

Session:



XML Support on iSeries

IBM  server iSeries

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Agenda

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What is XML?

- Origins, comparison to HTML
- Terminology and XML related standards

Areas where XML is a good technology choice

iSeries XML Environments

XML Toolkit for iSeries

DB2 XML Extender

XML Use/Support on iSeries

Development Tools - WebSphere

Agenda: Example of use of XML Toolkit for iSeries

What is XML?

What is XML?

XML is...

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eXtensible Markup Language

- A framework for defining markup languages
- Markup languages use tags to describe document structure and content
 <p>...data...</p>
- HTML is an example of a markup language
- XML is portable, ideal for use in transporting data in a standard, easy to interpret format

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. Describes how data should look.
 - XML is positioned to address some of the limitations and shortcomings found in HTML. Describes what data is.

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What is XML?

XML is...

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A standard way of representing information

- XML standards defined by the W3C (*World Wide Web Consortium*)
 - organization to establish specifications for Web technologies ensuring the highest degree of utility and interoperability
 - create and review specifications for XML and related components
 - latest XML standards list at:
 - <http://www.w3.org/>
- XML receiving extensive support from a wide range of IT vendors
 - IBM[®], Microsoft[®], Sun[®], HP[®], Adobe[®], Oracle[®], ...

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What is XML?

XML vs. HTML

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XML

- **Tagged markup for information**
 - Focused on data structure
 - Data retains meaning
- **Extensible - can define new tags**
- **Uses <tag> & </tag> style**
- **Stringent syntax**
 - end tags required
 - element nesting enforced
- **Associated components**
- **Automatically generated & used**
- **Requires newer browser**

HTML

- **Tagged markup for text**
 - Focused on presentation
 - Data is text (limited reuse)
- **(Relatively) Fixed set of tags**
- **Uses <tag> & </tag> style**
- **Loose syntax**
 - end tags assumed
 - nesting errors effect display
- **Simple and complete**
- **Manual handling & web use**
- **Works with any browser**

What is XML?

XML vs. HTML Example

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XML

```
<?xml version="1.0" encoding="UTF-8"?>
<books>
  <book>
    <title>XML for You and Me</title>
    <author>G. R. Righter</author>
    <isbn>0-13-68991-1</isbn>
    <readerlevel>beginner</readerlevel>
    <price>
      <wholesale>34.95</wholesale>
      <retail>41.95</retail>
    </price>
  </book>
  <book>
    <title>Core XML</title>
    <author>Betty Base</author>
    <isbn>0-44-37123-0</isbn>
    <readerlevel>knowledgable</readerlevel>
    <price>
      <wholesale>19.95</wholesale>
      <retail>23.95</retail>
    </price>
  </book>
</books>
```

HTML

```
<html>
<table>
  <tr>
    <td>XML for You and Me</td>
    <td>G. R. Righter</td>
    <td>0-13-68991-1</td>
    <td>beginner</td>
    <td>34.95</td>
    <td>41.95</td>
  </tr>
  <tr>
    <td>Core XML</td>
    <td>Betty Base</td>
    <td>0-44-37123-0</td>
    <td>knowledgable</td>
    <td>19.95</td>
    <td>23.95</td>
  </tr>
</table>
</html>
```



What is 23.95?

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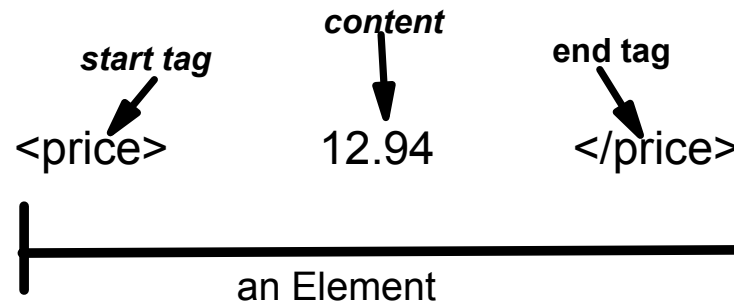
XML Terms

Elements and Attributes

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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

```
<price currency="USD">12.94</price>
```


Entity Reference

- Allow insertion of string literals into element content or attribute values
- A legal XML name, preceded by an ampersand (&) and followed by a semicolon (;)
- User example:
`<!ENTITY ibm "International Business Machines">`

`&ibm;`

- Fixed entities (note importance when streaming XML to file/buffer):
 - `< <`
 - `> >`
 - `& &`
 - `' '`
 - `" "`
- `&#xXXXX;` or `&#NNNNN;` Unicode character references
- Parameter entities

Well formed document

- An XML document that conforms to the structural rules for XML
 - First line must be the XML document declaration
`<?xml version="1.0" encoding="UTF-8"?>`
 - 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 have only attributes; no content case must match
 - Elements must be properly nested
`<A>` is invalid; `<A>` is valid

Valid document

- A well-formed document which also conforms to a defined grammar
 - DTD (Document Type Definition) is one way to define an XML grammar
 - DTDs define the valid elements and attributes that may appear in a particular type of XML document
 - DTDs also define element nesting rules for the document
 - XML schema is another, relatively new W3C standard to define XML document structure

DTD (Document Type Definition)

- Defines the valid elements and attributes that may appear in a particular type of XML document
- Also defines element nesting rules for the document
- See books.dtd

```
<!ELEMENT books (book+)> (books contain 1 or more book objects)
```

```
<!ELEMENT book ( title, author+, readerlevel? )>
```

```
<!-- (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)>
```

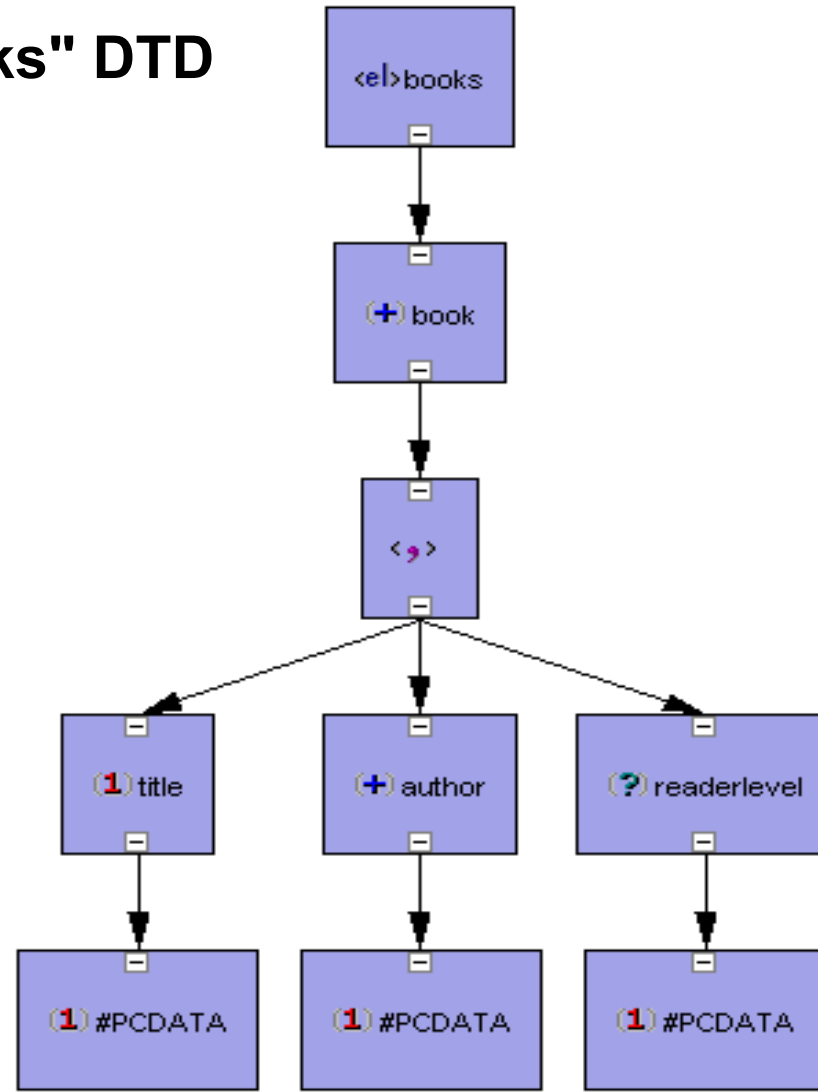
```
<!ELEMENT readerlevel (#PCDATA)>
```

XML Terms

DTD (Document Type Definition)...

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Graphical view of our "books" DTD



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DTD (Document Type Definition)...

- Element definitions within a DTD can be complex

```
<!ELEMENT page (identifier* ,(method|screen)* ,target* ,display+)>
```

The element page contains:

0 or more identifier elements, followed by

0 or more method or screen elements, followed by

0 or more target elements, followed by

1 or more display elements

XML Schema (replacement for DTDs)...

- Standard at recommended status at W3C
- Fixes the limitations of DTD (extensible, data types, etc.)
- Schema is written entirely in XML
- Components of the schema: element, attribute, simpleType, complexType, attributeGroup, identityConstraint
- addresses typing (derived or built-in, inherit)
- addresses cardinality
- addresses sequencing

Visit <http://www.w3.org/TR/xmlschema-formal>

XML Terms

XML Schema (new W3C recommendation)...

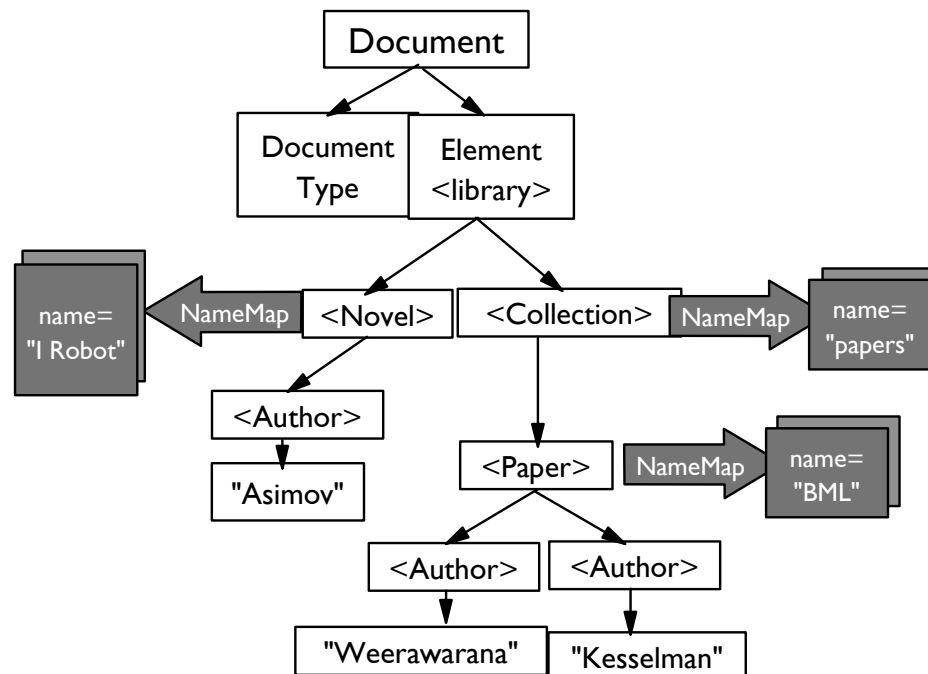
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XML schema example...books.xsd

```
<?xml version="1.0"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema">
  <element name="author" type="string"/>
  <element name="book">
    <complexType>
      <sequence minOccurs="1" maxOccurs="1">
        <element ref="title" minOccurs="1" maxOccurs="1"/>
        <element ref="author" minOccurs="1" maxOccurs="unbounded"/>
        <element ref="readerlevel" minOccurs="1" maxOccurs="1"/>
      </sequence>
      <attribute name="category" type="string" use="required"/>
    </complexType>
  </element>
  <element name="books">
    <complexType>
      <sequence>
        <element ref="book" minOccurs="1" maxOccurs="unbounded"/>
      </sequence>
    </complexType>
  </element>
  <element name="readerlevel" type="string"/>
  <element name="title" type="string"/>
</schema>
```

DOM (Document Object Model)

- Conceptual model used by applications to read, create, update XML data
 - Documents modelled as a hierarchy of nodes
- APIs provided to navigate and manipulate an XML DOM
 - Implemented by XML parsers
 - Supports retrieval, update and creation of XML document elements and attributes



XML Application Interfaces/Enablers

Points about parsers

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Two types of Parsers:

- non-validating - assures well-formed XML
- validating - uses DTD or XML Schema to ensure validity

Two primary types of parser implementation:

- Tree-based parsers (DOM)
- Event-based parsers (SAX)

Well formed documents again are those that can stand alone...don't need DTD to resolve external references or default attributes. If you have those in your XML, the DTD or XML Schema will need to be made available to the XML parser to do the resolution.

XML Application Interfaces/Enablers

Using a DOM Parser

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DOM parser provides a set of programming interfaces used to:

- Validate an XML document against a DTD and/or XML Schema
- Extract information (element and attribute values) from an XML document
- Insert/update content found in an XML document
- Create new XML documents

XML Application Interfaces/Enablers

Using a DOM Parser...

