# DTD/Schema Design

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# Overview

- Introduction
  - Classes of models
  - When to model
  - Overview of analysis and design
- Basic Tools
  - Schemas
  - Models
- Steps
  - Planning
  - Analysis
  - Design and modeling
  - Implementation and Review

# Context

- Schema are replacing DTDs (We use the terms schema, but the terms are generally interchangeable)
- XML is replacing SGML and there are both minor and major differences
- Under XML, schema are used for a number of different functions and the design methodologies will be different for the different forms.
  - This document focuses on document content modeling(DCM)
- Even DCM schema can serve different purposes – e.g. reference, authoring, etc.

# When is modeling needed

- XML is increasingly used for data interchange.
  - The “document” interchanged may simply be an XML wrapped DBMS record or table.
  - Data type modeling might be required in such a case, but content modeling is likely not needed.
- Before developing a schema, make sure that one that meets needs doesn’t already exist
- Document content modeling is called for when a model for a class of documents is required.
  - A DCM schema should apply to a range of documents – e.g. all of the policy statement in an organization, all the entries in a catalog, all classes of patient medical records

# Building a Document Content Model

- Building a DCM schema is a form of analysis and design and requires five basic steps:
  - Requirements gathering
  - Analysis of data
  - Modeling of application
  - Implementation
  - Validation
- The model can be implemented in a standard waterfall or an iterative design

# DAGs

- Under XML, modeling a document is very simple at the conceptual level. Documents are directed acyclic graphs(DAGs), meaning:
  - They have a root element
  - The root element may have children elements which in turn may have children
  - Elements may be defined as:
    - Having a sequences
    - Optional or required
    - Repeatable
    - A choice among alternatives
  - Elements may be further defined by attribute value pairs associated with the element

# Syntax

- SGML, and originally XML, used a special syntax for modeling a document
- XML has now turned to a method of modeling a document that defines a document content model through an XML document.
- A DCM defined in this form is called a schema
- The basic elements defined for schema include:
  - element
  - attribute
  - complextype
  - simpleType
  - sequence
  - choice
  - group
  - all

# An Simple Example

- The following example says that the element USAddress is a sequence that includes name, street, etc.

```
<xsd:element name="USAddress">
    <xsd:sequence>
        <xsd:element name="name" type="xsd:string"/>
        <xsd:element name="street" type="xsd:string"/>
        <xsd:element name="city" type="xsd:string"/>
        <xsd:element name="state" type="xsd:string"/>
        <xsd:element name="zip" type="xsd:decimal"/>
    </xsd:sequence>
</xsd:element>
```

# An Example with an Attribute

- The following example says that the element USAddress is a sequence that includes name, street, etc. and has the attribute country

```
<xsd:element name="USAddress">
    <xsd:sequence>
        <xsd:element name="name" type="xsd:string"/>
        <xsd:element name="street" type="xsd:string"/>
        <xsd:element name="city" type="xsd:string"/>
        <xsd:element name="state" type="xsd:string"/>
        <xsd:element name="zip" type="xsd:decimal"/>
    </xsd:sequence>
    <xsd:attribute name="country" type="xsd:NMTOKEN"
      fixed="US"/>
</xsd:element>
```

# Requirements

- Identify the stakeholders in the process
  - Users of the schema
  - Individuals to be involved in decision making
- Articulate the goals of the project, for example
  - Document validation,
  - Author productivity,
  - Multiple delivery formats
- Scope of the project
  - Documents included
  - Time frame for use
  - People and systems impacted
- Budget and timeline

# Analysis

- Collect samples of the document to be modeled
- Identify candidate elements and separate elements into content, structure and presentation
  - Generalize content elements to structure
  - Translate or discard presentation elements
- Identify and define the basic elements
  - Classify the elements into logical groups
  - Identify attributes of the elements
- Validate the components and the classification

# Design the DTD

- Select the components that should be modeled
- Build top level element and attribute models
- Build middle level element and attribute models
- Build low level element and attribute models
- Populate the model where choices will be made
- Establish the linkages with the outside world

