Assignment #7 (1/2)

- Due: 01/03/2013
- Assuming everyone has completed assignment #6 (thus we've completed a 2-tier application)
- In this assignment, we're going to build a static website (without database connectivity) using Microsoft Expression Web.

  http://www.microsoft.com/expression/try-it/Default.aspx
  - Choose Expression Studio 4 Ultimate or Expression Studio 4 Web Professional

Assignment #7 (2/2)

- Please use Microsoft Expression Web's template to create a web site for your company.
  - Please assume you're starting up a business and try to make a good corporate image on the web. (in other words, make it pretty!)
  - Please include all web pages for your core function. For now, just leave them as blank or "under construction".
  - Note: **TRY TO BE CURIOUS**
    - Try observe HTML codes and CSS generated by Expression Web to familiarize yourself with HTML. If you are already familiar with HTML, try to predict what kind of tags Expression Web will generate for you.
    - Try to be curious about the functions & formats provided by Expression Web.

Assignment #8 (1/2)

- Based on the static website that you've built in assignment #7, dynamic content based on information from database is to be added in this assignment.
  - Database is the same as in assignment #6.
  - Basic functions required are listed in the next page (copied from assignment #6) are to be implemented using Microsoft Expression Web.
  - As in assignment #6, two or more extra functions not on the next page's list should be implemented.
- Due: 01/17/2013

Assignment #8 (2/2)

  - Add/change/remove a book information in the database.
  - Add/change/remove a user in the trading system.
  - Add/change/remove a sale/buy advertisement in the system.
  - Add/change/remove a trading (history) in the system.
  - Search for a used textbooks in the trading system.
    - By at least four different methods (e.g. by user, by price, by program, …)
- Final presentation on 1/17/2013
  - Each company should prepare a 15 – 20 minutes presentation. The content includes at least the following:
    - Business model (20%)
    - 2-tier application functionality (40%)
    - 3-tier web site functionality (40%)

Lecture 14

Web Services

Today's Topic

- Introduction to Web Services
- Web Service Requirements
- SOAP web service
  - XML
  - WSDL
  - SOAP
- REST-style web service

Current Status

- Software concept → requirement analysis → architecture design → detailed design → implementation
- We've programmed a desktop application and are going to develop a web application for maintain user data, used computer part information, and trading used parts.
- What is left to do?
  - Verification & Validation
  - Electronic payment → data exchange with credit card agency or banks
  - Vertical integration: integrate your supplier, shipping company, … → data exchange with your partners
- Issues
  - Data format (middleware), security, …

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Introduction

- Web services are services for applications.
  - Web pages and web applications are services for people
  - Can be seen as objects or function calls offered through the Internet using protocols developed for the Web.
  - Web services can be located anywhere on the planet Earth.
- We can use web services to integrate different information systems and applications through the Internet.

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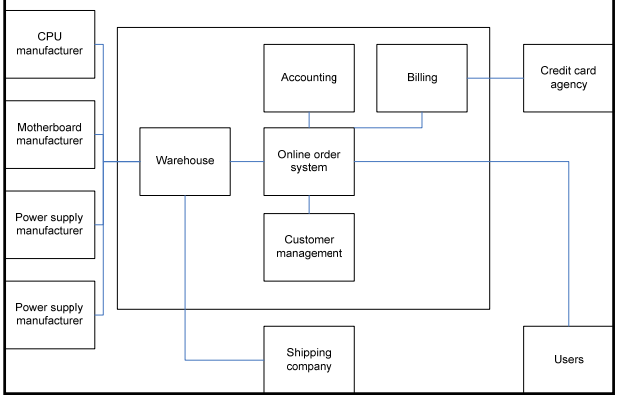

Web Service Requirements

- Standard RPC mechanism
  - HTTP is the most popular protocol and has been widely adopted on most platforms.
- Standard data format
  - Binary data is hardware dependent and difficult to debug (human unreadable) → use human-readable data format.
  - The data format needs to be extensible for all kinds of purposes (image, video, text, data record, map, …)
- Standard service description language
  - Describe information that the web service is needed and returns
- Standard service discovery mechanism
  - Helps programmers find needed service for his/her applications

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Two commonly used standards(?)