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Steps to using a DOM parser

- Create a parser (in XML4J and XML4C this involves instantiating a parser object, in XML4PR, XercesDOMParser_new)
- Call a method to parse the XML document
 - During this step, the parser will verify the document is well formed and valid (if using a validating parser) and builds a DOM tree containing the XML document content
- Get a reference to the parsed document
- Use DOM parser methods to navigate the DOM structure
 - Get children or attributes for a given element
 - Retrieve elements by tag name
 - Get parents for a given element
 - Get tag name and/or content associated with an element
 - ...

XML Application Interfaces/Enablers

Using a SAX Parser

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SAX = Simple API for XML

Represents an alternative interface for XML parsing:

- Bypasses DOM tree creation
- Scans document, notifying application when significant document constructs are found
- Can only be used to read XML documents; does not support document creation/update
- Can be a higher performance option than DOM parsing

XML Application Interfaces/Enablers

Using a SAX Parser...

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Steps to using a SAX parser

- Create a parser (in XML4J/XML4C this involves instantiating a parser object, in XML4PR, SAXParser_new)
- Call parser to set application handlers for various types of document content
 - Handler is a routine the parser will call when it finds the desired type of document content
 - ContentHandler is called when start/end of elements is encountered by the parser
 - ErrorHandler is called when the parser encounters a parsing error (eg invalid content based on DTD)
- Invoke parser
 - Application handlers called when parser encounters content of interest
 - Application handler can then examine the content encountered and decide what to do with it

XML Terms

XSL: The View Side of XML

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eXtensible Stylesheet Language is set of specifications from the W3C

XSL has two parts:

- a language for stylesheets and transformations (XSLT)
- a presentation-oriented vocabulary (XSL FO)

An XSL processor is software that transforms and styles XML data, either at the client or on the server

Typical uses:

- rendering XML to HTML
- XML vocabulary conversion

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What is XML good for?

What is XML good for?

Standard Data Interchange Format

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Supports "EDI" using Internet technologies/infrastructure

- Less costly, more pervasive infrastructure

Various new business to business data exchange formats and protocols based on XML

- XML used to represent product catalog, purchase order, invoice and shopping cart information
 - Example: Ariba/cXML

A number of XML extensions are being developed to facilitate commerce using XML and the Internet

- Digital signatures for XML data
- WebServices protocol suite
 - SOAP (Simple Object Access Protocol) for XML-based RPC
 - WSDL (Web Services Definition Language) to define the interface to a web services
 - UDDI (Universal Description, Discovery and Integration) used to register, locate and define interface to web services

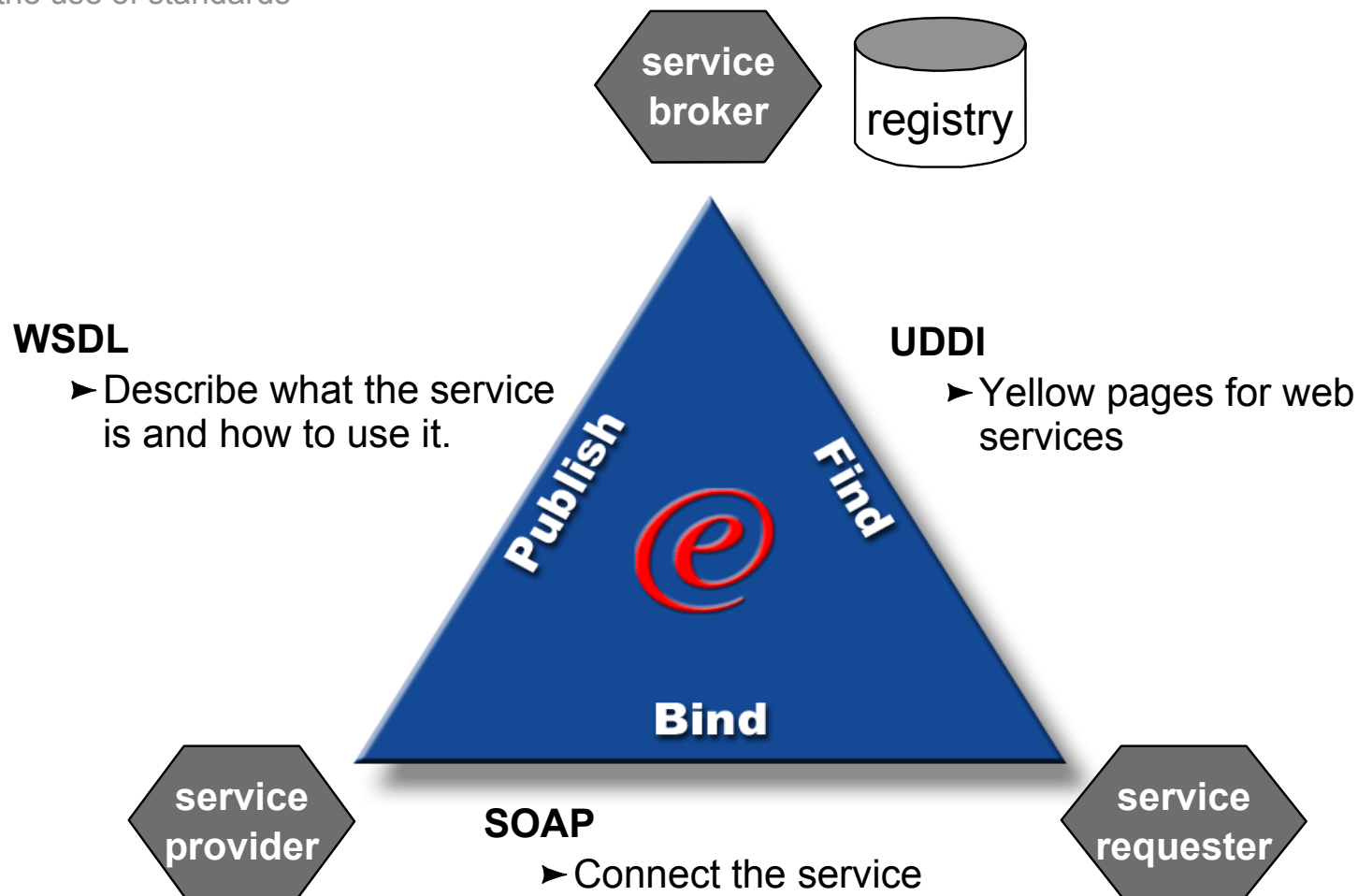
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What is XML good for?

Web Services

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"The Web Services Architecture defines the basic principles and functions required for such dynamic business interactions, including the ability to **publish** to a server, **find** a particular service and **bind** to it programmatically through the use of standards"



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What is XML good for?

HTML Supplement/Replacement

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XML extends capabilities of HTML through:

- Support for multiple views of the same information
 - Single XML document; multiple stylesheets

- Improved context based searching
 - Advanced search engine at IBM developerWorks/xml site is an example
 - Information on XML categorized using XML tags
 - Enables searching within a particular context
 - Find all "DTDs" associated with health care...

 - <http://www.ibm.com/developer/xml/>

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What is XML good for?

Foundation Technology for Pervasive Computing

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Standards for representing content to display on mobile, pervasive devices is XML based

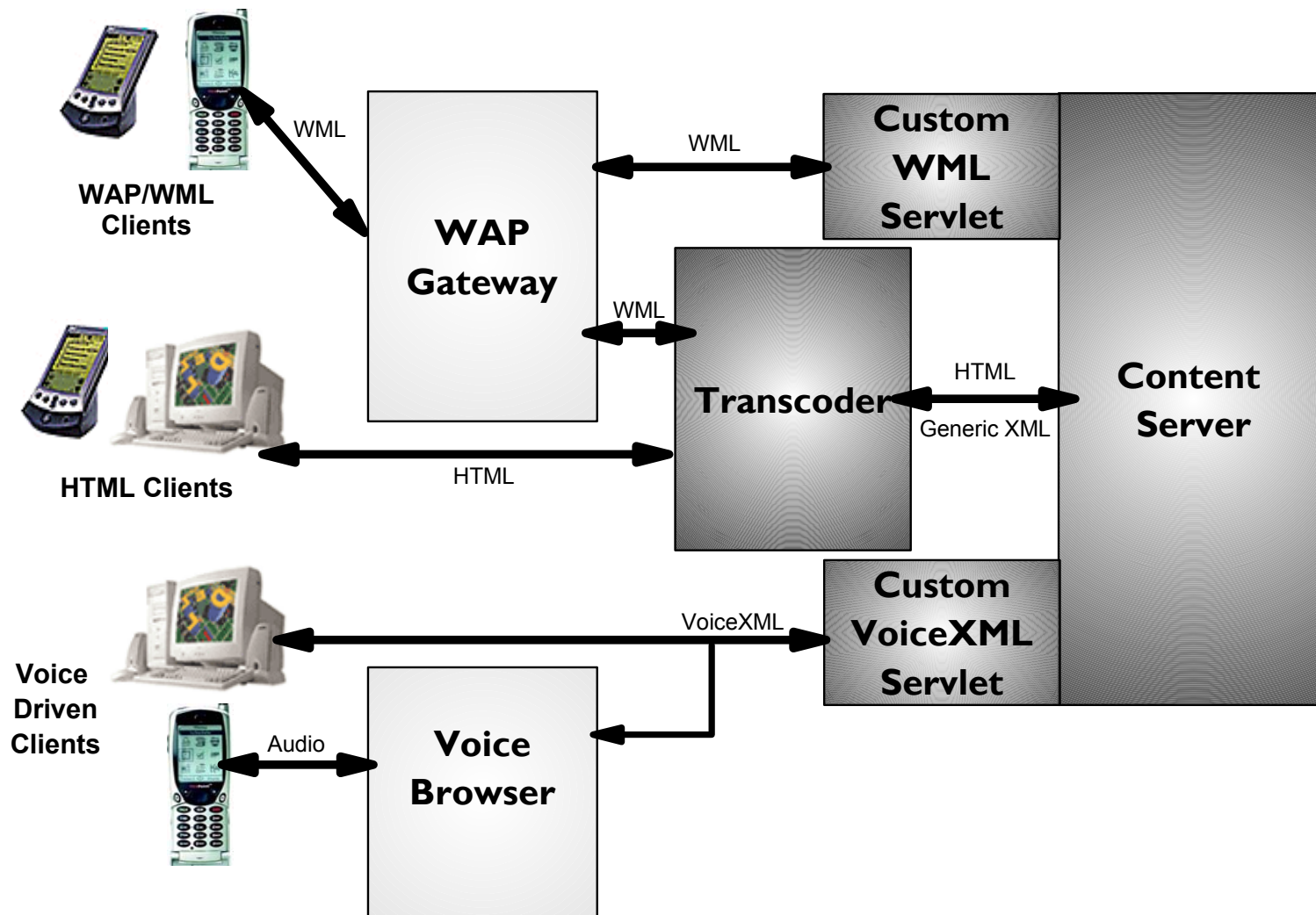
- WML (Wireless Markup Language)
 - Part of Wireless Application Protocol (WAP), a suite of application standards for cell phones, PDAs and other mobile devices
- VoiceXML
 - Standard defined for representing information presented by speech driven interfaces
- Transcoding
 - On-the-fly conversion of content to match end device capabilities
 - XML and XSL are two common components used for transcoding application content

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What is XML good for?

Foundation Technology for Pervasive Computing...