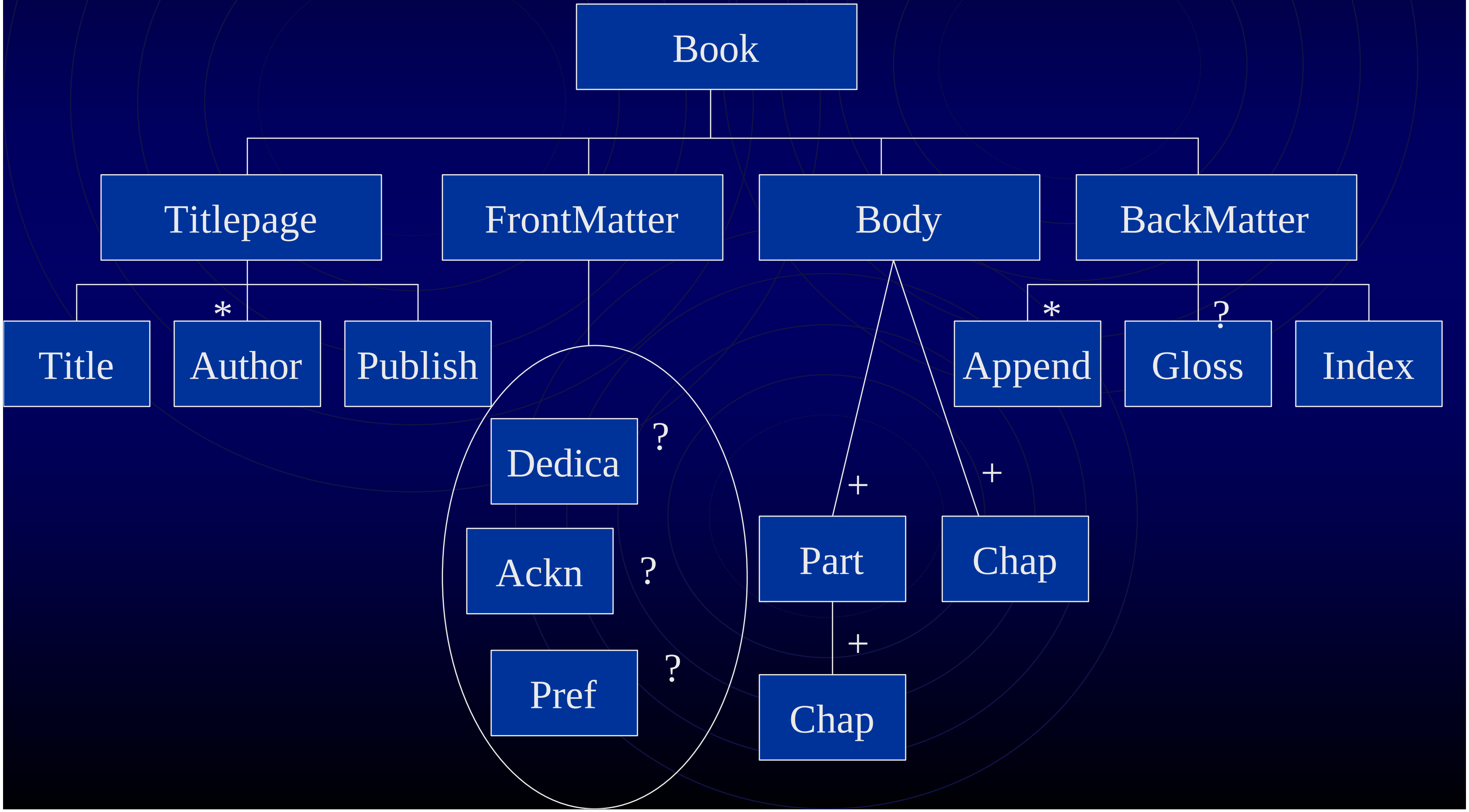
# Tree Diagrams

- Tree diagrams can be used to represent XML documents
- Nodes
  - Rectangles are used for elements
    - No symbol indicates required and non-repeatable
    - + sign on vertical link indicates required and repeatable
    - * means optional and repeatable
    - ? means optional and non-repeatable
  - Ovals indicate content e.g. PCDATA
- Edges
  - horizontal bracket means all elements at level in order
  - diagonal lines specify choice from set
  - A circle with nodes means all elements in any order

# Element/Attribute Decisions

- If data is to be accessible, it should be defined as an element
  - XSLT provides access to attribute data, but it is not necessarily the preferred way to do it.
- Attributes should be reserved for meta information – information about information.
- In general, when it is not clear whether something should be an attribute or a subelement, choose subelement
  - The rendering of a subelement can make it invisible.

# Sample Tree Diagram



# Validation

- Validate the model -- technically and semantically
- Review the relationships between the developed DTD and other existing DTDs
- Test the DTD to determine if it meets the Goals of the project
    - Does it do what we set out to do
- Implement the model providing appropriate end user training