- SOAP Web Service
  - XML as data format
  - SOAP as RPC mechanism
  - UDDI for service discovery
  - WSDL for service description
- REST-Style Web Service
  - A style, not a standard for RPC mechism
  - Data format are often JSON or XML.
  - No formal description or discovery mechanism

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Data Format

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XML
eXtensible Markup Language

- A markup language (recall HTML) that has tags enclosing data.
  - Tags: meaningful named tags to describe data enclosed.
  - Everything is in human-readable format.

```
<BOOK>
<AUTHOR> Aho, A. V. </AUTHOR>
<AUTHOR> Sethi, R. </AUTHOR>
<AUTHOR> Ullman, J. D. </AUTHOR>
<TITLE> Compilers: Principles, Techniques, and
Tools </TITLE>
<PUBLISHER> Addison-Wesley </PUBLISHER>
<YEAR> 1985 </YEAR>
</BOOK>
```

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Introduction

- Today, we have a lot of information on web pages (HTML). However, the data is difficult to be reused.
  - Mixed data and presentation

Introduction

- XML stands for eXtensible Markup Language
  - Designed to describe data, not their look.
  - XML tags are not pre-defined (thus extensible).
  - It is going to be everywhere for storing, carrying, and exchanging data.
    - Office 2007/2010/2013 now by default saves files as XML format (zip compressed), such as .docx, .xlsx, .pptx, …
  - XML documents has two parts: prolog (HTML head) contains XML declaration and document validation; and body (HTML body) that has tags define data.

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```
<note>
   <to> Tove </to>
   <from> Jani </from>
   <heading> Reminder </heading>
   <body> Don't forget me this weekend! </body>
</note>
```

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XML Example

```
1 <?xml version="1.0" encoding="ISO-8859-1"?>
2 <note date="12/11/2002">
3    <to> Tove </to>
4    <from> Jani </from>
5    <heading> Reminder </heading>
6    <body> Don't forget me this weekend! </body>
7 </note>
  <!-- This is a remark -->
```

PROLOG

BODY

1. XML Declaration (Prolog),including XML version and encoding
2. Root element: note, date is its attribute, "12/11/2002" is an attribute value for the attribute date.
3 – 6: 4 child elements of the root
7: closing tag

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XML vs. HTML

- XML contains only data, HTML mixes data with presentation (<H1>, <I> …)
- XML has no predefined tags, HTML tags are pre-defined so web browsers know how to render a HTML document.
- Both XML & HTML are human-readable, machine-independent text files.
- XML has more strict syntax than HTML
  - all elements must have a closing tag
  - Elements must be properly nested
  - Attribute values must be quoted
- Tags in XML are case-sensitive; HTML is case insensitive.
- XHTML → eXtensible HyperText Markup Language, should (not happening) replace HTML. Nearly identical to HTML 4.01. HTML 5.0 finalizing …
  - XHTML elements must be properly nested
  - XHTML documents must be well-formed
  - Tag names must be in lowercase
  - All XHTML elements must be closed

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Relationships

```
<book>
   <title> My First XML </title>
   <prod id="33-657" media="paper"> </prod>

   <chapter> Introduction to XML
      <para> What is HTML </para>
      <para> What is XML </para>
   </chapter>

   <chapter> XML Syntax
      <para> Elements must have a closing tag </para>
      <para> Elements must be properly nested </para>
   </chapter>

