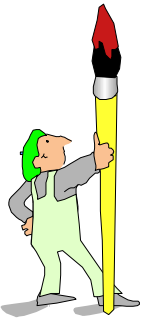


# XML Introduction CUA 2000



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## Agenda

- ▶ What is XML
  - Origins, comparison to HTML
  - Areas where XML is a good technology choice
  - Terminology and XML related standards
- ▶ XML on the AS/400
- ▶ XML & AS/400 Future



## XML is...

- ▶ **e**xtensible **M**arkup **L**anguage
  - A framework for defining markup languages
  - Markup languages use tags to describe document structure and content
  - HTML is an example of a markup language
- ▶ Heritage
  - HTML and XML are both derived from SGML (Standard Generalized Markup Language)
    - SGML is more complex and has been used heavily in the document publishing industry
    - HTML grew out of the need to deliver information on the Web
    - XML is positioned to address some of the limitations and shortcomings found in HTML



## XML is...

- ▶ A standard way of representing information
- ▶ XML standards defined by the W3C
  - organization to establish specifications for Web technologies ensuring the highest degree of utility and interoperability
  - 14 companies (Adobe, HP, IBM, MS, Netscape, Sun, ...)
  - create and review specifications for XML and related components
- ▶ Extensive support for XML across a wide range of IT vendors
  - IBM, Microsoft, Sun, HP, Adobe, Oracle, ...



## XML vs. HTML Example

```
<?xml version="1.0"?>
<books>
  <book>
    <title>XML for You and Me</title>
    <author>G. R. Righter</author>
    <isbn>0-13-68991-1</isbn>
    <reader level> beginner</reader level>
  </book>
  <book>
    <title>Core XML</title>
    <author>Betty Base</author>
    <isbn>0-44-37123-0</isbn>
    <reader level> knowledgeable</reader level>
  </book>
</books>
```

```
<html>
<table>
  <tr>
    <td>XML for You and Me</td>
    <td>G. R. Righter</td>
    <td>0-13-68991-1</td>
    <td>beginner</td>
  </tr>
  <tr>
    <td>Core XML</td>
    <td>Betty Base</td>
    <td>0-44-37123-0</td>
    <td>knowledgeable</td>
  </tr>
</table>
</html>
```



## XML vs. HTML

- ▶ Uses <tag> & </tag> style
  - ▶ Tagged markup for information
    - Focused on data structure
    - Data retains meaning
  - ▶ Extensible - new tags creatable
  - ▶ Descriptive markup
    - specific search criteria
  - ▶ Stringent syntax
    - end tags required
    - element nesting enforced
  - ▶ Associated components
  - ▶ Automatically generated & used
  - ▶ Requires newer browser
- ▶ Uses <tag> & </tag> style
  - ▶ Tagged markup for text
    - Focused on presentation
    - Data is text (limited reuse)
  - ▶ Fixed set of tags
  - ▶ Document tagging
    - too many hits
  - ▶ Loose syntax
    - end tags assumed
    - nesting errors effect display
  - ▶ Simple and complete
  - ▶ Manual handling & web use
  - ▶ Works with any browser



## What XML Is Good For

- ▶ As a replacement for HTML...
  - Improved context based searching
  - Can define multiple views of web data
- ▶ As an emerging format for data interchange...
  - EDI (Electronic Data Interchange) via Internet (cheap & not cryptic)
  - Various new business to business data exchange formats



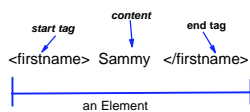
## What XML Is Good For

- ▶ As a facilitator for information reuse...
  - Different devices
  - Disparate applications can communicate easier
  - Different organizations can use same information different ways
  - Saves manual effort of re-keying data
- ▶ As a means to describe application metadata...
  - Express UML design models - make reusable in various tools
  - Abstract representation of UI (properties)



## XML Terms

- ▶ Element
  - An instance of a tag and its corresponding data
  - An XML document is composed of one or more elements



- ▶ Attribute
  - Additional information about an element
  - `<firstname gender="male"> Sammy </firstname>`



