

Object-Oriented Web-Based Courses Development through XML

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Abstract: Web-based methodology has become a new paradigm for constructing computer assisted learning system. While HTML is a data representation language; so HTML-based courseware is machine-readable but not machine-understandable. The lack of suitable abstraction makes it difficult to construct frameworks for retrieving reusable pieces from HTML documents of different Web-based courses. Therefore, the development of Web-based courses is still mostly ad hoc. There still lack of a rigorous, systematic approach, and most current Web-based courses development and management practices rely on the knowledge and experience of individual developers.

In this paper, we present an XML-cell based approach to construct Web-based courses, which is capable of improving the development and reusability of Web-based courses material by applying component oriented methodology and XML. In our approach, each curriculum element is encapsulated into an XML-cell, which is the basic component of a Web-based course, and the relative XML-cells can be aggregated into course units according to the course templates. So it will provide a systematic way for developing Web-based courses.

Two useful tools are also developed. XML-wrapper is used to encapsulate structured information into marked-up information. You can cut and paste (or drag and drop) an HTML pieces into the wrapper area, assign the cell-template and add your customized properties; after that the XML-wrapper will construct the XML-cell. Another tool is X-Cell manager that is a Design-time Control module. With X-cell manager, you can browse the XML-cell base and select the reuse cell that you need.

Keywords: Web-based course, XML, reuse

1. Introduction

The capabilities of cross platform, supporting multimedia, and information aggregation make WWW a suitable platform of asynchronous distance learning. Now Web-based methodology has become a new paradigm for constructing computer assisted learning system [1-3].

While HTML [4] documents serve very well for web browsing, automated information processing on them could be difficult because there is little semantics associated with the documents. The tags of HTML describe how the data should be formatted but tell us nothing about what kind of data included in the document. Moreover, HTML language is not extensible, which means that HTML cannot be used as a basis to create another markup language with its own rules and purposes.

In fact, the content of Web-based courses of different sites is frequently overlapping or complementary. However, the HTML documents are deficient in suitable abstractions, so it is difficult to construct frameworks for retrieving the reusable pieces from an HTML document or from different Web-based courses, hence these courses material can only reference each other via hyperlinks. Therefore, the development of Web-based courses is still mostly ad hoc.

There still lack of a rigorous, systematic approach. Current Web-based courses development and management practices mostly rely on the knowledge and experience of individual developers.

XML [5], a subset of SGML, is a meta-language that supports user-defined tags, and encourages the separation of document content from presentation. It offers three critical features:

1. Extensibility: XML allows the definition of customized markup languages with application-specific tags for representing information in such application domains.
2. Structure: A DTD (or Schema) can contain the information model of a document.
3. Validation: Each XML document can be validated whether it is conformance to the structure mandated by the DTD (or Schema).

With XML, we can now mark up our content or data "semantically" according to the meaning of the data. In this paper, we present an XML-cell based approach to construct Web-based courses, which is capable of improving the development and reusability of Web-based courses material by applying component oriented methodology and XML.

The rest of the paper is organized as follows. Section 2 gives an overview of the XML-cell. In section 3, we present the XML-cell tool called "xcell wrapper." Section 4 describes how to construct an XML-cell based courses. Finally, we conclude our work with the result of our prototype, and discuss the future work.

2. What's XML-cell?

Traditional Web-based course unit consists of one or more HTML pages; Each HTML page is stored in a file, and relative HTML pages are aggregated via hyperlinks. In such mechanism, we can only reuse the whole HTML page files or refer to the HTML pages in other Web sites via hyperlinks.

In our approach, each curriculum element is encapsulated into an XML-cell (as shown in Figure 1) that is the basic component of a Web-based course, and the relative XML-cells can be aggregated into course units according to the course templates. So it will provide a systematic and efficient way for developing Web-based courses and reuse.