</book>
```

Root element: book
Child elements of book: title, prod, chapter
Title, prod, chapter are siblings (or sister elements)

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Element Contents

- Elements can have different content types.
  - An XML element is everything from (including) the element's start tag to (including) the element's end tag.
  - An element can have element content, mixed content, simple content, or empty content. An element can also have attributes.
  - In the previous example
    - Book has element content, because it contains other elements.
    - Chapter has mixed content (text + other elements).
    - Para has simple (text) content because it contains only text.
    - Prod has empty content, because it carries no information.
    - Prod element has attributes. The attribute named id has the value "33-657". The attribute named media has the value "paper".

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Element Naming & Attribute

- Element Naming
  - Names can contain letters, numbers, and other characters
  - Names must not start with a number or punctuation character
  - Names must not start with the letters xml (or XML or Xml ..)
  - Names cannot contain spaces
- Attribute
  - <img src="computer.gif">
  - Provide information that is not a part of the data. In the example below, the file type is irrelevant to the data
    - <file type="gif">computer.gif</file>
  - Values of attributes must be enclosed by quotes (single or double)
    - If values contain double quote, then single quotes must be used.
    - If values contain single quote, then double quotes must be used.

<gangster name='George "Shotgun" Ziegler'>

<gangster name="George 'Shotgun' Ziegler">

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Well Formed and Valid XML

- Well formed XML
  - File content follows XML syntax
- Valid XML
  - Well-formed + conforming to rules in DTD or XSD
  - DTD: Document Type Definition (superseded by XSD)
  - XSD: XML Schema Definition

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE note SYSTEM "note.xsd">
<note>
<to> Tove </to>
<from> Jani </from>
<heading> Reminder </heading>
<body> Don't forget me this weekend! </body>
</note>
```

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XSD
XML Schema Definition

- XSD defines
  - elements and attributes that can appear in a document
  - which elements are child elements
  - the order and number of child elements
  - whether an element is empty or can include text
  - data types for elements and attributes
  - default and fixed values for elements and attributes
- XSD originally proposed by Microsoft, and became an official W3C recommendation in May 2001.
- XSD uses XML syntax
- Example: http://www.w3schools.com/schema/schema_intro.asp

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XML Parser & Error Handling

- XML files are read by applications to get data inside.
  - Class libraries or functions designed to read XML data are called “XML parsers”. (need to parse data file to get data)
  - Both Java & .NET have standard XML parsers.
  - Many free or commercial XML parsers exist.
- Error handling
  - W3C XML specification states that a program should not continue to process an XML document if it finds a validation error.

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XML Transformation

- Most modern browsers can view XML data.
  - Native XML → Mozilla and IE uses tree-view
  - XML can be translated/transformed into HTML through XSLT
- XSLT
  - XSLT is a language for transforming XML documents into XHTML documents or to other XML documents.
  - XSLT = XSL Transformation
  - XSL = Extensible Stylesheet Language
- Demo: XML → XHTML

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XML Parsing

- Reading data from XML in programming is usually done using parsers.
  - Parser: APIs or classes to help programmers extract data from XML documents.
- Two approaches for parsing XML documents:
  - SAX: Simple API for XML
    - Sequentially read given XML document, no turning back.
    - The parser generates a series of events (in sequence), and it is programmer's responsibility to handle these events.
    - Element starts, element ends, text node
  - DOM: Document Object Model
    - View a document as an object, and each tags in its content is an attribute of the document.

http://everything.explained.at/Simple_API_for_XML/
http://en.wikipedia.org/wiki/Document_Object_Model

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Reference

- XML:
  http://www.w3schools.com/xml/xml_whatis.asp
- XHTML:
  http://www.w3schools.com/xhtml/
- XSD:
  http://www.w3schools.com/schema/schema_intro.asp
- XSLT:
  http://www.w3schools.com/xsl/

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JSON

- JavaScript Object Notation. Although it originates from JavaScript standard, it is a compute-laugnage neutral standard.
- A light-weight text-based data-interchange format.
  - Easy for humen to read and write.
  - Easy for machines to parse and generate.
- Corresponds to two data types in computer languages:
  - unordered list (name/value pairs) → object, struct, associative array, etc.
  - ordered list → array.
- It is very popular for data interchange between JavaScript on webpages and web services. JavaScript has a eval() function to directly translate JSON data into a native object, and therefore programmers do not need to worry how to parse JSON data format.
- For other languages, there are many JSON parsers that can be used.

http://json.org/

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JSON

```
{
  "employees": [
    { "firstName":"John"  , "lastName":"Doe" },
    { "firstName":"Anna"  , "lastName":"Smith"},
    { "firstName":"Peter" , "lastName":"Jones"}
  ]
}
```

- In the example above, it describes an object (because of {…}). This object has one name/value pair. The name is "employees".
- The value paired with "employees" is an array (because of […]) containing three objects.
- Each of the contained object has two name/value pairs.
- Values can be nested structures (objects as an array element, array as the value for objects, etc.)

