XML in JADE White Paper

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jade

Contents

XML in JADE

Open communication - it's the key to any successful relationship. In the mid-90s, with the proliferation of new, enhanced, and increasingly divergent technologies, the question of how best to ensure ongoing interoperability between systems was crying out for an answer. That answer was found in 1997, and Extensible Markup Language (XML) was born.

Like HyperText Markup Language (HTML), XML is a markup language made up of sets of tags describing data. These tags are in turn interpreted by applications. Unlike HTML, XML does not have a prescribed set of tags into which you must shoehorn your information requirements. Rather than prescribing tags, XML defines a standard by which you can, in effect, create your own markup languages. The result is that an infinite number of tags can be created to describe information and used as part of an XML document. Unlike HTML, interpretation of XML is not restricted to a specific set of applications.

All of this delivers flexibility, improved efficiency, and provides the mechanism by which to achieve that all-important interoperability.

The XML framework in JADE has been implemented to enable rapid development of XML applications and XML components. Its objective is to make XML construction, manipulation, and interpretation as easy and as intuitive as possible.

This white paper and detailed examples illustrate just how the JADE XML framework achieves this objective.

XML Structure

Structurally, an XML document is an entity that "owns" a set of other XML nodes. Although it must have a root element, you can optionally include any of the following nodes.

- Declarations
- Processing instructions
- Elements
- Character data

Elements are the essential individual components of XML content. They contain both the data and the markup that describes that data. The ability to group and nest user-defined elements within one another provides much of the extensibility of XML. The rest is provided by allowing you to define the rules by which the XML tree structure is to be interpreted.

All languages have rules to which users must adhere in order to be understood. In spoken languages, this means:

- Including the appropriate subjects, objects, and verbs
- Using correct vocabulary
- Applying the correct grammatical rules

Well-formed XML

"But XML allows me to create my own language. Surely there are no rules". Well, yes and no.

While XML is not restricted by a set of available tags and it allows you to create your own markup, there are still overarching rules that you must follow. Adherence to these rules results in XML that is well-formed. By definition, a well-formed XML document is one that syntactically conforms to the World Wide Web Consortium (W3C) XML Specification.

Essentially, using the spoken language parallel, this means that the right components of a sentence must be included and spelled correctly. An example in XML is that a processing instruction must always begin with the **<?** characters.

Valid XML

Unfortunately, having a sentence that includes the correct components does not necessarily result in something that makes sense. The words need to be included in the correct order and conform to grammatical rules. In this, XML is no different. However, as users of XML are effectively creating their own markup language, these rules are theirs to define. This is done through the Document Type Definition (a type of declaration) or more-recently, XML Schema.

An XML Schema definition is effectively a DTD written in XML, with all of the accompanying benefits of extensibility. Another added advantage is its support for data types in describing the rules for an XML document's content.

To be structured and interpreted correctly, XML documents must be both well-formed and valid.

Why XML?

The best way to answer this question is to outline the background to its emergence as a global standard for communications between heterogeneous systems.

A Short History

The development of XML is a result of the evolution of markup languages, designed to capitalize on the advantages while overcoming the disadvantages of its two precursors; that is, Standard Generalized Markup Language (SGML) and HTML.

Like XML, SGML does not impose on you the use of specific tags, and therein lies its power and flexibility. Unfortunately, there the similarities end. Simple, widely supported tools with a low cost of entry are not easy to come by.

HTML was originally designed as a simplified version of SGML to be accessible to a wider range of users of varying knowledge and abilities. Its simplicity, coupled with the fact it was free and compatible with Web browsers, resulted in rapid widespread adoption. The downside is that in simplifying SGML, much of the associated power and flexibility was lost. With its finite set of tags, primarily concerned with information presentation and layout in browsers, use of HTML to structure any set of data for a range of uses is just not an option.

A clear need was identified for a markup language that delivered the flexibility, extensibility, and portability of SGML, combined with the simplicity of HTML. That it should also be free was obvious and that it be developed in a way that was easy for applications to develop functionality to support it was essential.

W3C sponsored a group of developers to come up with the solution, with XML being the result. In 1998, the W3C XML Specification Version 1.0 was approved and it is still the standard. That this is the case is a strong testament to the fact that the work carried out by the original group of developers of XML was right on the money. However, developers the world over will be familiar with how quickly business needs evolve.

No sooner has one dream been delivered and a new one has been formulated, the predecessor is taken for granted. While the XML specification has well and truly earned the title of a standard, the associated technology that uses XML has rapidly evolved.

XML versus Web Services

As a standard for communication between systems, by nature XML has limitless application, including:

- Populating data on Web pages
- Framing data used in complex inquiries and transactions
- Producing files for interpretation by a wide range of systems
- Streaming data from one application to another XML can be understood and interpreted by all

To explain the difference between XML and Web services, let's look at a situation that presents itself to most of us many times each day. You receive a phone call from a colleague or family member asking you to carry out a task and get back to them with the result. Implicitly, all of the following decisions and abilities are in place.