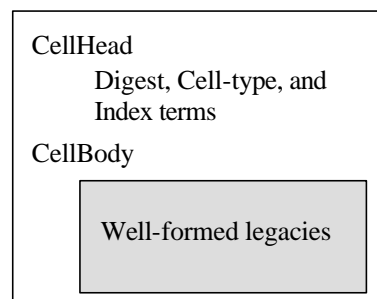


Figure 1. The architecture of an XML-cell

XML-cells are self-contained chunks of course material. Each XML-cell consists of two parts: CellHead and CellBody. The CellHead is used to record the cell type, digest, and the index terms of the XML-cell. The CellBody is the content of the curriculum element; it is the visual part of an XML-cell when learner browses the XML-cell courses. The base schema of XML-cell is as shown in Figure2.

3. XML-wrapper

Each XML-cell can be new created or transform from legacies, and be maintained independently of other XML-cells. XML-wrapper is used to encapsulate structured information into marked-up information. When we cut and paste (or drag and drop) an HTML pieces into the wrapper area, XML-wrapper will translate it into a well-formed XML first [6], then we can assign the cell-template and add our customized properties.

In our prototype, there are seven cell templates supported in XML-wrapper, and the cell templates are extensible. The function of each cell is explained as follows:

The profile cell is used to record learner's log. The FAQ cell is used to encapsulate frequently ask questions. The example cell is used to encapsulate in class examples. The annotation cell is used to encapsulate personal notes. The theorem cell is used to encapsulate theorem description. The procedure cell is used to encapsulate client side script. The xhtml cell is used to encapsulate HTML legacies.

```

<?xml version="1.0"?>
<Schema xmlns = "urn:schemas-microsoft-com:xml-data"
  xmlns:dt="urn:schemas-microsoft-com:datatypes">

<AttributeType name = "property" dt:type = "char"/>
<AttributeType name = "value" dt:type = "char"/>
<AttributeType name = "type" dt:type = "enumeration"
  dt:values = "profile faq example annotation theorem procedure xhtml"/>

<ElementType name = "item" content = "empty">
  <attribute type = "property"/>
  <attribute type = "value"/>
</ElementType>

<ElementType name = "CellHead" content = "eltOnly">
  <attribute type = "type" default = "xhtml"/>
  <element type = "item" minOccurs = "0" maxOccurs = "*" />
</ElementType>

<ElementType name = "CellBody" content = "textOnly"/>

<ElementType name = "XCell" content = "eltOnly">
  <element type = "CellHead" minOccurs = "1" maxOccurs = "1"/>
  <element type = "CellBody" minOccurs = "1" maxOccurs = "1"/>
</ElementType>
</Schema>

```

Figure 2. The base schema of a XML-cell

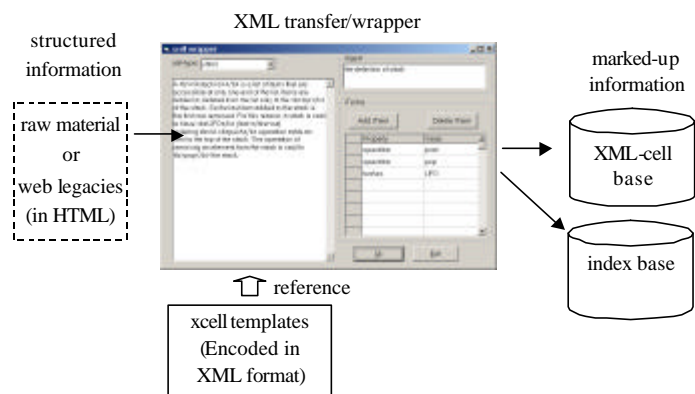


Figure 3. Encapsulate legacies into XML-cell

4. Construct XML-cell based courses

FrontPage [7] is one of the most popular Web page design tools. It provides a friendly user interface and visualized web page editing environment. Moreover, FrontPage allows us to design our own page templates and to enhance the functionality of FrontPage via Design-time Controls (DTC) module [8].

Design-time Controls are standard ActiveX controls that can generate code for us. In order to manage the XML-cells created by xcell wrapper, we design an X-Cell manager that is a Design-time Control module, so we can incorporate X-cell manager into FrontPage.