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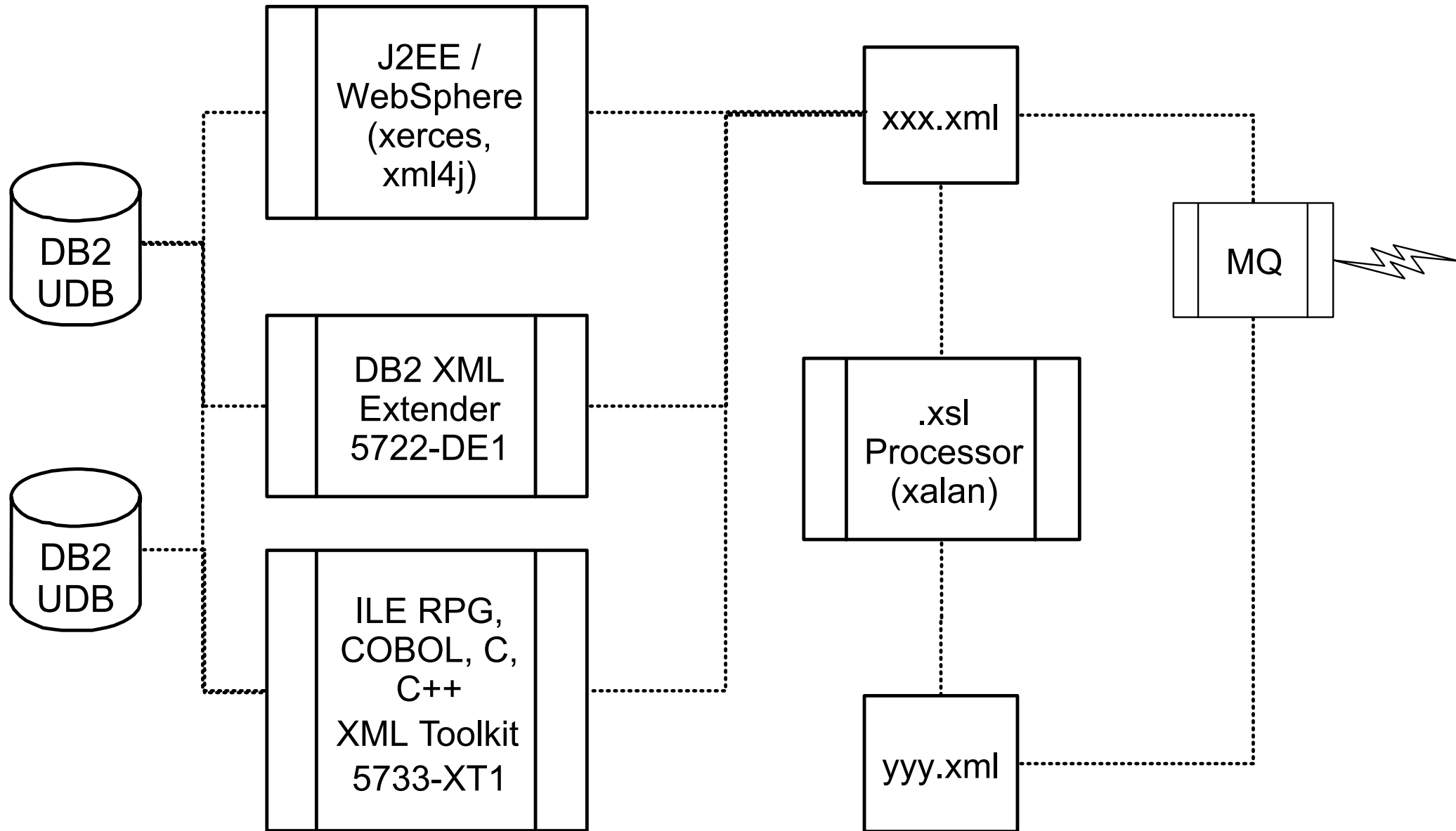


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iSeries XML Environments

Typical iSeries XML SW Components

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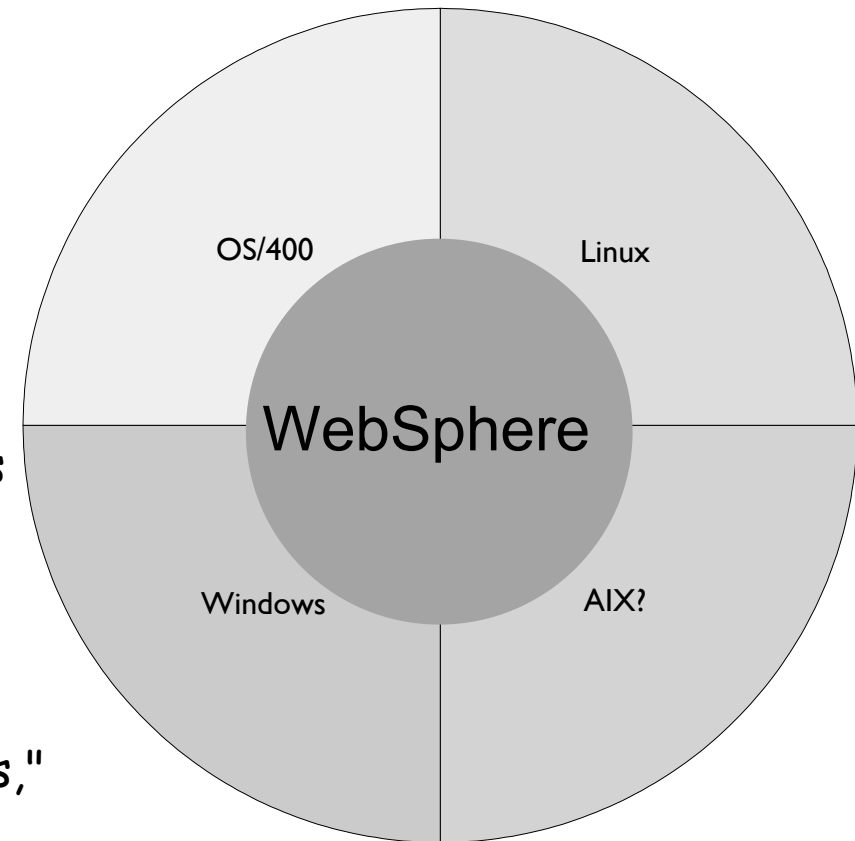


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Terminology Shift - "iSeries"

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- Traditionally, "iSeries" referred to the OS/400 env.
 - ▶ Allows decades-old applications to avail of new architecture (64 bit, etc.)
- "i" in iSeries stands for Integrated
 - ▶ Integrated Operating Systems co-existing
 - OS/400
 - Linux
 - Windows™ (IxA, IxS)
 - AIX?
 - ▶ Integrated facilities, DB2, security, etc.
 - ▶ Integrated, with multiple e-business technologies
 - JDK, JVM, WebSphere
 - HTTP, Domino, etc.
- Should terminology be more precise?
 - ▶ When there is mention of "WebSphere on iSeries," which one is being referred to?



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"i"Series = "I"ntegrated Operating Systems

- Multiple OS images in a single server

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	OS/400	Windows	Linux	AIX (Intentionally left blank)
LPAR Dynamic CPU movement	Y		Y	
LPAR Shared (fractional) processors	Y		Y	
LPAR Dynamic memory movement (no IPL)	Y			
Capacity Upgrade On Demand	Y		Y	
Add disk space on the fly	Y	Y	Y	
Shared resources: tape, CD, DVD	Y	Y	Y	
Shared resources: DASD & scatter loading	Y	Y	Y ¹	
Storage Virtualization: replicate *NWS & *NWSSTG, link & unlink, provide higher availability at low cost		Y	Y	
Secure, high speed network communications	Virtual Ethernet	1 Gb High Speed Link & Virtual Ethernet	Virtual Ethernet	
Disaster Recovery - single save & restore of shared DASD	Y ²	Y	Y ¹	

¹ Yes, if Linux partition uses virtual I/O

² Individual OS/400 LPARs need their own backups. A backup of an OS/400 LPAR will also backup the Windows and Linux images that it hosts.

App. "Development" vs. App. "Deployment"

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- Premise: Use of open standards provides portability and many other benefits. Examples:
 - ▶ Java/J2EE for application logic
 - 1 language, many deployment platforms
 - Contrast with competing AD technology: several languages, single deployment platform
 - ▶ SQL for DB
 - Data Definition Language (CREATE TABLE . . . orderdetail . . .)
 - Data Access & Data Manipulation (SELECT * FROM orderdetail . . .)
 - Extensions (variations) among RDBs
 - ▶ XML for information exchange
 - Internal vocabularies
 - Standard vocabularies, by industry or technology
 - Even HTML is now well-formed XML
 - Web Services, e.g., SOAP, WSDL
 - Transformation/Translation technologies - XSL
- Ergo,
 - ▶ the development platform can be distinct from deployment platform
 - ▶ Corollary: the application development technology cannot (AND SHOULD NOT) dictate the deployment platform
 - ▶ Application no longer dictates specific OS. OS now only affects systems management
- Why are these important?

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App. "Development" vs. App. "Deployment"

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- Development/test platform

- ▶ Primary criterion

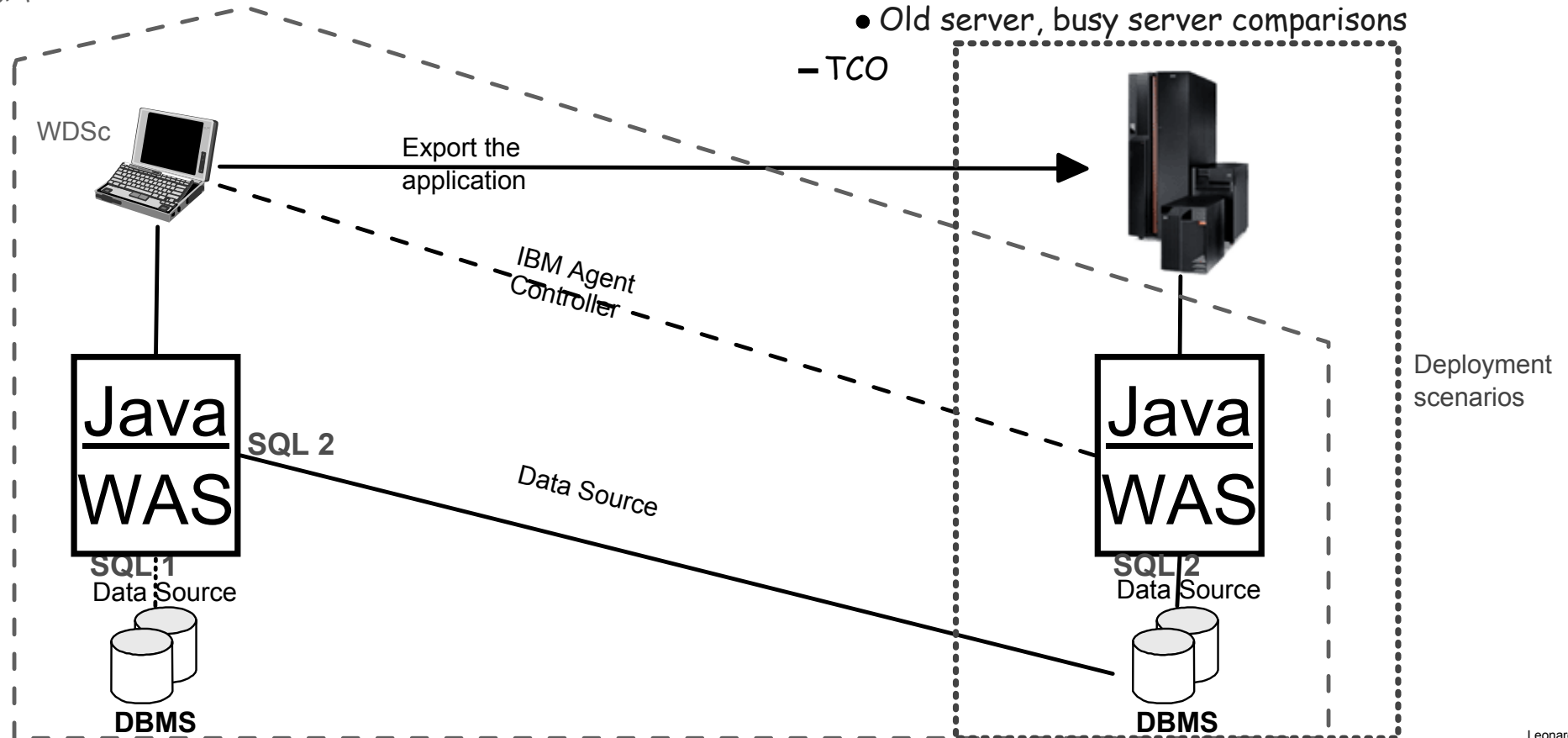
- developer productivity

- Deployment platform

- ▶ Primary criteria: ALL of the following

- Reliability
- Security
- Performance & scalability
 - Beware of low volume comparisons
 - Old server, busy server comparisons
- TCO

Development scenarios








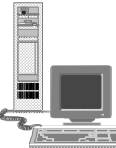
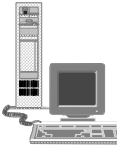



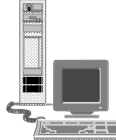

















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Configuration Alternatives (there are many more)

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	Line of Business	WebSphere	Firewall	Web Server	Firewall
Competitive Infrastructure	OS/400 	Intel 	Intel 	Intel 	External 
2nd iSeries for WebSphere	OS/400 	OS/400 	Intel 	Intel 	External 
2nd OS/400 Partition for WebSphere	OS/400 	OS/400 	Intel 	Intel 	External 
Multiple OS/400 Partitions and IXS	OS/400 	OS/400 	Wintel - IxS/IxA 	OS/400 	External 
3 Linux Partitions (Integrated Platform)	OS/400 	Linux  	Linux  	Linux  	External 

Integrated Platform is designed to simplify a complex process: design, order, install, config, test