1. You have both decided to use a common language (for example, English)
2. You both conform to grammatical rules and acceptable vocabulary (for example, English grammar and words)
3. You both understand the meaning of that vocabulary (for example, please run the **xyz** report)
4. You both know what you can do for each other and how to get each other to do it (for example, that you can provide the other person with the data to run the **xyz** report and he or she can run it)
5. You are able to act upon the request received (for example, you are able to run the report and provide him or her with the information)
6. They are able to understand the information returned (for example, he or she can understand the report)
7. You have both agreed on a mechanism by which the exchange is facilitated (for example, you know each other's phone number)

All of the above can be broadly cast into the following three separate areas of understanding.

- Language
- Meaning and behavior
- How to establish a dialog

The situation is similar when two systems need to communicate. Use of XML is effectively an agreement to use a common language. However, both systems must be able to know all of the other details required to interact. To continue with the analogy, you and your colleagues speak the same language, understand each other's capabilities, how to make contact, make meaningful requests, and understand responses. You know this through experience with each other and training.

Use of Web services makes it possible for an application to publish language, behavior, and connection information about itself. This information can then be used by other systems that want to interact with it. The document that provides this description (also written in XML) is known as a Web Services Description Language (WSDL) and includes the following.

- Language
  - XML
  - Vocabulary and type definitions (for example, XML Schema)
- Meaning and behavior

- Operations and messages
- Exposed methods and properties

- How to establish a dialog
  - Connection types
  - Connection ports
  - Communication method; for example, Simple Object Access Protocol (SOAP)

Use of Web services is equivalent to you publishing who you are, what language you speak, what you can do for anyone, what you need to do it for them, how you will respond, where they can contact you, and how they should communicate.

XML on its own is only the language component of the broader Web services functionality, but it is significant in that it's the foundation on which it's all built. It can also be used effectively by itself, and this white paper covers how you can do this in JADE.

JADE provides SOAP Web services functionality. For details, see the *SOAP Web Services White Paper*.

JADE XML

The JADE XML framework has been developed to provide the ability to create, interpret, and manipulate XML using JADE code, and designed with the JADE developer in mind.

Objectives

The objectives of the JADE XML framework are to:

- Enable rapid development of XML applications and XML components in JADE
- Make the most-common XML development tasks easy and intuitive

Using XML in JADE

How do you actually go about working with XML in JADE? What's involved? Most importantly, how the is use of XML in JADE made easier?

A number of classes exist in the RootSchema that contain all of the methods, references, and properties you require to create, manipulate, and interpret well-formed and valid XML using JADE code.

These classes can be separated into two groups with two distinct purposes.

1. The first group is primarily concerned with the creation and manipulation of XML.
2. The second relates to the processing or interpretation of XML.

Creating and Manipulating XML

The XML framework in JADE allows you to create and manipulate XML through the creation of objects upon which you can carry out operations, and to which you can make property alterations, just like anything else you might do in JADE. As these objects are treated and behave in the same way as other JADE objects, there is very little new material for you to learn.

The inherent ease and flexibility of JADE, coupled with the extensibility of XML, makes for a powerful partnership. This section and its subsections discuss how the XML framework in JADE has been implemented, its individual components, and how they are used to generate XML.

Overview

As discussed earlier, an XML document is comprised of a set of entities, with components that can include:

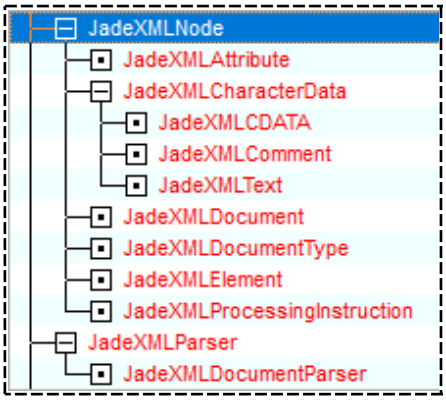
- Declarations
- Processing instructions
- Elements
  - Attributes
- Character data

All of these components and their variants have corresponding classes provided in the JADE RootSchema. It is with these classes that you can use JADE to model an XML tree structure from an external XML document source or from your own JADE database.

The objects created when modeling XML actually mirror the visual structure of the real-life document, making use intuitive.

Including the document itself, all of the XML entities have properties in common with each other and common actions are taken upon them.

All XML classes are grouped under one abstract superclass, **JadeXMLNode**, as shown in the following image.



A full class diagram is provided in the following topic.

As useful as these system classes are for creating and manipulating XML, it was important to us to ensure that you have the flexibility to adapt and extend what has been provided to suit your own unique needs. The result is that you can add your own methods and user subclasses, allowing you to capitalize on existing functionality without being restricted in any way.