With X-cell manager, we can browse the XML-cell base and select the reuse cell that we need. After that, the X-cell

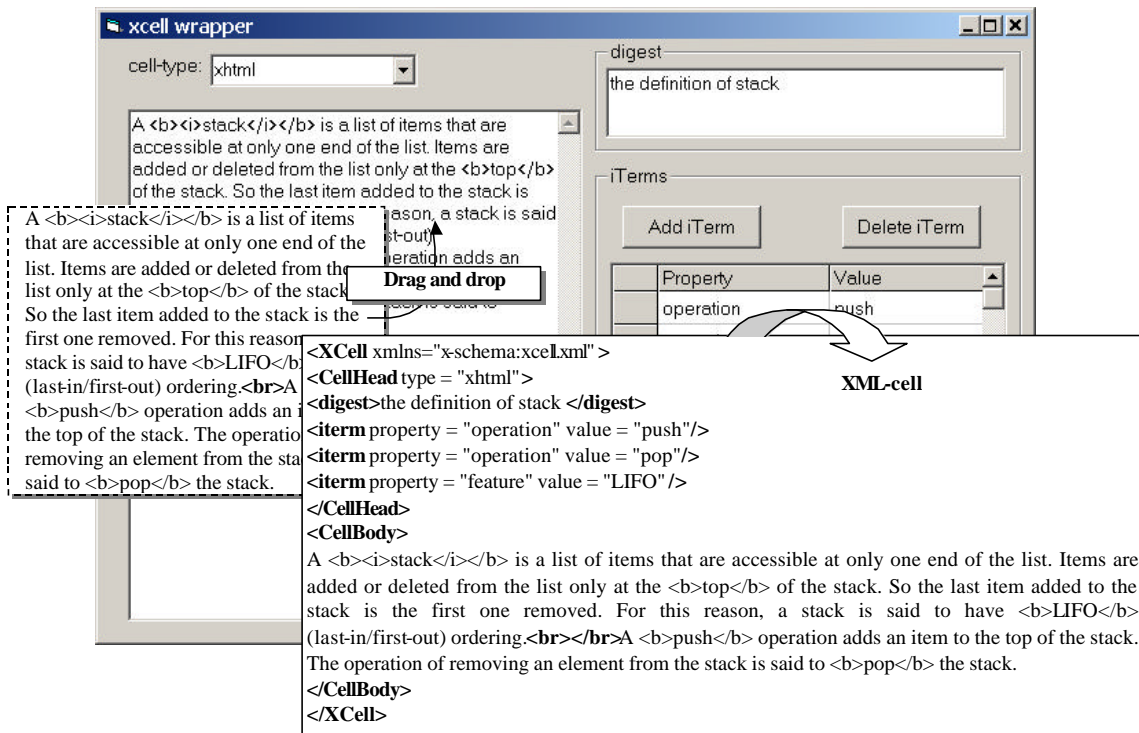


Figure 4. An example of wrapping html legacies into xhtml cell

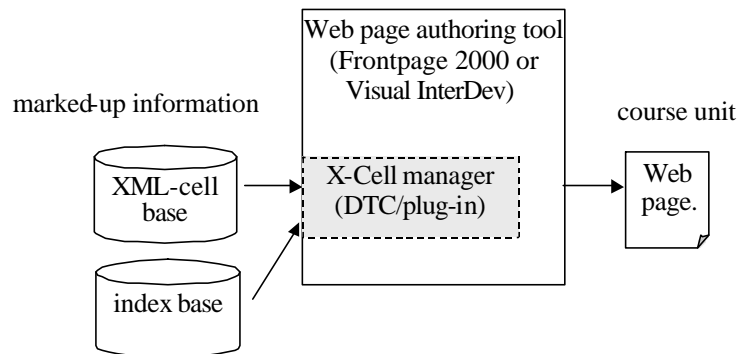


Figure 5. Using DTC to manage XML-cells

manager will extract the reuse code from the CellBody of XML-cell, and insert it into Web page.

5. Conclusion

In this paper, we present an XML-cell based approach for Web-based courses design, which is capable of improving the development and reusability of Web-based courses material by applying component oriented methodology and XML.

While this topic is still quite new and has not been developed to its full capability. Future enhancements to the system will include improving the user interface, supporting more cell templates, and allowing importing individual cells and aggregating them into a new cell.

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