► Can cut implementation time by up to 75%

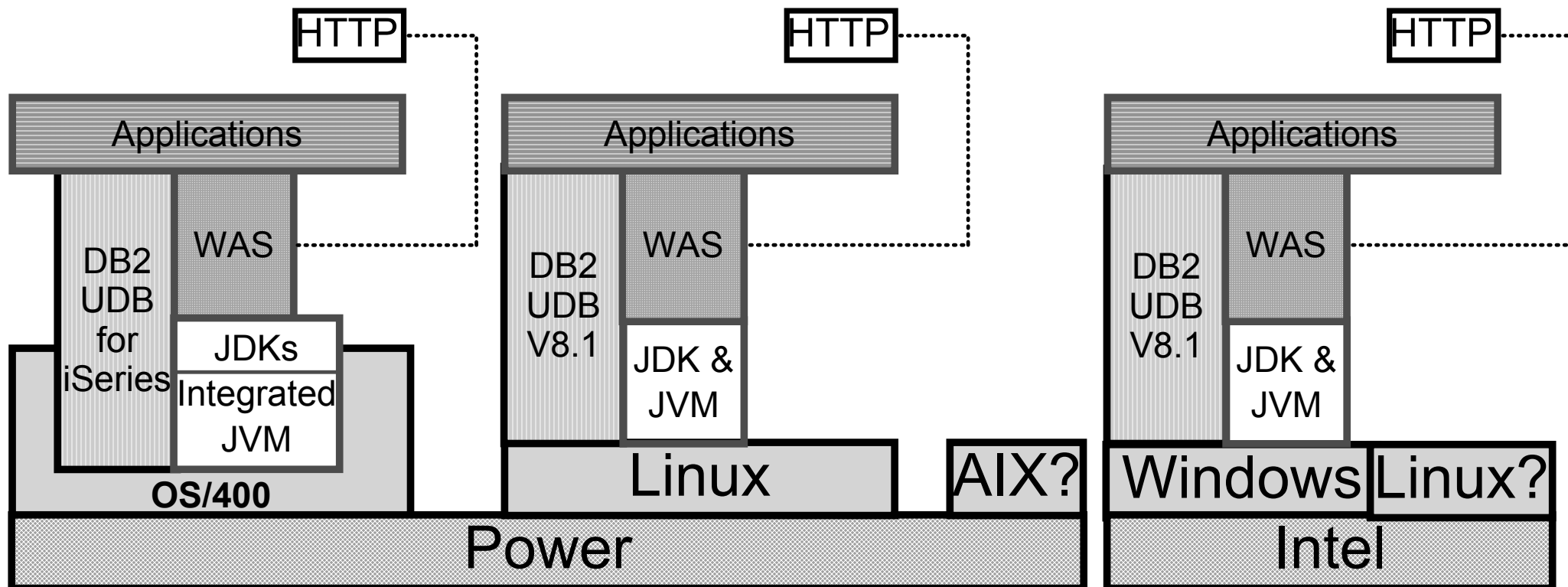
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Application Components - WebSphere Applications

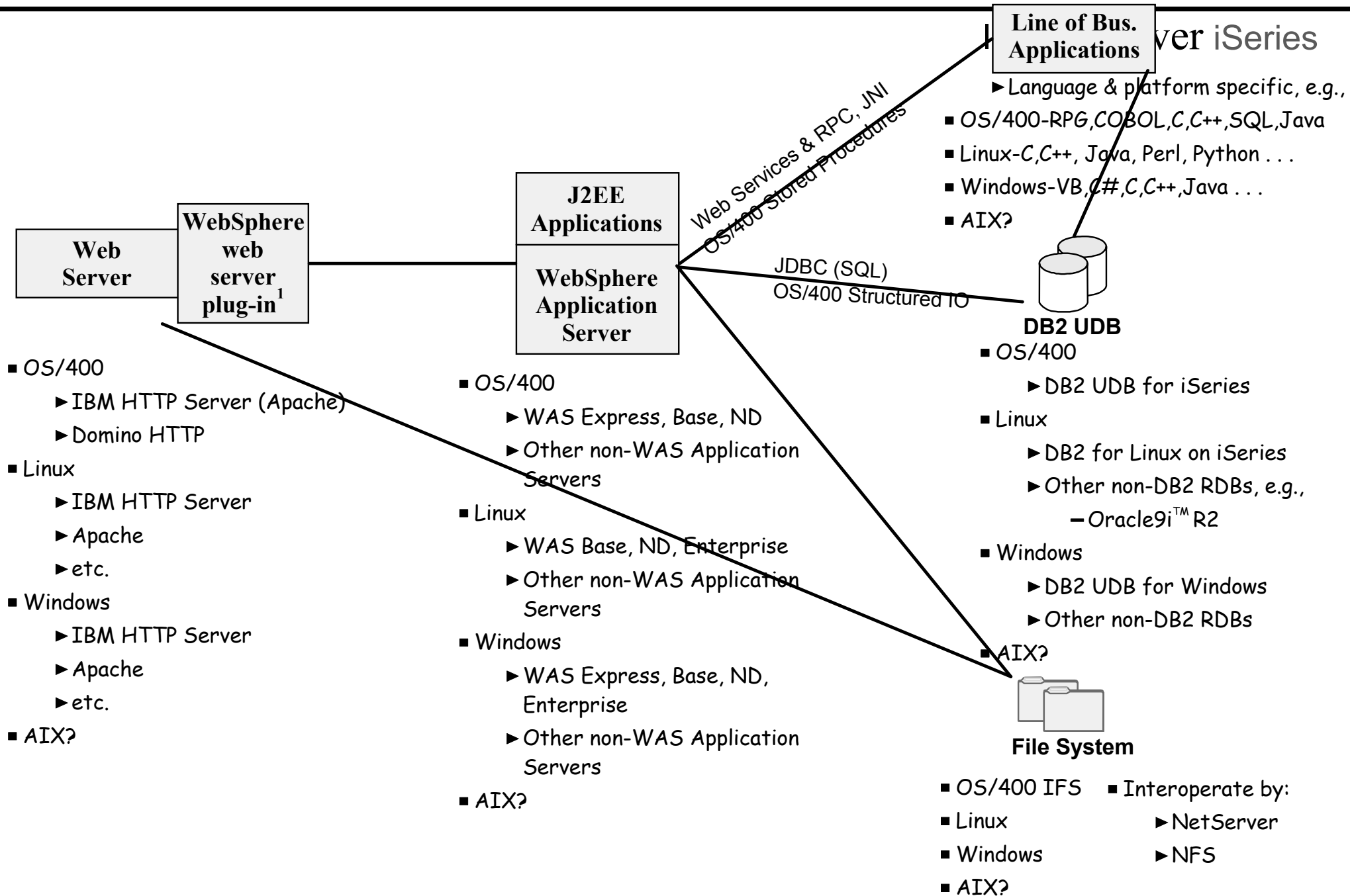
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- These environments can co-exist and be interconnected
 - ▶ LPARs interconnected with Virtual Ethernet
 - ▶ Windows (IXA) connected with 1 Gb High Speed Link or Virtual Ethernet
- Linux & Windows can all be managed from hosting OS/400 partition/s



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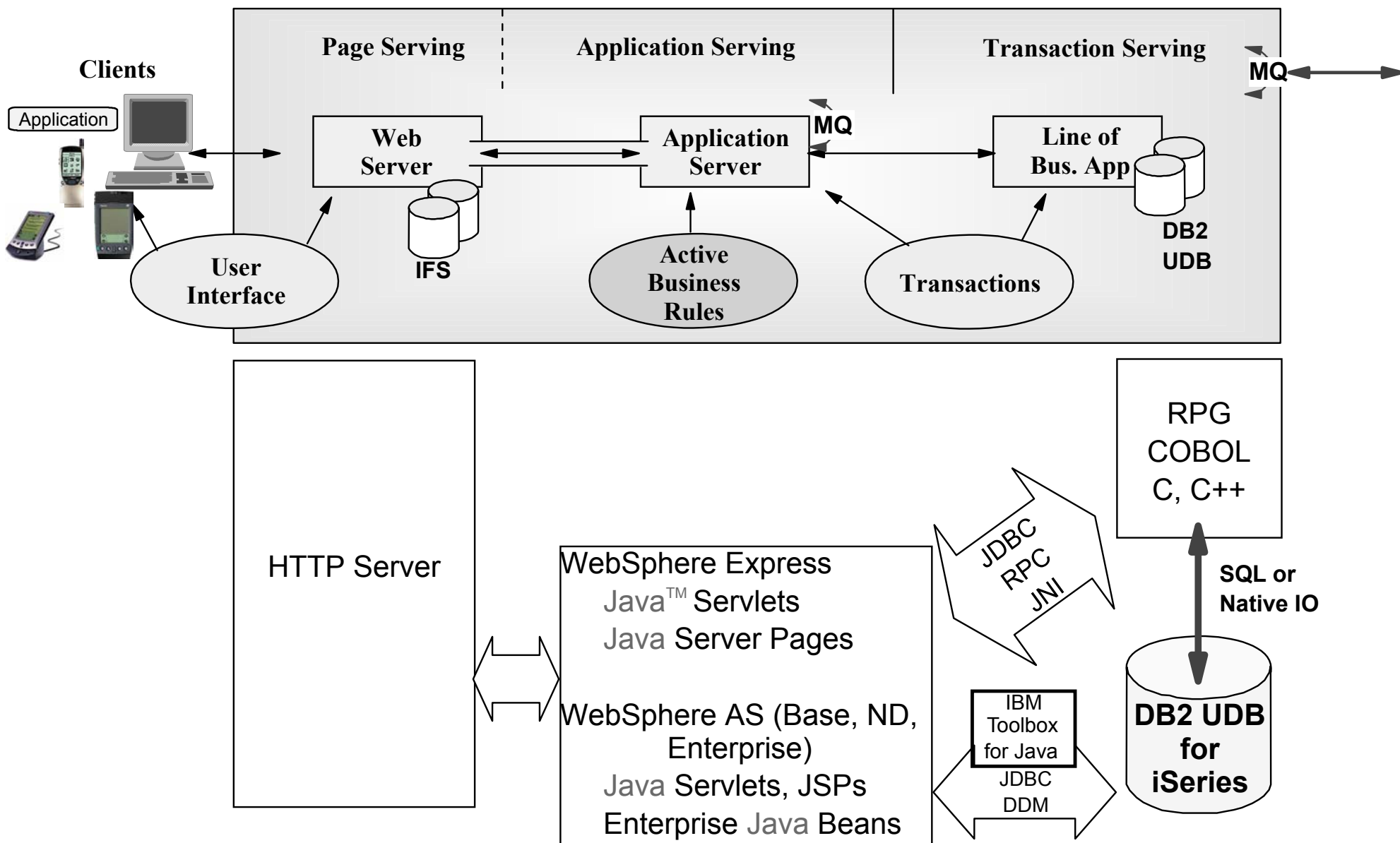
iSeries: Application Component Options



¹WAS Express on iSeries currently supports IBM HTTP Server Powered by Apache plug-in only

Options - Application Server to LOB or DB Integration

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XML Toolkit for iSeries (5733XT1)

XML parser strategy

- Java parser (xml4j) continues to be available in base OS via PTF, see /qibm/proddata/os400/xml/lib for versions/jars
- Java JDK 1.4.1 also contains subset of XML services, a SUN implementation
- C++ parsers (xml4c) ship when ready available via IBM XML Toolkit
- ILE RPG, C and COBOL parser (xml4pr) available via IBM XML Toolkit
- A refresh approach providing new install options (similar to JDK) being used

XSL Stylesheet runtime

- XSL (xalan) provided with V5R1 release of OS/400
- XSL (xalan Java) available in /qibm/proddata/os400/xml/lib
- XSL (xalan C++) will become available as future XML Toolkit install option

XML Toolkit for iSeries

XML Application Enablers -parsers

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XML parser versions

- Sourced from Apache Software Foundation and the IBM XML Enablement team
- New versions approximately every 9-12 months
- Each version is a distinct binary (i.e., separate bind) with new/changed functions (i.e., there is no 'guarantee' of upward compatibility)
- Each version has include/header files, samples and documentation

XML Toolkit for iSeries V1R1M0

- Initial version is XML parsers version 4.0
- Provide both a C++ and Procedural parser at both 4.0 & 5.0 level
 - Version 4.0 supported by install options 1 & 2
 - Version 5.0 supported by install options 3 & 4
 - Version 5.2 supported by install options 5 & 6
- Two install options per version (binary option and development option)
- Development option contains API Doc, samples and include files necessary to compile an XML application
- Software configurator will have a refresh option to reorder with newest install options

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Changes for Version 5.0 DOM parser -> XercesDOMParser

- Based on experimental IDOM parser & replaces existing DOM parser.
- Generally faster.
- Not upward compatible. Source changes needed. Need to either 1) use deprecated includes or 2) update to XercesDOMParser.
 - The underscore '_' has been removed from DOM methods and objects. Example: DOM_Node is now DOMNode. QxmlIDOM_Node_delete is now QxmlIDOMNode_delete.
 - All places where DOMStrings were passed as input to procedures will now accept XMLCh strings. These input parameters follow the same rules as other places character data is passed to the parser APIs. The key is that QxmlIINDOMSTR is no longer a supported CCSID identifier.
 - All places where APIs returned a DOMString, an XMLCh string will be returned instead. Use QxmlTranscode to translate these to native character sets if necessary.
 - DOMParser has been renamed to XercesDOMParser. This means that procedures called on a DOMParser construct have changed names. For example, QxmlIDOMParser_parse_SystemId is now QxmlXercesDOMParser_parse_SystemId.
 - For 5.0, memory management has changed. However, your changes should be minimal. There may be special cases where certain new delete procedures are needed.