## XML Terms...

- ▶ Well formed document
  - An XML document that conforms to the structural rules for XML
    - First line must be the XML document declaration
    - The document must contain at least one element (or tag)
    - Every starting tag must have a closing tag
      - `<tag/>` is also permitted for tags that do not contain data
    - Tags cannot overlap.
      - `<A><B></A></B>` is not valid
- ▶ Valid document
  - A well-formed document which also conforms to the grammar defined by a DTD (Document Type Definition)

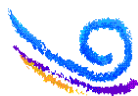


## XML Terms...

- ▶ DTD (Document Type Definition)
  - Defines the valid elements (tags) and attributes that may appear in a particular type of XML document
  - Also defines element nesting rules for the document

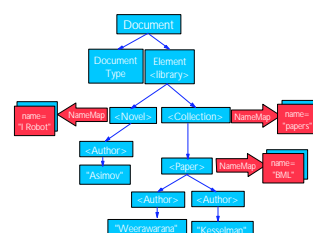
```

<!DOCTYPE books [ (identifies this as a unique document type)
<!ELEMENT books (book+) (books contain book objects, in this case 1 or more)
<!ELEMENT book ( title, author+, reader level?)
(book contains these elements -
title ("no indicator" means appears once)
author - must be present (+ = one or more)
reader level optional (? = once or not at all)
<!ATTLIST book category (fiction|nonfiction) #REQUIRED>
(category is a required attribute of book and can be either "fiction" or "nonfiction")
<!ELEMENT title (#PCDATA) (#PCDATA - a reserved name - denotes character content)
<!ELEMENT author (#PCDATA)>
<!ELEMENT reader level (#PCDATA)>
]> (ends the books structure)
    
```



## XML Terms...

- ▶ DOM (Document Object Model)
  - APIs provided to navigate and manipulate an XML document
    - Supports a node hierarchy abstraction for XML data
  - Implemented by XML parsers
  - Supports retrieval, update and creation of XML document elements and attributes



## XML Terms...

- ▶ XSL - eXtended Stylesheet Language
  - Has two roles
    - XSLT: Transform from one XML document type to another
    - XSL FO (formatting objects): how to render an XML document visually
  - A superset of CSS (Cascading Style Sheets)
  - Value
    - Define multiple views for the same XML document
    - Conversion between documents conforming to different DTDs
    - Map from XML to HTML for browsers which do not support XML



## XML Support in WebSphere 2.02

- ▶ Delivered via XML Document Structure Services component of WebSphere:
  - XML4J: IBM Java-based XML parser
    - Added to application server CLASSPATH during install
  - DTD library
    - Collection of pervasive XML DTDs used in a number of industries
    - Installed into a known directory for use by WebSphere applications
  - Samples and documentation on how to write servlets which generate and consume XML data



## XML on AS/400



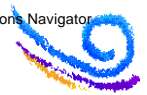
## XML and AS/400

### Current AS/400 Support for XML WebSphere® for AS/400 (V4R3)

- Includes XML4J (Java™) parser for XML and DTD library

### AS/400 Toolbox for Java (V4R4)

- Panel Definition Markup Language (PDML)
  - XML used for defining GUI layout and components
  - Visual GUI builder and a tool to convert from Microsoft® GUIs to XML
  - Runtime to generate Java/Swing GUI from PDML
- Program Call Markup Language (PCML)
  - AS/400 program interface defined in XML
  - Runtime framework supporting program calls from Java
- XML4J parser shipped/used by both PDML and PCML
- ★ PDML and PCML used to build Java components of Operations Navigator



## New in V4R4 - Graphical Toolbox

### The Graphical Toolbox

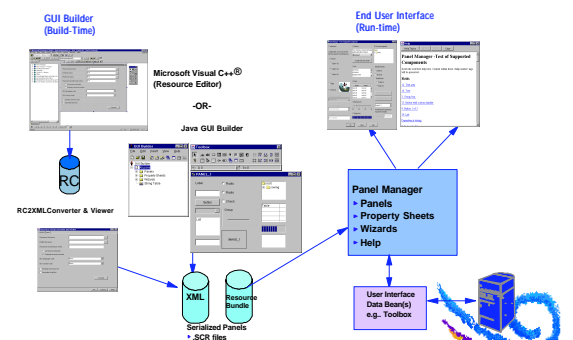
- is a set of tools and runtime frameworks
- can easily build GUIs using XML that are rendered using Java.