Before giving an example of JADE code creating an XML document, we will look at each of the JadeXMLNode subclasses and how they relate to XML components.

Example Reference

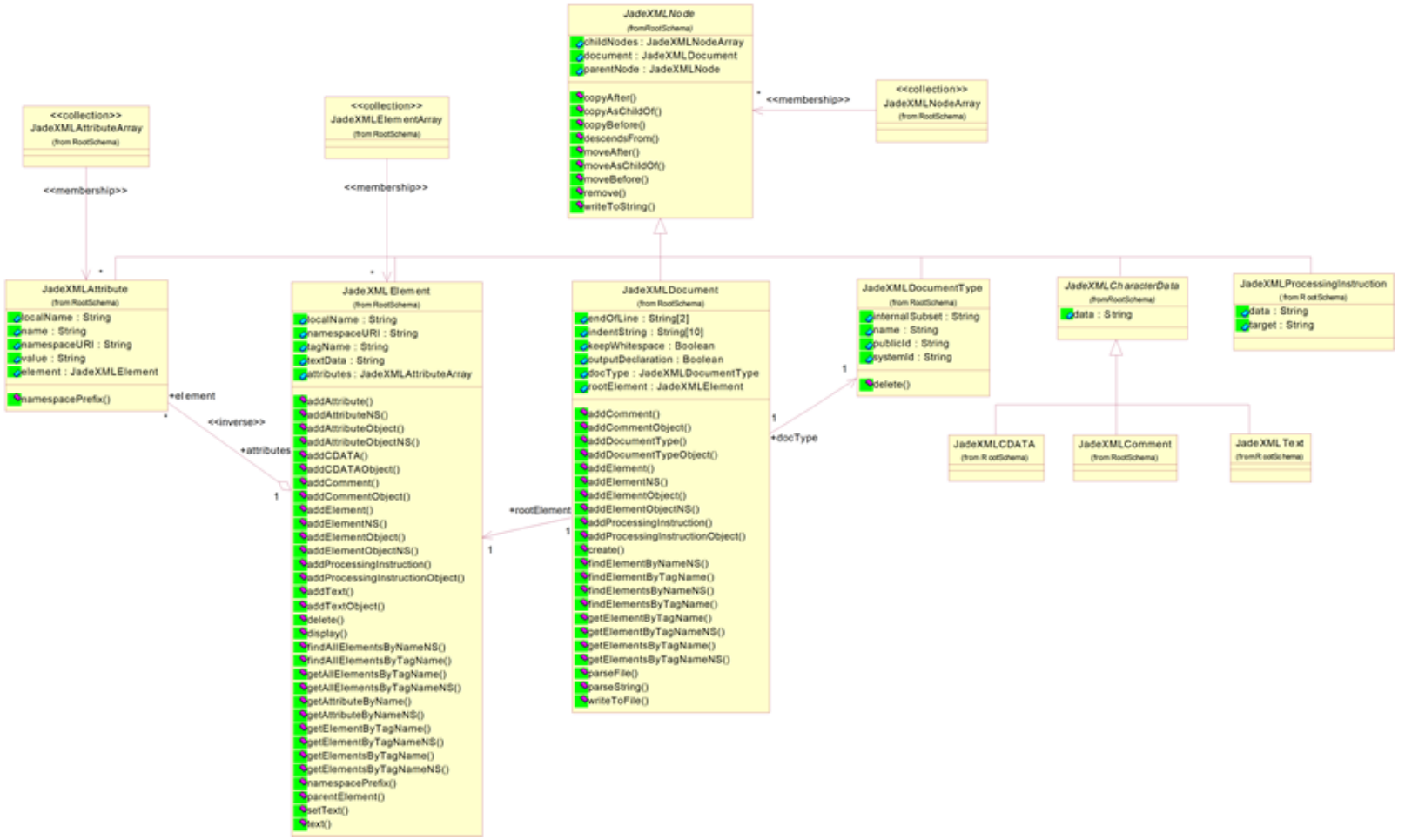
The following is an example XML document, complete with declarations, processing instructions, elements, and attributes. This example is used as a reference in discussing each of the **JadeXMLNode** subclasses.