XML Toolkit for iSeries

Some details

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XML Toolkit general info/conventions

- The DOM/SAX APIs are provided in single service program
- QXMLTOOLS is the product library containing the installed XML parser binaries
- QXML4Cxxx is the service program naming convention for C++, where xxx is the XML parser version
- QXML4PRxxx for ILE RPG, C and COBOL service program
- QXMLDEVxxx is the development library (include files and samples) for particular version
- Information Center XML Toolkit link: indicates currently available XML parser versions, how to install, and the location of documentation and samples after install
- All API documentation, description of samples, programming tips, FAQ, and compile/bind information available only from the installed development option and accessed via mapped network drive and browse, open file
- Naming FYI: XERCES=XML parsers , XALAN=XSLT processors, you will see Xerces in the documentation as we source from Apache
- Transcode services used by XML Toolkit is ICONV (other platforms use ICU)

<http://www.ibm.com/eserver/series/software/xml>

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XML Toolkit getting started

- Install both the binary and development options for desired XML parser version
 - Parsers available via install options documented in Info Center
 - <http://publib.boulder.ibm.com/html/as400/v5r2/ic2924/index.htm?info/rzamj/rzamjmain.htm>

XML Toolkit Article

- Article in April 2003 issue of eServer Magazine, iSeries edition.
 - By Jay Hansen and James DeVries of IBM
 - <http://www.eservercomputing.com/series/articles/index.asp?id=581>

See Appendix for an RPG example

DB2 UDB XML Extender (5722-DE1)

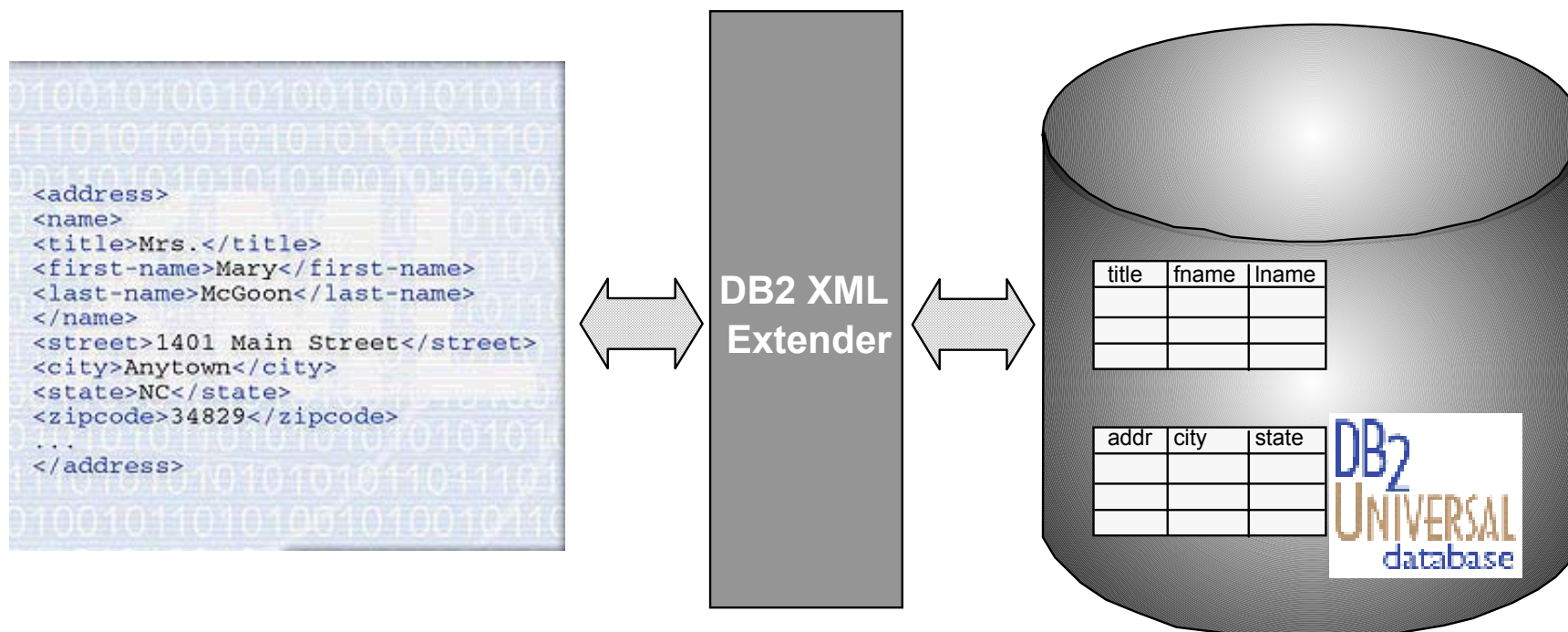
XML Extender

DB2 XML Extender

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XML Extensions to DB2 UDB

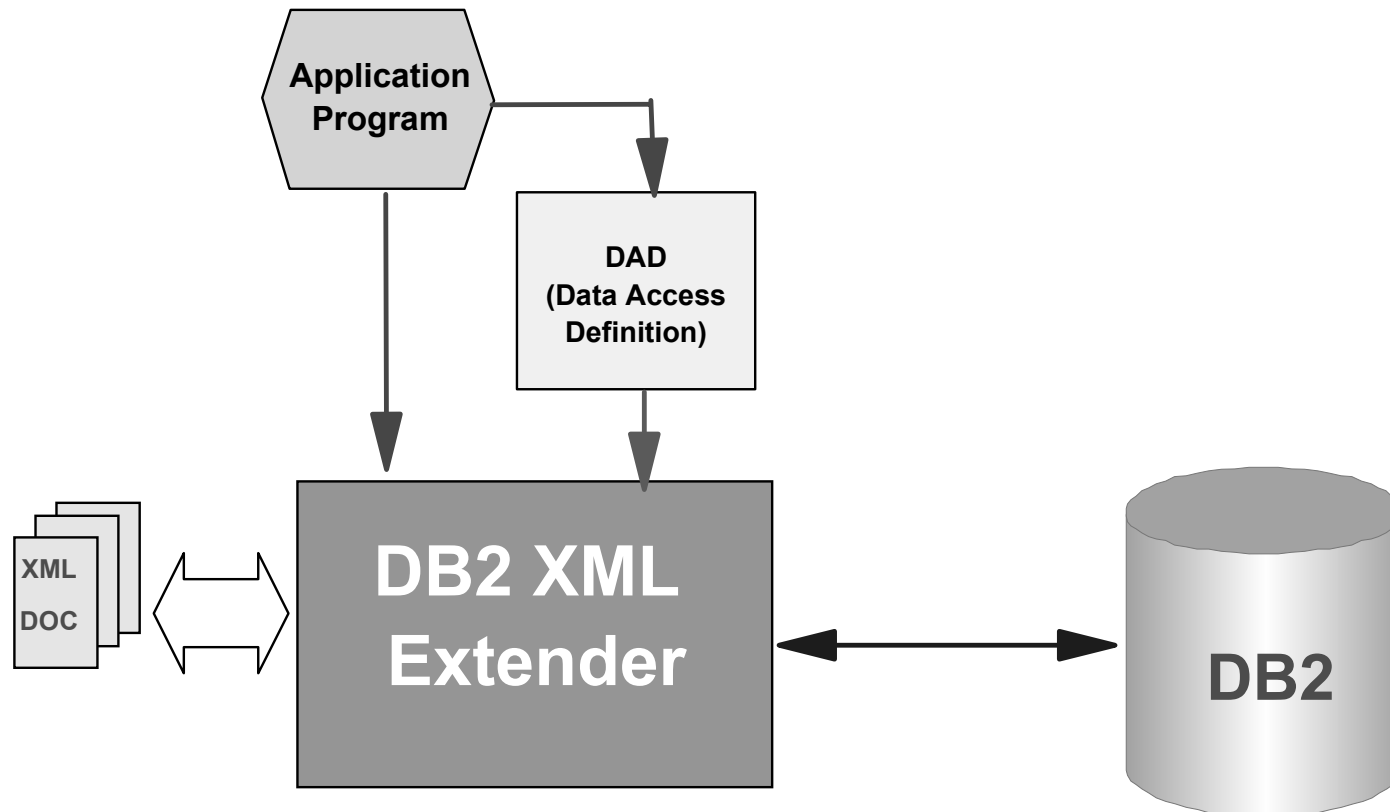
- Focus on interchange between data in XML and relational format
 - Map XML data elements to tables/columns in DB2
 - Reconstruct XML document from DB2 data



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XML Extender Overview

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DB2 XML Extender provides

- new data types that let you store XML documents in DB2 databases
- new functions that assist you in working with these structured documents

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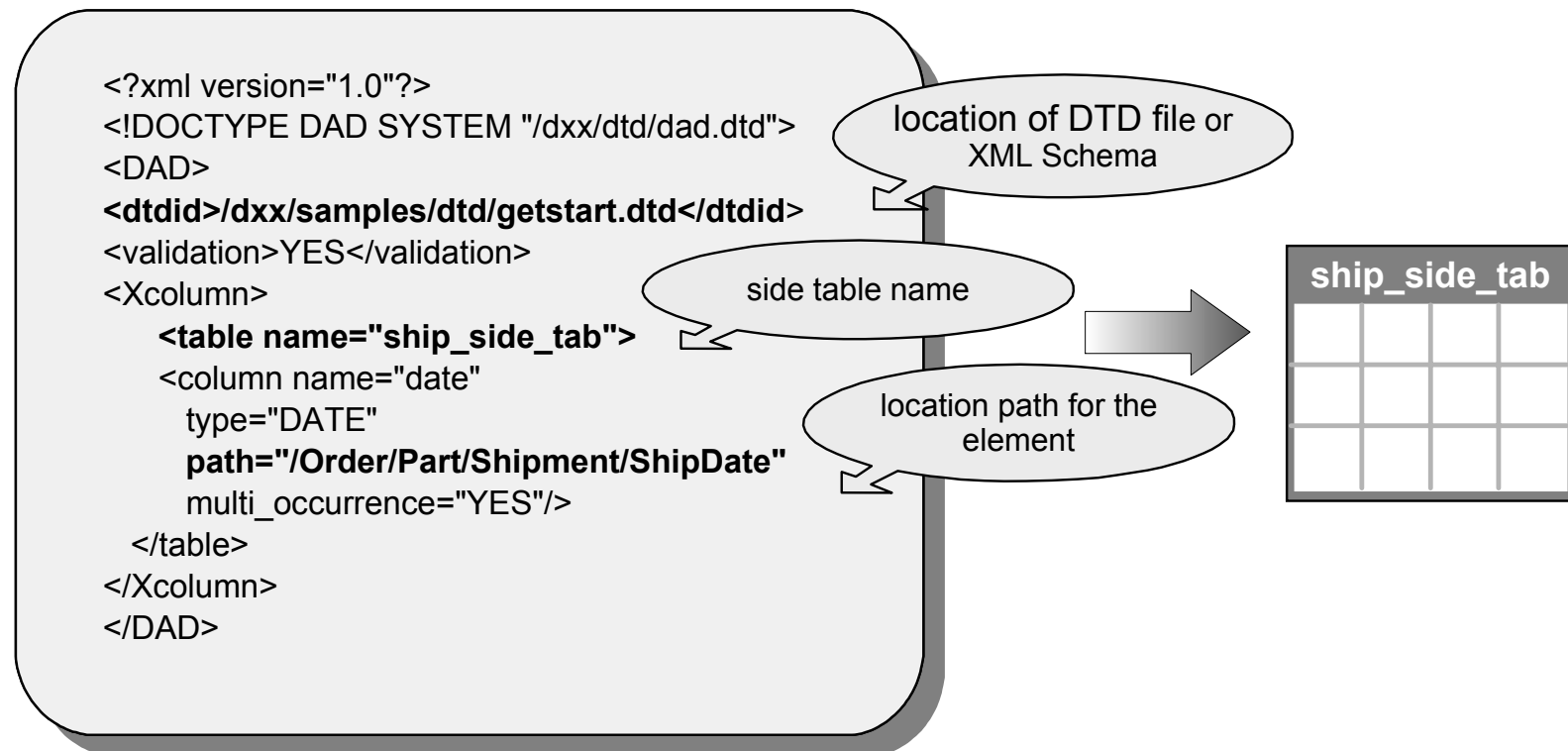
Document Access Definition (DAD)