### The Graphical Toolbox consists of:

- PCML - for building Toolbox Program Calls
- PDML - for building Graphical Interfaces and a pure Java technology for rendering these GUI definitions using JFC (Swing).
  - Based on Java Beans
  - WYSIWYG Java GUI panel builder
  - RC to XML converter



## XML and AS/400 - PDML



## Displaying your Panels at runtime

### Graphical Toolbox runtime environment

Handles all data exchange between UI controls & Javabeans identified in the PDML

Validates user data

- common integer and character data types
- allows custom validation

Defines standardized processing of Commit, Cancel & Help events

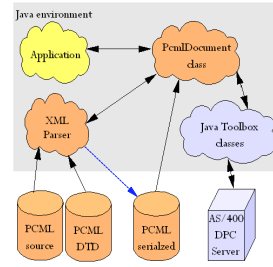
Manages interactions between UI controls based on state information defined in PDML

`com.ibm.as400.data.ProgramCallDocument`

- A Java class representing the interfaces described in a PCML source file
- Performs data conversion and program calls to the AS/400



## PCML - Details



PCML Document used to:

- Define name/location of program
- Define parameters and their types including structure types

Runtime framework provided to:

- Perform program call between Java and defined program
- Handle data type conversions
- Support both local and remote calls

Java application scenario:

- Create ProgramCallDocument class specifying PCML document and target AS/400
- Call `setValue` to set input parm values
- Issue program call
- Call `getValue` to retrieve output parm values

## PCML - Simpler AS/400 program calls

Simplifies Java programs by handling complex relationships in AS/400 data

- Varying length character strings
  - Varying length structures
  - Varying sized arrays of fields and structures
  - Nested arrays
  - Varying locations of data -- offsets and displacements
  - Strings with run-time CCSID tagging
- Default values for input fields



## Record-level database access

Converts between Java data and AS/400 data

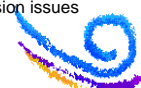
Java data type

Object[]  
Short  
Integer  
byte[]  
Float  
Double  
BigDecimal  
BigDecimal  
AS400DataType[]  
String  
Integer  
Long

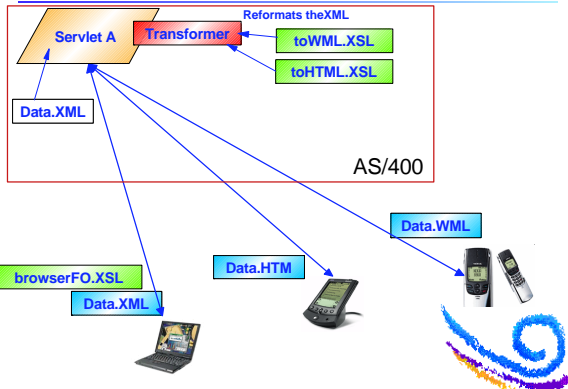
AS/400 data type

Array  
2 byte binary  
4 byte binary  
Byte array  
4 byte floating point  
8 byte floating point  
Packed decimal  
Zoned decimal  
Structure  
Text  
2 byte unsigned binary  
4 byte unsigned binary

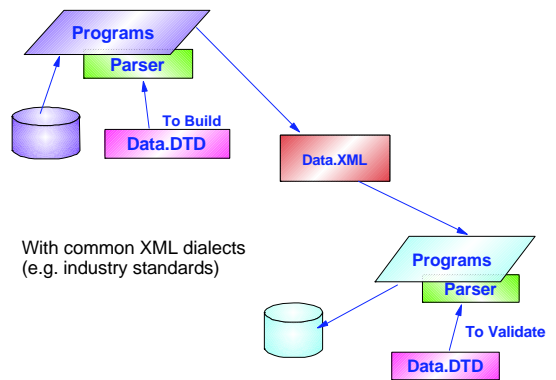
Handles all code page, byte order, and data conversion issues