Note that the numbers at the left of the example are not part of the XML document; rather they are used as a reference tool.

```
 1. <?xml version="1.0"?>
 2. <?xml-stylesheet type="text/xsl" href="peopleresults.xsl"?>
 3. <!DOCTYPE PEOPLE_DETAILS [
        <!ELEMENT PEOPLE_DETAILS ANY>
        <!ELEMENT PERSON_DETAILS (PERSON_FIRST_NAME, PERSON_LAST_NAME, OCCUPATION,
            CONTACT_DETAILS)>
        <!ELEMENT PERSON_FIRST_NAME (#PCDATA)>
        <!ELEMENT PERSON_LAST_NAME (#PCDATA)>
        <!ELEMENT OCCUPATION (#PCDATA)>
        <!ELEMENT CONTACT_DETAILS (EMAIL+, PHONE+)>
        <!ELEMENT EMAIL (#PCDATA)>
        <!ELEMENT PHONE (#PCDATA)> ]>
 4. <!--This document includes Person Details-->
 5. <PEOPLE_DETAILS>
 6. <PERSON_DETAILS>
 7. <PERSON_FIRST_NAME>Joanne</PERSON_FIRST_NAME>
 8. <PERSON_LAST_NAME>Howard</PERSON_LAST_NAME>
 9. <OCCUPATION>Chief Executive Officer</OCCUPATION>
10. <CONTACT_DETAILS>
11. <EMAIL TYPE="Work">j.howard@company.com.au</EMAIL>
12. <PHONE TYPE="Home">+61 2 9256 2222</PHONE>
13. <PHONE TYPE="Work">+61 2 9246 4621</PHONE>
14.             <PHONE TYPE="Cell">+61 41 378 6787</PHONE>
            </CONTACT_DETAILS>
        </PERSON_DETAILS>
    </PEOPLE_DETAILS>
```

Note The use of capital letters in the above XML tags (and other examples throughout this white paper) is only a convention and not at all a requirement.

The following diagram shows the structure of the **JadeXMLNode** class and its subclasses.



JadeXMLNode Class and Subclasses

As stated earlier, all XML nodes share common properties and are subject to common operations. Perhaps the most demonstrable example of this is illustrated in the recursive structure of XML documents.

All XML nodes can be both a parent and child of other nodes in an XML tree structure, and they can all belong to an owning document. These relationships are specified in the **parentNode** and **childNodes** reference properties, while the **document** reference property links the node with its owning **JadeXMLDocument** class.

Every numbered item in the XML document in "Example Reference", earlier in this white paper, represents an instance of a **JadeXMLNode** subclass. Each node can be copied, moved, or removed, and it can output its XML representation.

The abstract **JadeXMLNode** class provides you with the reference properties and methods that are inherited and available for use across its subclasses.

Note You can create your own persistent user subclasses of the **JadeXMLNode** subclasses. For more details, see "Appendix A – Persisting XML", later in this white paper.

JadeXMLDocument Class

You can represent an XML document as a tree structure in JADE, with each node in the tree corresponding to an object.

The **JadeXMLDocument** class acts as the owning object of those objects. In other words, it's the ultimate parent node. Once instantiated, you can treat it as you would any other object in JADE.

As management of the document and its contents is a key part of utilizing XML effectively, methods have been provided to assist you with adding, copying, moving, and getting nodes within the document structure.

Each of the elements, processing instructions, and declarations in the XML document in "Example Reference", earlier in this white paper, belong to an instance of **JadeXMLDocument**.

JadeXMLElement Class

Equally as important as the document itself, the elements it contains are responsible for describing and recording the data in your XML tree structure. These elements are represented by instances of the **JadeXMLElement** class and are associated with one another in a tree of objects, reflecting their physical layout in an XML document.

The importance of elements is reflected by the methods provided by JADE to support the actions you will most frequently take upon them as a developer, while allowing you to implement your own behaviors as well.

When looking at the XML document in "Example Reference", earlier in this white paper, every opening tag pair, including **PEOPLE_DETAILS**, is an element. **PEOPLE_DETAILS** is known as the root element of the document. In JADE, defining the data or textual content for an element is usually done through updating the **textData** property of the **JadeXMLElement** object. Using this approach results in reduced processing time and improves parsing performance. However, there is another option, which is discussed in "JadeXMLText Class", later in this white paper.

The following code example creates an XML document and constructs a tree of elements within it.

```
vars
    xmlDoc : JadeXMLDocument;
    elmnt  : JadeXMLElement;
begin
    create xmlDoc transient;
    elmnt := xmlDoc.addElement("PEOPLE_DETAILS");
    elmnt := elmnt.addElement("PERSON_DETAILS");
```

```
    elmnt := elmnt.addElement("PERSON_FIRST_NAME");
    elmnt.setText("John");
    write xmlDoc.writeToString;
epilog
    delete xmlDoc;
end;
```

Note Unless otherwise specified, XML objects are created as transient objects.

The above code example results in a tree of objects being created, as displayed in the diagram of the JADE XML nodes created by the above code.

The **addElement** method is used repeatedly and is available on both the **JadeXMLDocument** and **JadeXMLElement** classes. Essentially, the two methods are the same. The only difference is that on **JadeXMLDocument**, the method also sets the **rootElement** reference to the element that is created. A document can have one root element only.