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JSON

- Name is a string. JSON string mostly follow C/C++ string definitions, including some escape characters.
- Value can be string ("…"), object ({…}), array ([…]), number, true, false, null.

```
 1 {   "intArray": [1,2,3,4,5,6,7,8,9,10],
 2     "father": {
 3         "name": "George the Monkey", "age": 48,
 4         "married": false, "hasChildren": true,
 5         "speedTicket": null,
 6         "children": {
 7             "son1": { "name": "Lala", "age": 18 },
 8             "son2": { "name": "Kiki", "age": 15 },
 9             "daughter": { "name": "Koko", "age": 5 }
10         }
11     }
12 }
```

JSON

- JSON is different from XML in the following aspects:
  - There is no concept as “tag”.
  - It is easier & faster to parse JSON than to parse XML.
  - JSON needs less data size to describe the same data.
- References
  - www.json.org
  - http://www.w3schools.com/json/json_intro.asp

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WSDL
Web Service Description Language

- XML formatted.
- Describes SOAP web services.
- Content:
  - Description and format of messages that can be passed in <types> and <message> tags
  - Direction of message passingin<portType>:
    - Request-only, request-response, response-only
  - Message encoding in <binding> element (literal, etc.)
  - Location where service is offered in <service> element

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Function Prototype

- Prototype in C/C++/Java:
  - Defines arguments/parameters and the returning information of functions
  - e.g.
    ```
    int func1(int a, int b, int c);
    ```
- Prototype in Web service
  - Web services provide functions through the Web
  - Prototype is required for each function provided through web services → WSDL!
  - In addition, the prototype also needs to identify where/how to invoke the function (e.g. URLs)

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WSDL
Web Service Description Language

- WSDL is a document written in XML to describe a Web service. It:
  - Specifies the location of the service
  - Specifies the operations (or methods) the service exposes
  - Describes a set of SOAP messages and how the messages are exchanged
- Six main elements are there in a WSDL document:
  - <definition>: Root WSDL element
  - <types>: The data types used by the web service.
  - <message>: The messages used by the web service. → The input and output of a web service.
  - <portType>: The operations performed by the web service. Similar to defining classes and functions or methods in traditional programming.
  - <binding>: The communication protocols used by the web service
  - <service>: where the service is located

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WSDL Example

```
<message name="getTermRequest">
   <part name="term" type="xs:string"/>
</message>

<message name="getTermResponse">
   <part name="value" type="xs:string"/>
</message>

<portType name="glossaryTerms">
  <operation name="getTerm">
      <input message="getTermRequest"/>
      <output message="getTermResponse"/>
  </operation>
</portType>
```

Similar to class

A method of class glossaryTerms

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Online WSDLs & References

- Amazon
  - http://soap.amazon.com/schemas2/AmazonWebServices.wsdl
  - Details at: http://aws.amazon.com/
- eBay
  - http://developer.ebay.com/webservices/latest/eBaySvc.wsdl
- Microsoft TerraService
  - http://terraservice.net/TerraService2.asmx?WSDL
- References:
  - http://www.w3schools.com/wsdl/default.asp
  - http://www.w3.org/TR/wsdl
  - http://www.developer.com/services/article.php/1602051

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SOAP

SOAP
Simple Object Access Protocol

- A simple XML based protocol to let applications exchange information over HTTP → web services, communication between applications, platform independent.
- XML over HTTP
  - HTTP – for data transport, some headers are added to HTTP protocol
  - XML as data transmission format
- Key element of SOAP:
  - New MIME type: text/xml
  - Agreed definitions of data types, mandatory values, etc.
- Use URL to describe endpoints (how to access services)

SOAP Building Blocks

- A SOAP message is an ordinary XML document containing the following elements:
  - A required Envelope element that identifies the XML document as a SOAP message
  - An optional Header element that contains header information
  - A required Body element that contains call and response information
  - An optional Fault element that provides information about errors that occurred while processing the message
- The message is delivered to web server (service provider) through HTTP POST method
- The response from web services is gotten from server using HTTP GET method.