## Simple Example: Various Devices

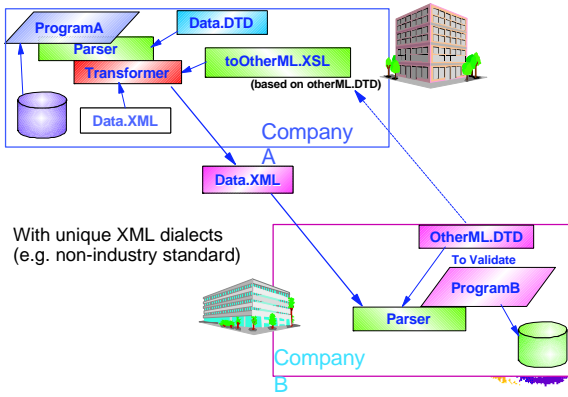


## Simple Example: Between Applications

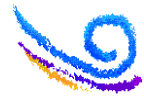


With common XML dialects (e.g. industry standards)

## Simple Example: B2B



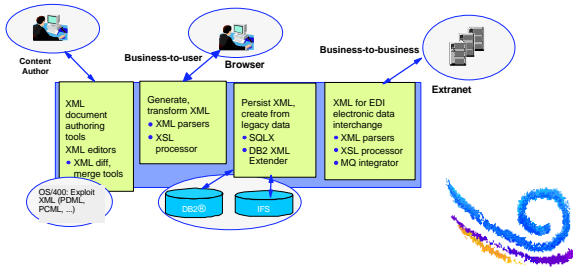
## Future of XML on AS/400



## XML for AS/400 Objectives

Establish AS/400 as a fully enabled platform for exploitation of XML technologies:

- Business-to-business transactions using XML for data interchange
- Business-to-user provide business data in XML for viewing
- Keep the AS/400 easy to use for AS/400 App Dev and system administration tasks
  - ◆ Example: provide a logical view of relational schema (ala DDS)



## XML and AS/400 Future Focus Items

Deliver a convenient, current and complete package of XML enablers for AS/400

- Similar in concept to AS/400 Toolbox for Java
- Contains a number of enabling tools for XML including:
  - ◆ XML parser
  - ◆ XSL processor
  - ◆ SQLX - generate XML from DB2 data
  - ◆ Basic XML content authoring tools
  - ◆ Sample and examples
- ★ Value: Simplify XML-based application development by providing supported package of latest XML enablers



## XML and AS/400 Future Focus Items

Integrate select XML enablers into OS/400®

- For use by other o/s components and AS/400 applications
  - ◆ Candidates: XML parser, XSL processor
- ★ Value: Support use of XML outside of Java

Provide extensions to DB2 for storage/retrieval of XML documents

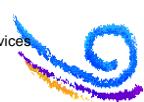
- Construct XML documents from 1 or more tables/columns
- ★ Value: Provide a robust repository to store and retrieve XML documents

Extend MQSeries® to support XML-based messaging

- ★ Value: Leverage MQSeries to integrate applications based on XML for data interchange format

Transcoder - Generate XML from 5250 data stream

- ★ Value: Leverage existing applications to attach other devices
  - ◆ part of Host on Demand



## XML and AS/400 Future Focus Items

Exploit XML within Domino™

- Render views and documents as XML data streams
- Support LSX or DECS interfaces to XML data
- ★ Value: Extend Domino's ability to participate in business-to-user and business-to-business scenarios



## XML and AS/400 Future Focus Items

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Continue to examine and leverage opportunities for exploiting XML within OS/400 and related products

- Potential areas include:
  - A print framework for Java using XML to define print layout
  - Enhanced AS/400 install support using XML as data format for installed application information
  - More extensive use of XML to support interoperation between Java and legacy applications (enhanced PCML)



## XML and AS/400 Summary

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XML - a core technology for data oriented and web-based applications.

XML Strategic instrument for defining corporate data across application domains

- platform, vendor and language neutral
- open and create own meaningful tag set

Core support to start using XML is available on AS/400 in V4R4

- WebSphere and the AS/400 Toolbox for Java.



## Additional Information

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► WebSphere - XML:

- How to write servlets which use XML
- <http://www.software.ibm.com/webservers/appserv/doc/v20d-std/doc/>

► IBM XML:

- XML education and products from IBM
- xCentral: Web search engine for XML resources
- <http://www.ibm.com/xml>

► IBM alphaWorks:

- Latest tools and enablers supporting XML
- <http://www.alphaVorks.ibm.com/>

► W3C - XML standards and specifications:

- Status and detail on various XML-related standards
- <http://www.w3c.org/XML/>