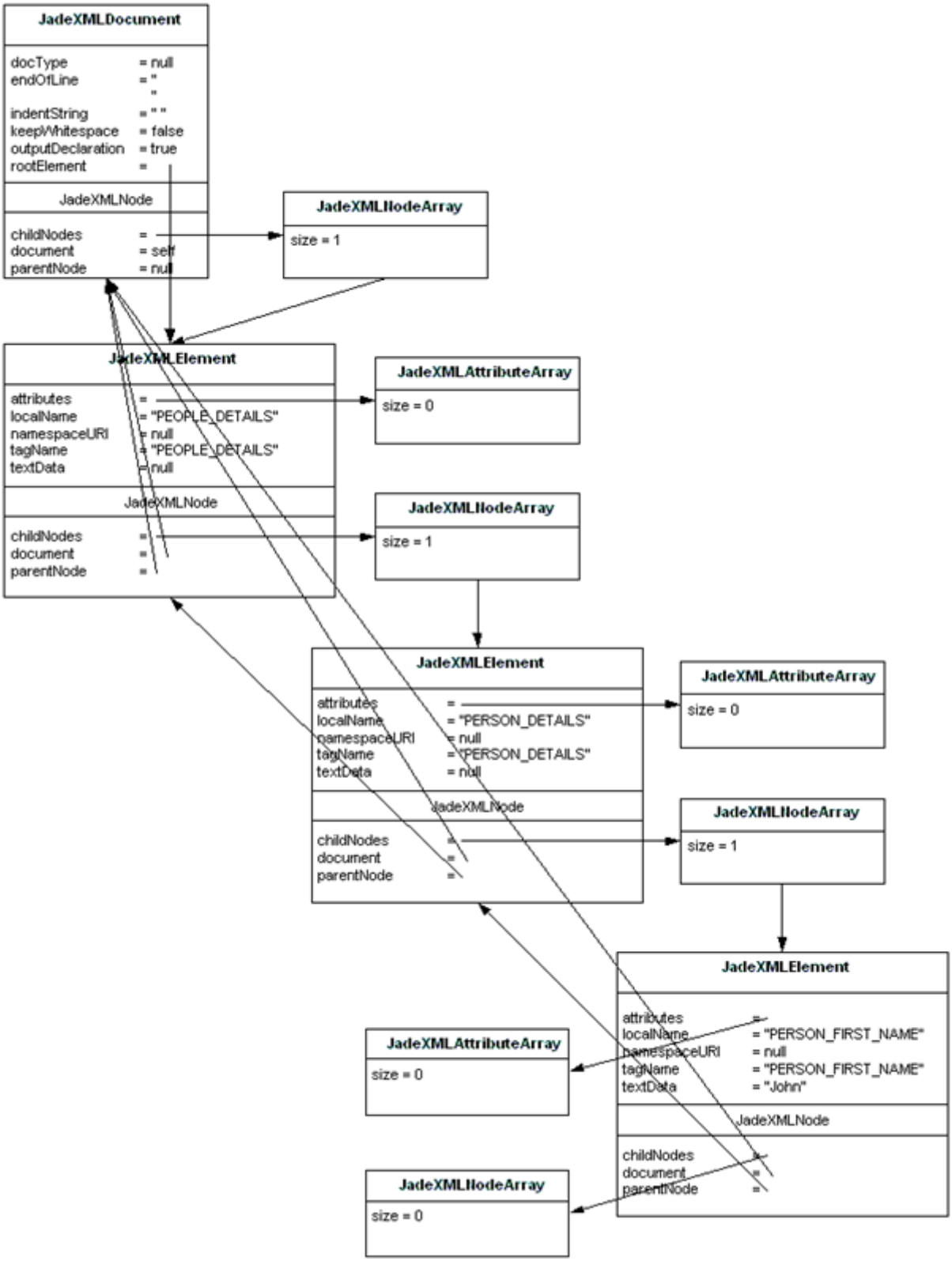
The method creates a new instance of **JadeXMLElement** as a child node of the object for which it is called, but it also returns the newly created element, making it available to be assigned to a local variable. This allows you to work with it further. The above code therefore creates **PEOPLE_DETAILS** as a child node (and the root element) of the XML Document and then assigns that element to the **elmnt** variable.

The **addElement** method, which has the following format, is used in the same way throughout the examples in this white paper. The *element-to-work-with* variable is always of type **JadeXMLElement** and the *parent-node-you-are-adding-to* variable is of type **JadeXMLDocument** or **JadeXMLElement**.

```
element-to-work-with :=
    parent-node-you-are-adding-to.addElement("element-to-work-with-tag-name");
element-to-work-with.setText("element-to-work-with-data");
```

All methods that begin with **add** but do not end in **Object** behave in the same way as **addElement**. Those methods that *do* end in **Object** are similar, but are generally used in the context of user subclasses. For details, see "Appendix A – Persisting XML", later in this white paper.

The **writeToString** method, when called for the **xmlDoc** object, produces the following XML tree structure.