IBM  server iSeries

A well-formed XML document itself

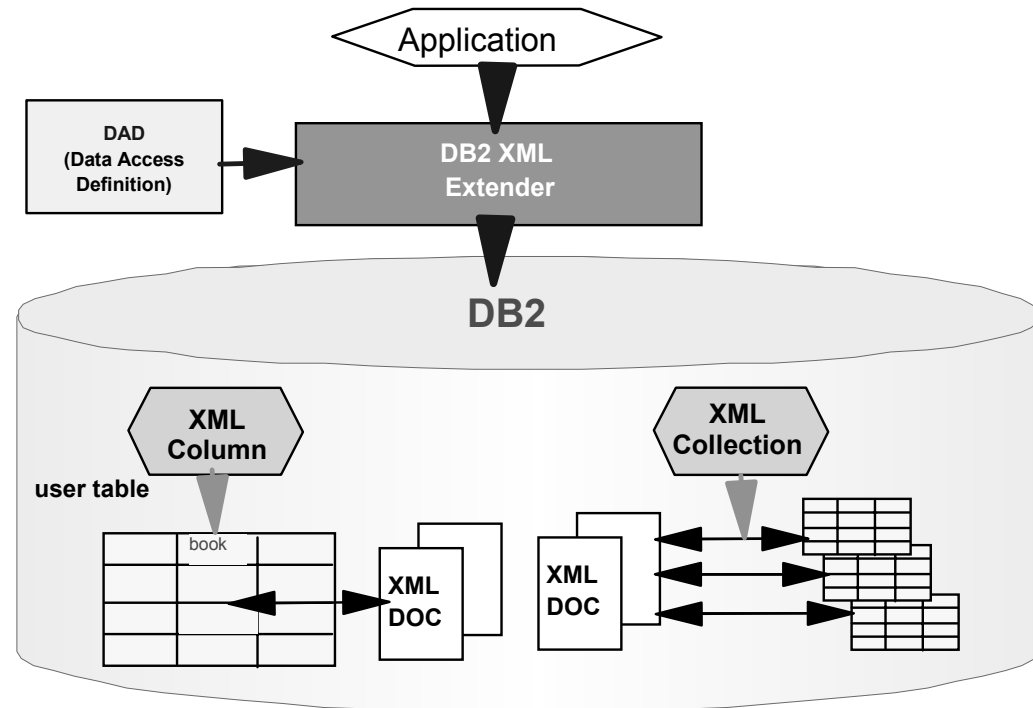
- defines the location of key files such as DTD
- defines the mapping between XML document and relational tables

Used for both XML Column and XML Collection



The XML Extender Approaches

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XML column

- store and retrieve entire XML documents as DB2 column data
- XML data represented by XML column

XML Collection

- decompose XML document into a collection of relational tables
- compose XML documents from a collection of relational tables

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XML Columns Scenario

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- **Scenarios suitable for XML Columns:**
 - XML documents already exist or come from some external source
 - you want to store them in DB2 for integrity or for archive and auditing purposes
 - you prefer to store documents in native XML format
 - XML documents are read mostly
 - performance of update is not critical
 - range search is needed based on the values of XML elements or attributes
 - The documents have elements with large text block and you want to use Text Extender for structural text search

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XML Collections Scenario

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- **Scenarios suitable for XML Collections**
 - You have data in your existing relational tables, and you want to compose XML documents using your existing data based on DTD
 - You want to create different view of your relational data using different mapping scheme
 - The XML documents come from other source and you want to store pure data
 - A small part of your XML documents need to be updated often, and update performance is critical
 - You like to store the data of entire incoming XML documents but often only want to retrieve a subset of them;
 - Your XML documents are large in size, which exceed 2 GB and you must decompose them

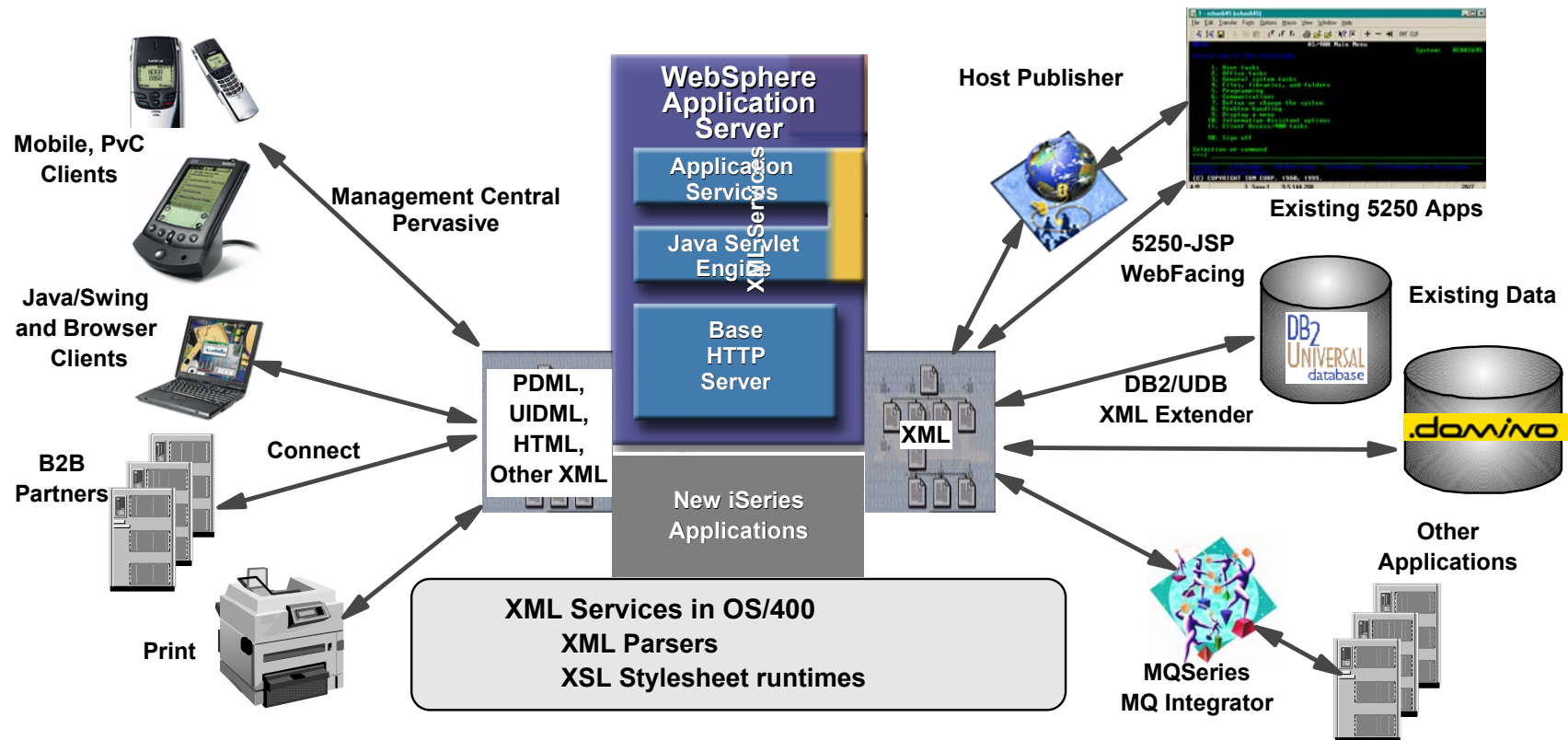
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Additional XML Use/Support on iSeries

iSeries Use and Support of XML

Summary of iSeries Exploitation and Enablement of XML

IBM  server iSeries

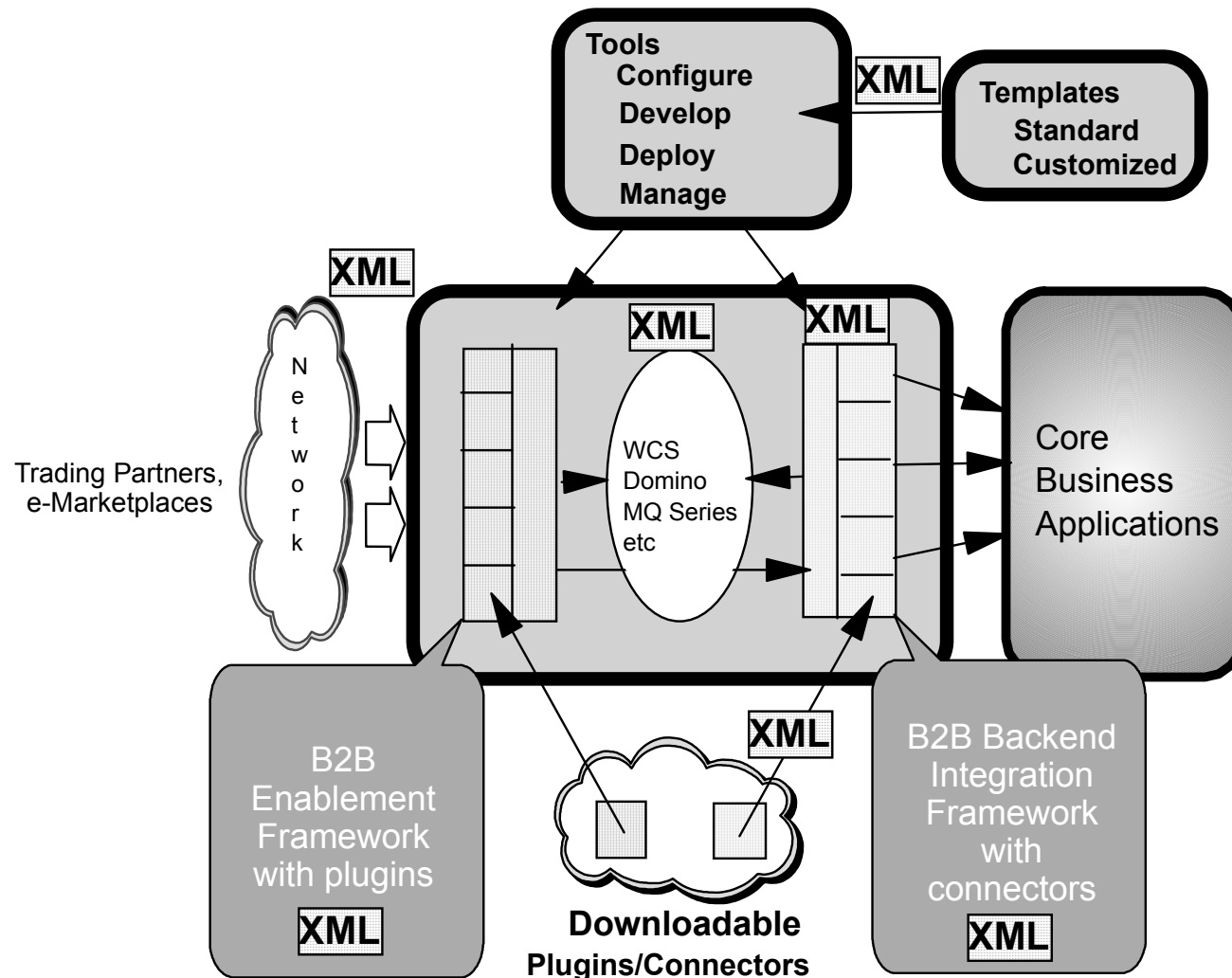


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iSeries Use and Support of XML

Connect for iSeries: Enabling B2B Solutions

IBM  server iSeries



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iSeries Use and Support of XML

iSeries Access for Wireless

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Manage multiple systems in a wireless fashion from mobile devices

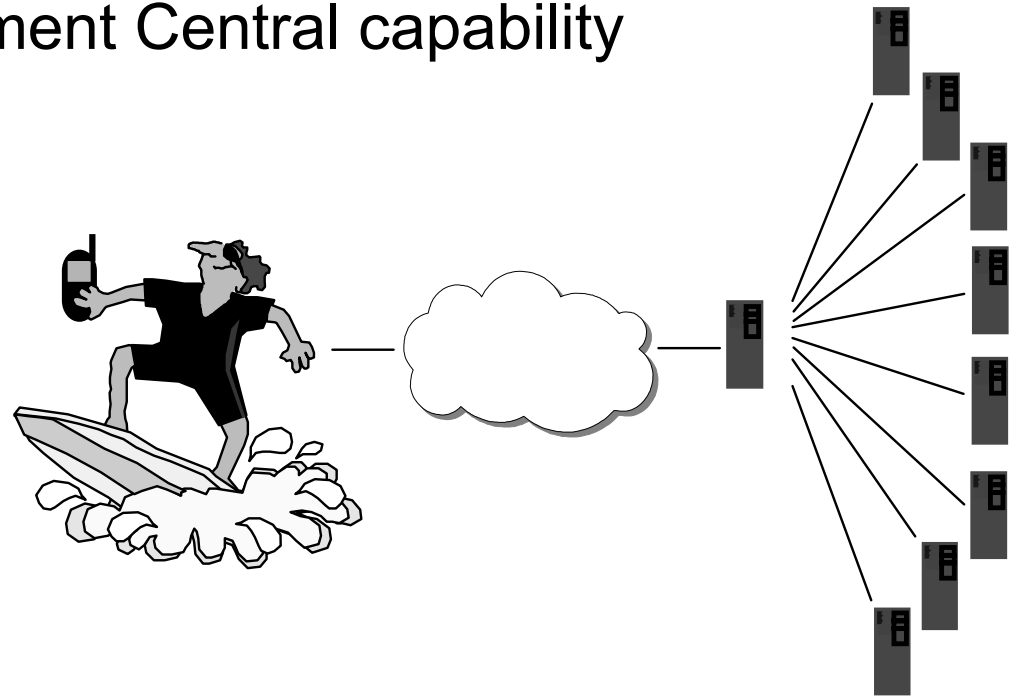
- PDA
- Cellular Phone

Also runs in a workstation Web browser

Provides a subset of the Management Central capability

October 2000 availability (V4R5 PTF)

Additional capability in V5R1 (GA PTF)

