->
<!--ENTITY % extension "%p:extension"> -->
<!--ENTITY % element "%p:element"> -->
<!--ENTITY % alternative "%p:alternative"> -->
<!--ENTITY % unique "%p:unique"> -->
<!--ENTITY % key "%p:key"> -->
<!--ENTITY % keyref "%p:keyref"> -->
<!--ENTITY % selector "%p:selector"> -->
<!--ENTITY % field "%p:field"> -->
<!--ENTITY % group "%p:group"> -->
<!--ENTITY % all "%p:all"> -->
<!--ENTITY % choice "%p:choice"> -->
<!--ENTITY % sequence "%p:sequence"> -->
<!--ENTITY % any "%p:any"> -->
<!--ENTITY % anyAttribute "%p:anyAttribute">
Beginning a Simple XML Schema

- `xmlns:xs = “http://www.w3.org/2001/XMLSchema”`
  - Declares the XML Schema namespace (`xmlns`)
    - Namespace: a “space” in which names reside
    - `xs`:
      - W3C created a namespace
      - Contains all XML Schema elements and data types

```xml
<?xml version="1.0"?>
<xsd:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  ...
</xsd:schema>
```
Associating an XML Schema with an XML Document

- **xsi:**
  - XML Schema Instance namespace
  - Includes `xsi:noNamespaceSchemaLocation` attribute

- **xsd.uri**
  - Can refer to a `xsd` file on the Internet, local area network, or local computer

```xml
<?xml version="1.0"?>
<wonder xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="09-06.xsd">
  <name>Colossus of Rhodes</name>
  <location>Greece</location>
  <height>107</height>
</wonder>
```
Annotating Schemas

- Standard XML comments in XML Schema documents
  - `<!-- comments -->`
  - Since an XML Schema is an XML document

- More structured comments
  - `<xs:annotation>` can create annotations anywhere after the root element
  - `<xs:documentation>` for comments

```xml
<?xml version="1.0"?>
<xsd:schema xmlns= "http://www.w3.org/2001/XMLSchema">
  <xs:annotation>
    <xs:documentation>
      This XML Schema will be used to validate the set of XML documents for the Wonders of the World project.
    </xs:documentation>
  </xs:annotation>
  ...
</xsd:schema>
```