The following is an example of the XML String created by the previous JADE code example.

```
<?xml version="1.0"?>
<PEOPLE_DETAILS>
    <PERSON_DETAILS>
        <PERSON_FIRST_NAME>John</PERSON_FIRST_NAME>
    </PERSON_DETAILS>
<PEOPLE_DETAILS>
```

JadeXMLDocumentType Class

As mentioned in "Valid XML" earlier in this white paper, XML Document Type Definitions determine the grammar and vocabulary of the markup used in the XML document. It is the mechanism by which rules are established to validate XML structure, inclusions, exclusions, and so on.

Item 3 in the XML document in "Example Reference", earlier in this white paper, covers the Document Type Definition. It states that the **PERSON_DETAILS** element must have children elements of **PERSON_FIRST_NAME**, **PERSON_LAST_NAME**, **OCCUPATION**, and **CONTACT_DETAILS**. An additional rule is specified regarding the **CONTACT_DETAILS** element, stating that it must have one or more **EMAIL** child elements, followed by one or more **PHONE** child elements. To be considered valid, the XML tree structure must conform to these rules; however, the JADE parser is non-validating.

The **JadeXMLDocumentType** class represents the document type declaration in an XML document tree. A reference to the document type (if the document has one) is stored in the **docType** property of the **JadeXMLDocument** class.

JadeXMLProcessingInstruction Class

The **JadeXMLProcessingInstruction** class represents a processing instruction in an XML document tree. Processing instructions are application-specific instructions on how to handle an XML document after the document has been parsed.

Item 2 in the XML document in "Example Reference", earlier in this white paper, represents a processing instruction. In this case, it is providing style sheet information that can be applied by an application such as an Internet browser. This means that XML can be sent to the browser and it can present the included information in the intended format.

Creating XML processing instructions is a simple matter of calling the **addProcessingInstruction** method for the **JadeXMLDocument** or **JadeXMLElement** class to which you want to add the instruction. The target application and instructions are then passed into the method as parameters.

JadeXMLAttribute Class

As with HTML, XML elements can have attributes.

Each of the elements with a **parentNode** property value of **CONTACT_DETAILS** has a **TYPE** attribute. This attribute is used to describe the type of contact detail that the element contains, whether it is a home or work contact, and so on.

The **JadeXMLAttribute** class is used to represent an attribute of an XML element in your XML document tree. It will have a name, an optional namespace, and a value. It is added by calling the **addAttribute** method for the element to which you want to add the attribute.

JadeXMLCharacterData Class

XML defines Character Data to be the text that falls within XML start and end tags. It can be any Unicode character with the exception of **<**, which is reserved to denote the beginning of a tag.

This sounds fairly simple, but why have a class, or indeed a set of classes, to cover it?

The **JadeXMLCharacterData** class is the abstract superclass of character-based nodes in an XML document tree. These nodes include the text, CDATA, and comment nodes.

JadeXMLCDATA Class

There are times when you may want to use certain characters inside XML tags that are reserved for specific markup purposes; for example, quotation marks. These are used in markup to surround the attribute values of XML elements. If, however, you want to use actual quotation marks within an attribute value (that is, within another set of markup quotation marks), you must replace it with an entity reference or create a CDATA string with those quotation marks included.

Instances of the **JadeXMLCDATA** class automatically escape blocks of text for correct representation in XML.

The **JadeXMLCDATA** class is a subclass of the **JadeXMLCharacterData** class but it does not add any additional properties or methods.

JadeXMLComment Class

In JADE, single-line comments are preceded by **//**, while multiple-line comments are surrounded by **/*** and ***/**.

XML also provides the facility for including comments in the body of XML documents. Comment tags begin with **<!--** and end with **-->**. To create an XML comment in JADE, an instance of the **JadeXMLComment** class is created and the data property set to the **String** value of the comment.

Item 4 in the XML document in "Example Reference", earlier in this white paper, is an XML comment. In JADE, the data property would be the equivalent of "This document includes Person Details".

The **JadeXMLComment** class is a subclass of **JadeXMLCharacterData**, but it does not add any additional properties or methods.

JadeXMLText Class

The **JadeXMLText** class represents the textual content within an XML document tree.