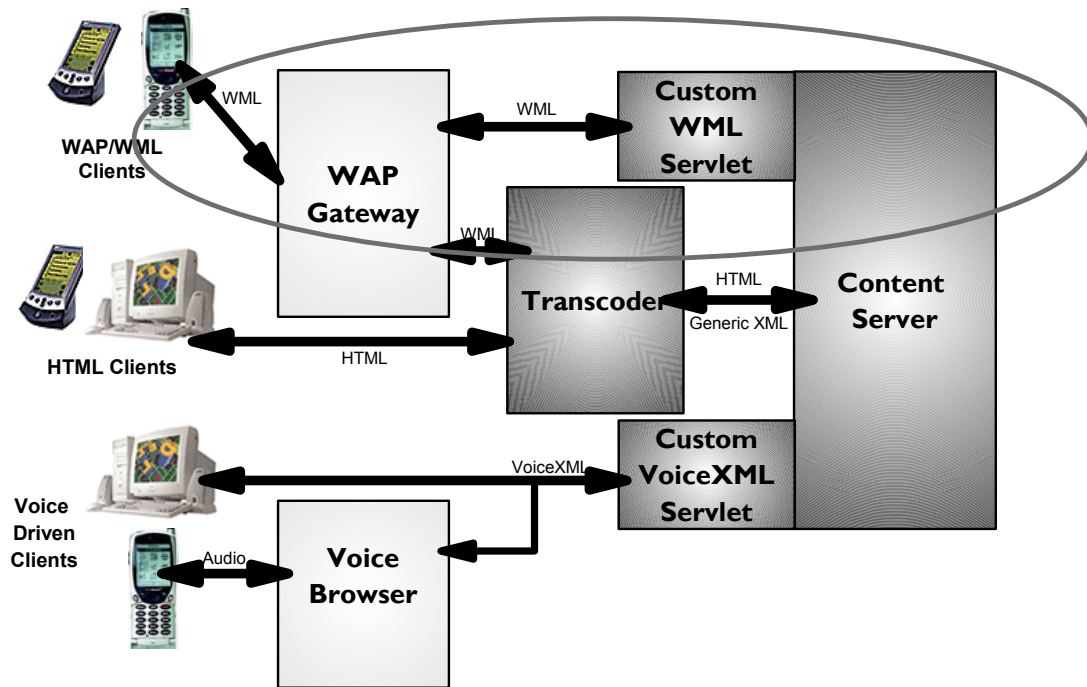


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iSeries Use and Support of XML

iSeries Access for Wireless: Demonstration

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Runaway Job with Graphical Background.exe

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Development Tools

WebSphere Development Studio V5

RPG **COBOL**

C/C++ **PDM, SEU
SDA, RLU**

V5R1 or V5R2
5722-WDS

**Unlimited
Licenses**

iSeries	iSeries	iSeries	iSeries	Web Facing	iSeries Projects
Java	Debug	Struts Web	Web Service		RSE
Trace	Profiling	DB	XML	App Server	

+CODE
+VisualAge RPG

WebSphere Development Studio Client V5

www.ibm.com/software/awdtools/wds400

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WebSphere Development Studio Advanced V5

IBM  server iSeries

NEW!

C/C++

**PDM, SEU
SDA, RLU**

V5R1 or V5R2
5722-WDS

**Unlimited
Licenses**

www.ibm.com/software/awdtools/wds400

iSeries	iSeries	iSeries*	iSeries	Web Facing*	iSeries Projects	
Java	Debug	Struts Web	Web Service		RSE	
Trace	Profiling	DB	XML	App Server	EJB* J2EE*	Test Cases*

WebSphere Development Studio Client Advanced V5

+CODE
+VisualAge RPG

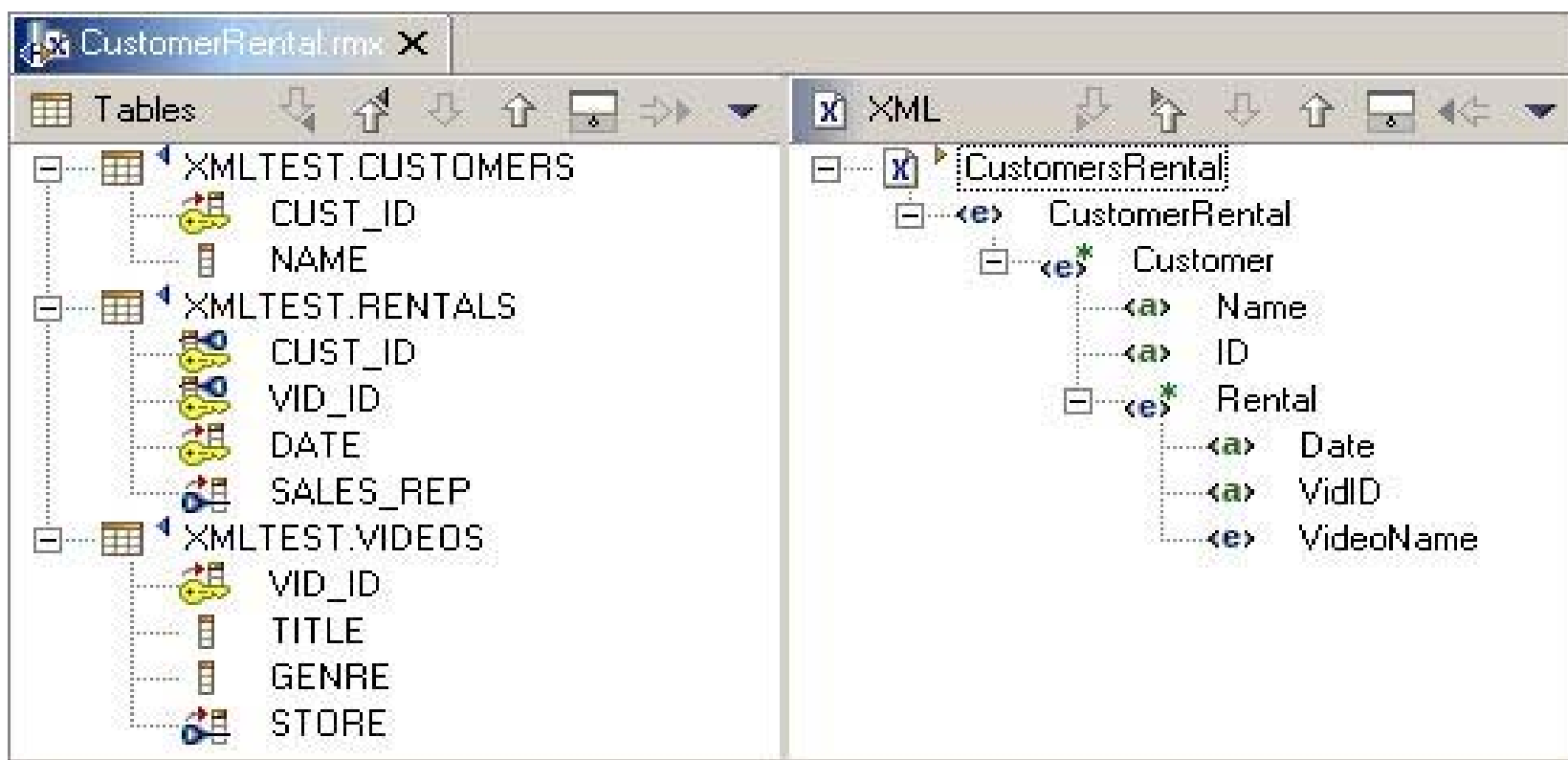
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DAD Generation with RDB to XML Mapping Editor

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Websphere Studio Application Developer includes an RDB to XML editor to simplify creation of DAD files

- Online tutorial at:
http://www7b.boulder.ibm.com/wsdd/techjournal/0204_russell/russell.html



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- **XML Editor**

- For creating and viewing XML files

- **DTD Editor**

- For creating/viewing Document Type Definitions

- **XML Schema Editor**

- For creating, viewing and editing XML Schemas
- Conversion of DTD to XML Schema

- **XML to XML Mapping Editor**

- To map one+ source XML files to a target XML file

- **XSL Trace Editor**
 - To visually step through an XSL transform

- **XML and SQL Query Wizard**
 - To create an XML file from an SQL query

- **RDB to XML Mapping Editor**
 - To map one+ relational tables to a target XML file

What's new in XML Tools for Version 5.0

IBM  server iSeries

Generate Java **Beans** from **XML** documents and vice-versa

Use the Xalan processor to create HTML and XML documents with the **XSL Stylesheet**

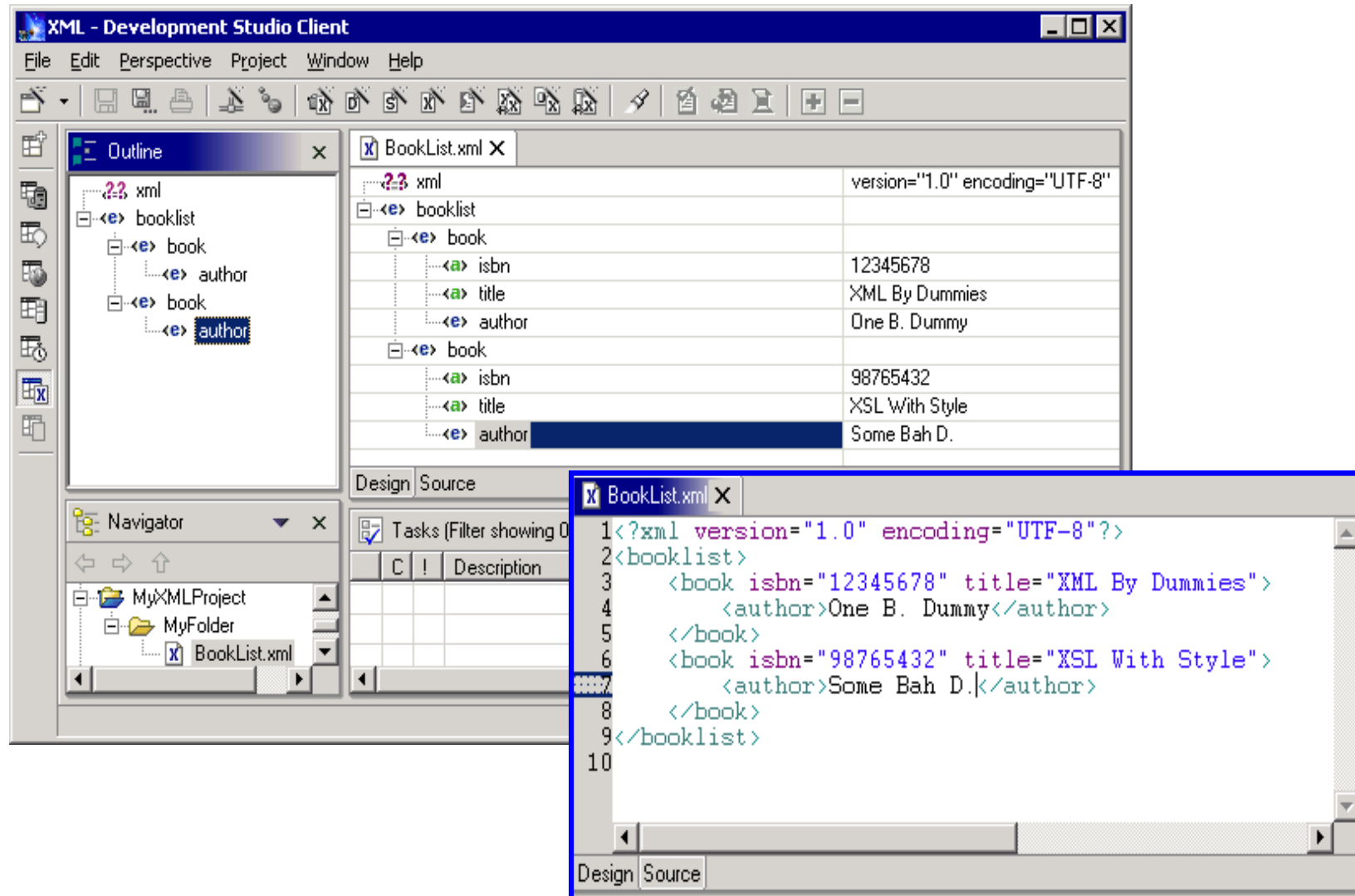
Create and execute an XPath with the **XPath wizard**

Generate **document access definition scripts** for use with IBM DB2

Create XML documents from **DB2 data** and vice-versa

Validation for use with an **iSeries host**

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Related standards will continue to evolve

- XML Schema - at recommendation status
 - Support additional constraints on XML data
 - Numeric, date, user defined types...

- XML Query
 - XML query language syntax
 - XML query semantics

- Standards to facilitate XML use in Business-To-Business applications

- Industry DTD efforts
 - Collaborative efforts to converge on common DTDs for use within a given industry
 - Chemical, Finance, Health,...