SOAP Example
(Sending)

```
POST /InStock HTTP/1.1
Host: www.stock.org
Content-Type: application/soap+xml; charset=utf-8
Content-Length: nnn

<?xml version="1.0"?>
<soap:Envelope
xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">

  <soap:Body xmlns:m="http://www.stock.org/stock">
    <m:GetStockPrice>
      <m:StockName> IBM </m:StockName>
    </m:GetStockPrice>
  </soap:Body>

</soap:Envelope>
```


SOAP Example
(Response)

```
HTTP/1.1 200 OK
Content-Type: application/soap; charset=utf-8
Content-Length: nnn

<?xml version="1.0"?>
<soap:Envelope
xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">

  <soap:Body xmlns:m="http://www.stock.org/stock">
    <m:GetStockPriceResponse>
      <m:Price> 34.5 </m:Price>
    </m:GetStockPriceResponse>
  </soap:Body>

</soap:Envelope>
```


Reference

- http://www.w3.org/TR/soap12-part0/
- http://www.w3schools.com/soap/default.asp
- http://terraservice.net/
  - http://terraservice.net/TerraService2.asmx
  - http://terraservice.net/TerraService2.asmx?WSDL
- http://livedocs.adobe.com/jrun/4/Programmers_Guide/wsmonitor3.htm
- http://www.intertwingly.net/stories/2002/03/16/aGentleIntroductionToSoap.html
- http://www.soapware.org/bdg

UDDI

Universal Description, Discovery, and Integration

- Defines a standard of being yellow pages (directory service) for web service providers.
- UBR: UDDI Business Registry
  - Global public directory of businesses and services

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Some Online Web Services

- http://www.google.com/apis/
- http://aws.amazon.com/
- http://msdn.microsoft.com/en-us/library/dd877180.aspx
- http://arcweb.esri.com/arcwebonline/index.htm
- http://developer.ebay.com/

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A super simple web service

Request: http://140.118.105.174/ws/adder.php?a=3&b=4

Adder.php:

```
<?php
    if(isset($_GET['a'])) {
        $a = $_GET['a'];
        if(isset($_GET['b'])) {
            $b = $_GET['b'];
            echo $a + $b;
            return;
        }
    }
    echo "ERROR!";
?>
```

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REST-style web service

- REST: Representational State Transfer
- RESTful web service
- It's a style, a way of architecuring software. There is no standard for rest-style web service.
- It can be implemented using any technology
- REST-style was inspired by world-wide-web, which is a highly-scalable system.

Actions and Resources

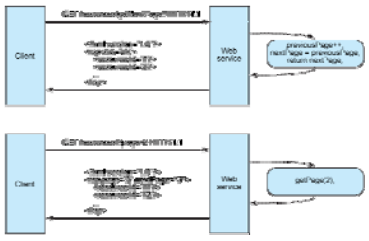
- In HTTP, there are four types of requests that mapps well to CRUD in database.

Actions	HTTP	SQL
Create	PUT	INSERT
Read	GET	SELECT
Update	POST	UPDATE
Delete	DELETE	DELETE

- Use URI to specify resource; use HTTP request to specify actions to be performed.
  - HTTP/GET on http://localhost/users - list users in the system
  - HTTP/DELETE on http://localhost/users/3 - delete user id=3
  - …

Stateless (無狀態)

- Since HTTP is a stateless protocol, REST-style WS is also stateless.
- In other words, all the arguments needed must be from the caller. Calls should not rely on the state of previous function invocation.



http://www.ibm.com/developerworks/webservices/library/ws-restful/

This book provides the foundation for understanding the theory and pracitce of compilers. Revised and updated, it reflects the current state of compilation. Every chapter has been completely revised to reflect developments in software engineering, programming languages, and computer architecture that have occurred since 1986, when the last edition published. Have a question about Compilers: Principles, Techniques, and Tools (2nd Edition)? Leave a comment for Laura, Andris and 1 other contributor. Something went wrong. Please try again. Submit. See Product Page for "Compilers: Principles, Techniques, and Tools (2nd Edition)". Help millions of people make better decisions. Each month, over 2.8 million people use Slant to find the best products and share their knowledge.