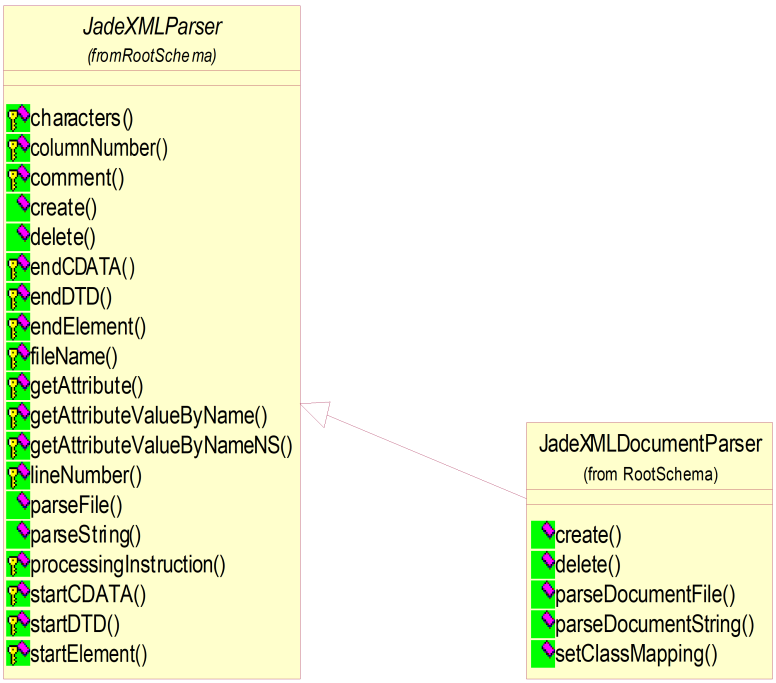
Normally, to set the value for a **JadeXMLElement**, you would simply set the **textData** property of that **JadeXMLElement** instance. Using this approach reduces the size of the XML document tree and improves parsing performance.

However, an alternative has been provided that allows you to create instances of the **JadeXMLText** class as child nodes of the element for which they represent a value. Where multiple instances exist, the values of their respective data properties are concatenated and returned within the start and end tags of their parent node element.

Interpreting XML

In most cases, you will find that simply creating and manipulating XML isn't enough to meet your requirements. Conversations are much more rewarding if they are two-way, which means that you need to be able to interpret XML as well. With an in-built XML document parser and facilities in place that enable you to build your own, the JADE XML framework makes this easy for you.

The following diagram shows the **JadeXMLParser** class with its **JadeXMLDocument** subclass.



JadeXMLParser Class

The purpose of the abstract **JadeXMLParser** class is to provide a base on which you can create your own parser subclasses that can be used as the interface for parsing XML documents.

The fundamental properties and methods required to parse XML documents are provided with this class.

JadeXMLDocumentParser Class

One parser implementation is already provided. The **JadeXMLDocumentParser** class is a transient-only class that provides the interface for parsing XML documents into a tree of objects. The parser reads an XML file and creates a tree of object nodes that are instances of **JadeXMLNode** subclasses or your own subclasses.

This class enables you to take an XML file or **String** and create a tree of XML nodes, like that shown in the XML tree structure diagram under "JadeXMLElement Class", earlier in this white paper. The following JADE code is an example of parsing an XML document.

```
vars
    xmlDoc : JadeXMLDocument;
    parser : JadeXMLDocumentParser;
begin
    create xmlDoc transient;
    create parser transient;
    parser.parseDocumentFile(xmlDoc, "c:\XMLDocument.xml");
    xmlDoc.inspectModal;
epilog
    delete xmlDoc;
    delete parser;
end;
```

Executing this code takes the file **XMLDocument.xml** file, parses it, and creates an XML tree structure with **xmlDoc** as the owning document object. These objects can then be used and manipulated in the same way as any other JADE objects. The **inspectModal** method invokes the Schema Inspector, allowing you to review the tree of objects created.

Examples

This section and its subsection explore two different examples of XML creation, manipulation, and interpretation using JADE code.

There will be times when you will want to create an XML tree structure using information in your database, and write it to file. While very useful, it will also be imperative to import an XML file from which you can build an XML tree structure.

Other situations will call for a greater level of direct interaction. You will have two applications that will need to communicate on a real-time basis, with one retrieving information from the database of the other and sending instructions for specified updates.

File In/File Out

This section and its subsections demonstrate how the first of these situations can be supported in JADE.