Summary

XML is a standard technology for representing information

- Portable, ideal for use in transporting data in a standard, easy to interpret format
- XML is a key technology component of a growing number of IT solutions
 - Popular component of new B2B implementations
 - Core technology in mobile/pervasive computing standards

To work with XML you need application enablers (i.e. XML parsers)

XML Toolkit for iSeries is a new LPO providing application enablers

- Intent: to support more timely delivery of XML parsers
- Future: Allows other 'XML' enablers (such as XSL or others) to be plugged in

Appendix A: Additional Resources

Additional Information

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iSeries XML Technical Resources

- <http://www-1.ibm.com/servers/enable/site/xml/series/start.html>

XML Toolkit for iSeries - published article

- <http://www.eservercomputing.com/series/articles/index.asp?id=581>

XML.org:

- Information on XML standards, tools and new developments in XML
- Repository for industry standard DTDs that may be shared across companies
- <http://www.xml.org/>

IBM developerWorks™:

- Latest news and information on XML
- <http://www.ibm.com/developer/xml/>

IBM alphaWorks:

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

PartnerWorld for Developers, iSeries XML website:

- Information and tutorials on use of XML
- <http://www.iseries.ibm.com/developer/java/xml/>

IBM Toolbox for Java:

- Additional information on PDML and PCML
- <http://www.ibm.com/servers/eserver/series/toolbox>

W3C - XML standards and specifications:

- Status and detail on various XML-related standards
- <http://www.w3.org/XML/>

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DB2 XML Extender - Additional Information

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Redbooks & RedPapers (<http://ibm.com/redbooks>)

- DB2 XML Extender - Hints and Tips for the IBM eServer iSeries
- Integrating XML with DB2 XML and Text Extenders (SG24-6130)
- Stored Procedures, Triggers, and UDFs on DB2 UDB for iSeries (SG24-6503)
- DB2 UDB for AS/400 Object Relational Support (SG24-5409)

Downloadable Lab

- <http://ibm.com/servers/enable/education/i/ad/db2/recentindex1.html>
- Samples to get you started...
 - DB2 Text Extender: CALL PGM(QDB2TX/TXSAMPLE)
 - DB2 XML Extender:
 - RSTLIB SAVLIB(DXXSAMPLES) DEV(*SAVF)SAVF(QDBXM/QZXMSAMP1)
 - RST DEV('/qsys.lib/qdbxm.lib/qzxmsamp2.file')
 - OBJ('/QIBM/UserData/DB2Extenders/XML/Samples')

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DB2 XML Extender - Additional Information

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DB2 UDB for iSeries home page - ibm.com/eserver/series/db2

DB2 UDB for iSeries Publications

- Online Manuals: <http://www.iseries.ibm.com/db2/books.htm>

Newsgroups

- USENET: comp.sys.ibm.as400.misc, comp.databases.ibm-db2
- iSeries Network (iSeries NEWS Magazine) SQL & DB2 Forum - <http://as400network.com/communities/sqlldb/>

Education Resources - Classroom & Online

- <http://www.iseries.ibm.com/db2/gettingstarted.html>
- <http://ibm.com/servers/enable/education/i/ad/db2/recentindex1.html>
- Generating & Integrating XML Content with DB2- IBM Course#: CG121

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DB2

developerWorks

iSeries

WebSphere

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Appendix B: RPG & XML Toolkit Example

XML document - input

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```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<Calculator>
```

```
  <Expression operation="add">
```

```
    <Operand>4.0</Operand>
```

```
    <Operand>3.5</Operand>
```

```
  </Expression>
```

```
  <Expression operation="subtract">
```

```
    <Operand>4.0</Operand>
```

```
    <Operand>3.5</Operand>
```

```
  </Expression>
```

```
</Calculator>
```

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Main Program

Get the RPG procedure and data definitions for the procedural parser XML4PR

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```
/COPY QXMLDEV500/QRPGLESRC,QXML4PR500
```

Dtrue	C		1
Dfalse	C		0
DEnvData@	S	*	INZ(%ADDR(Qxml_DomExcData))
DPEnvData@	S	*	INZ(%ADDR(Qxml_SaxExcData))
DcalculatorEl	S	10A	INZ('Calculator')
DexpressionEl	S	10A	INZ('Expression')
DprocessDocument	pr		
D domdoc@		*	VALUE
DvalExpression	pr	8P 5	
D domexpr@		*	VALUE
DvalOperand	pr	8P 5	
D domoper@		*	VALUE
DprintError	pr		

Main Program (continued)

Initialize Parser Environment

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```
C*  *ENTRY
DinFile          S          40A  INZ('/temp/calc.xml')
DinFileStr@      S          *
Dparser@         S          *
Ddomdoc@         S          *
DOUTSTR@         S          *
C                ALLOC      256      inFileStr@
C                ALLOC      256      OUTSTR@
C                EVAL       %str(inFileStr@:256)=%trimr(inFile)+x'00'
C                CALLP      QxmlInit(EnvData@)
C                IF        Qxml_DOMRTNCOD <> Qxml_DOMNOERROR
C                EVAL       %str(OUTSTR@:256)='Error: '
C                +%trimr(Qxml_Reserve)+x'25'+x'00'
C                CALLP      QxmlGenPrint(OUTSTR@:0)
C                RETURN
C                ENDIF
```

Main Program (continued)

Create DOM parser, parse input file

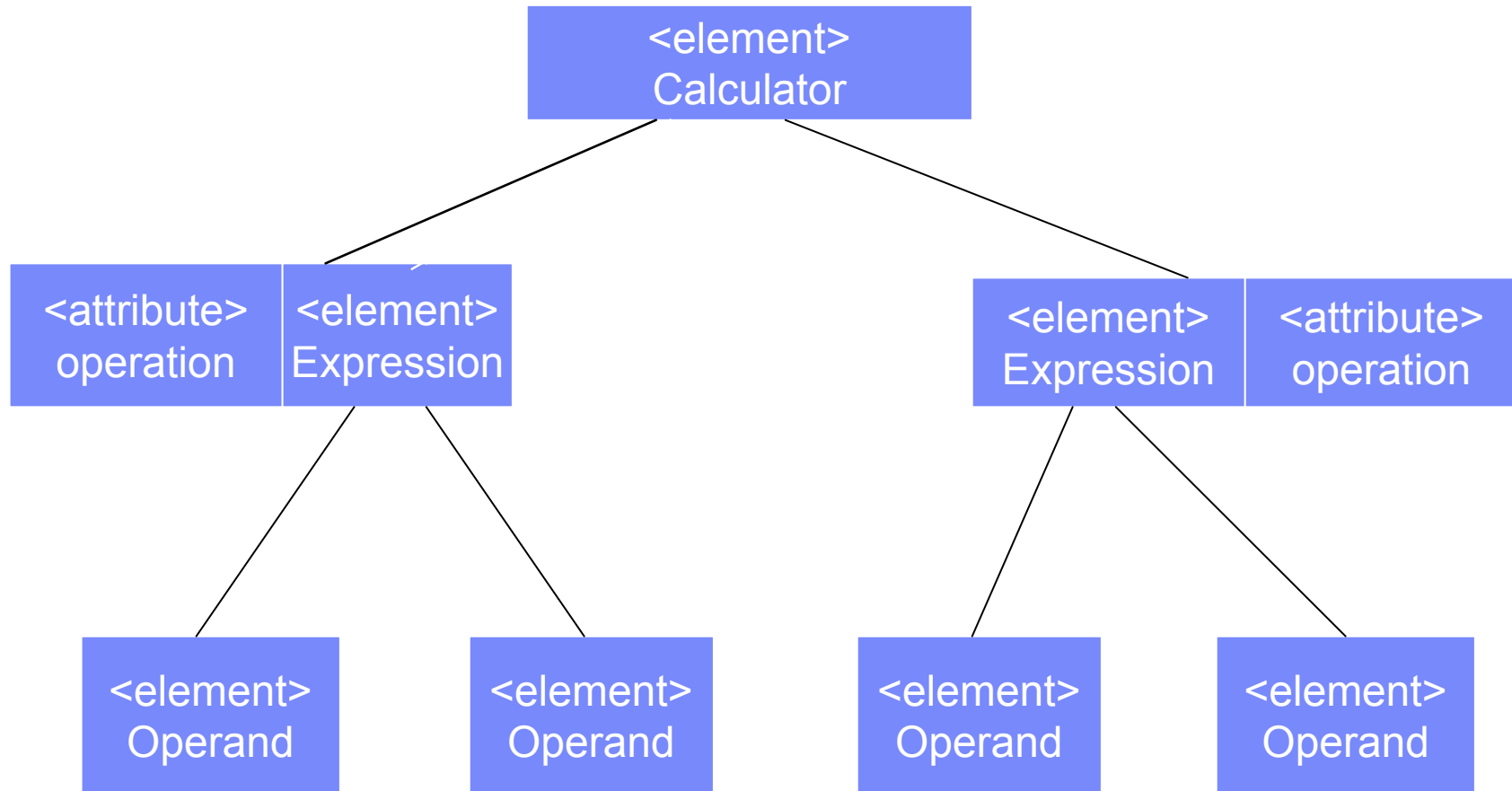
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```
C*
C      EVAL      parser@=QxmlXercesDOMParser_new(PEnvData@)
C      CALLP     QxmlXercesDOMParser_setValidationScheme(
C                parser@:
C                false)
C      CALLP     QxmlXercesDOMParser_parse_SystemId(Parser@:
C                inFileStr@:
C                Qxml_CHARSTR: 0)
C      If        Qxml_ErrorType <> 0
C      CALLP     PrintError
C      RETURN
C      ENDIF
```

C*

C*

C* Now the XML document is in a DOM tree (document)



Main Program (continued)

Get the document, process it

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```
C      EVAL      DomDoc@ = QxmlXercesDOMPARSER_getDocument
C                                     (parser@)
C      IF        DomDoc@ <> *null
C      CALLP    processDocument(DomDoc@)
C      ENDIF
```

Main Program (continued)

Don't forget to shut down the environment when done working with IBM @server iSeries the document and parser.

```
C*  
C      CALLP      QxmlIDOMDocument_delete(DomDoc@)  
C      CALLP      QxmlXercesDOMParser_delete(parser@)  
C      CALLP      QxmlTerm()  
C      RETURN
```

Traverse (Navigate) the DOM Tree

IBM  server iSeries

```
C      EVAL    rootElement@ = QxmlDOMDocument_getDocument...
C                               Element(domdoc@)
C      EVAL    rootName@ = QxmlDOMEElement_getTagName(
C                               rootElement@
C      IF      QxmlXMLString_compareString(rootName@:
C                               Qxml_UNICODE: 0:
C                               %ADDR(calculatorEI): Qxml_CHARSTR: 10) = 0
C      EVAL    curExpr@ = QxmlDOMNode_getFirstChild(
C                               rootElement@)
C      DOW     QxmlDOMNode_isNull(curExpr@) = false
C      EVAL    nodeName@ = QxmlDOMNode_getNodeName(curExpr@)
C      if      QxmlXMLString_compareString(nodeName@:
C                               Q xml_UNICODE: 0:
C                               %ADDR(expressionEI): Qxml_CHARSTR: 10) = 0
C      eval    val = evalExpression(curExpr@)
C      eval    %STR(OUTSTR@:256) = %trim(%editc(i: 'N')) +
C                               ': '+ %trim(%editc(val: 'N')) +
C                               x'25' + x'00'
C      CALLP   QxmlGenPrint(OUTSTR@:0)
C      eval    i = i + 1
C      endif
C      EVAL    curExpr@ = QxmlDOMNode_getNextSibling(
C                               curExpr@)
C      ENDDO
C      ELSE
C      ENDIF
PprocessDocument E
```

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Evaluate the expression

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```
C      EVAL      temp@ = QxmlDOMElement_getAttribute(  
C          domexpr@: %ADDR(operationAttr):  
C          Qxml_CHARSTR: 9)  
C      CALLP    QxmlTranscode(temp@: Qxml_UNICODE:  
C          %ADDR(operation): %ADDR(opProv):  
C          %ADDR(opAvail): Qxml_CHARSTR)  
C      EVAL      opslen = QxmlXMLString_stringLen(temp@:  
C          Qxml_UNICODE):  
C      EVAL      children@ = QxmlDOMElement_getElementsByTa...  
C          gName(domexpr@:  
C          %ADDR(operandEI):  
C          Qxml_CHARSTR: 7)  
C      EVAL      length =QxmlDOMNodeList_getLength(children@)  
C*  
C      DOW      operSet < 2 AND i < length  
C      EVAL      curNode@ = QxmlDOMNodeList_item(children@  
C          :i)  
C      EVAL      tempFloat = evalOperand(curNode@)  
C      IF      operSet = 0  
C      EVAL      oper1 = tempFloat  
C      EVAL      operSet = 1  
C      ELSE  
C      EVAL      oper2 = tempFloat  
C      EVAL      operSet = 2  
C      ENDIF  
C  
C      EVAL      i = i+1  
C      ENDDO
```

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Extract the data

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```
C      EVAL      text@ = QxmlDOMNode_getFirstChild(domoper@)
C      EVAL      nodeValue@ = QxmlDOMNode_getNodeValue(text@)
C      CALLP     QxmlTranscode(nodeValue@: Qxml_UNICODE:
C                %ADDR(transValue): %ADDR(provided):
C                %ADDR(available): Qxml_CHARSTR)
C      EVAL      nodeslen = QxmlXMLString_stringLen(
C                nodeValue@: Qxml_UNICODE)
C      EVAL      returnValue =
C                %dec(%subst(transValue:1:nodeslen)
C                :8:5)
C      RETURN    returnValue
```