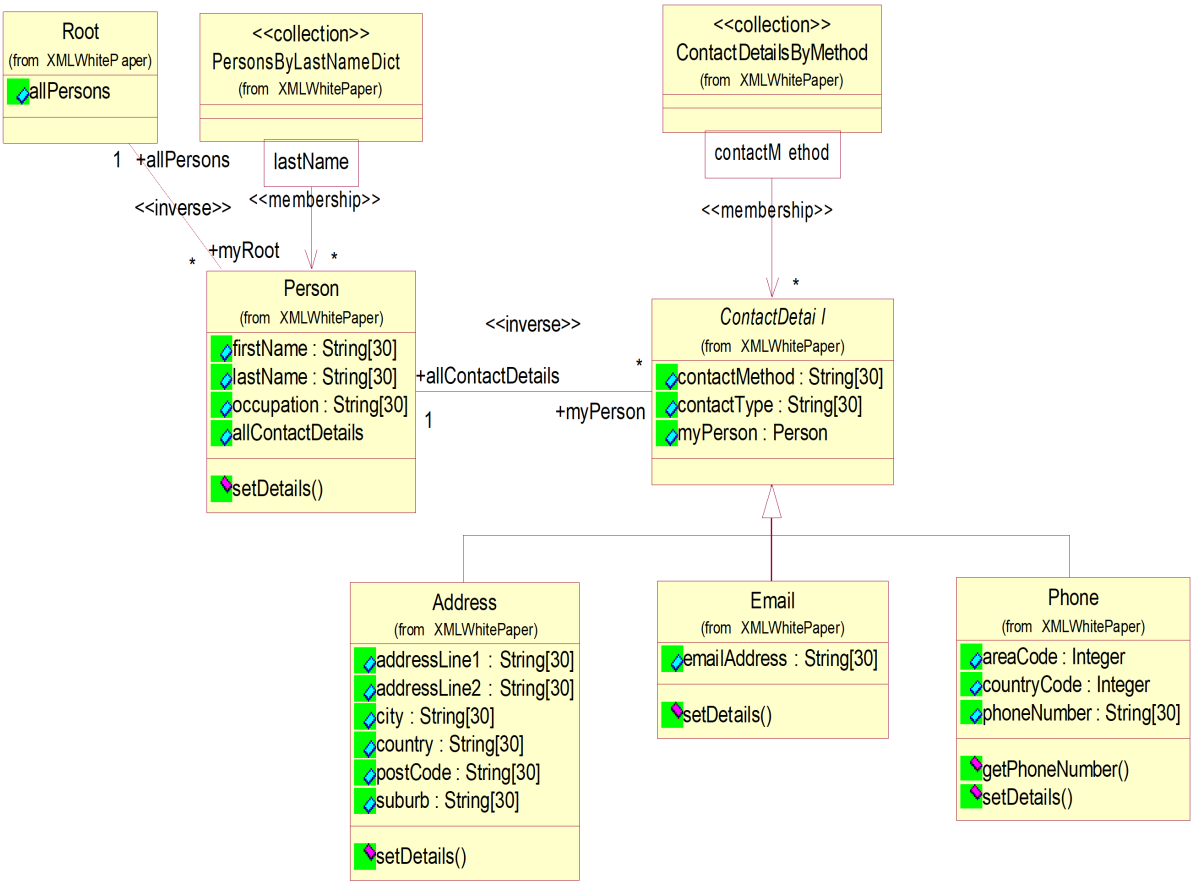
Scenario

You have a database that stores details of people, and you would like to export that information as an XML document. You would also like the ability to import an XML document structured in the same way as the one you have output, and create person records according to the information it contains.

In your database, each instance of the **Person** class contains the following information.

- First name
- Last name
- Occupation
- Address
- Home phone number
- Work phone number
- Cell phone number
- E-mail address

The following scenario class diagram shows how the information is structured in the database.



Instructions

This section and its subsections contain the instructions that result in the export and import of an XML document using JADE.

General set-up instructions are covered first, followed by an export and import scenario. The "Explanation" section later in this white paper explains what happens programmatically in each of the scenarios.

General Setup

To set up XML in JADE

1. Download the XML white paper files from the **JADE-WP-XML** link at https://github.com/jadesoftwarenz. to your **c:** drive.

   As a new directory is created, we recommend that you don't change the extract path to anything other than **c:**, because instructions and methods throughout this "Examples" section rely on the path remaining the same.

2. Navigate to **c:\JadeXMLWhitePaper**. This new directory contains:

   - People to Import 1.xml
   - People to Import 2.xml

- Persistent XML Structure.xml
- XMLWhitePaper.scm
- XMLWhitePaper.ddb
- XMLWeb (directory)
- XMLWeb_jadehttp (directory)

3. Load the **XMLWhitePaper** schema and forms definition files into your JADE development environment.
4. Navigate to the **JadeScript** class, select the **setupAllData** method, and then execute the script by pressing the F9 key.

Exporting an XML Document

To export an XML document

1. Select the **listPeople** method and then execute the script by pressing the F9 key.

   This method outputs a list of the **Person** objects from the database. The list is output to a Jade Interpreter Output Viewer.

   The XML document created in the next step contains details of all these objects, including contact information. Use the output to check that all objects are represented in the XML document that is produced.

2. Select the **createPeopleXMLDocument** method, which iterates through all instances of the **Person** class and creates an XML file.

   The file is called **People Exported.xml** in your **c:\JadeXMLWhitePaper** directory.

3. Execute the script by pressing the F9 key.
4. Review the XML file that is produced.

Importing an XML Document

To import an XML document

1. Review the **c:\JadeXMLWhitePaper\People to Import 1.xml** file.

   This file contains the details of people that will be imported.

2. Select the **JadeScript** class **importPeople** method and then press the F9 key to execute the script.

   This method processes the specified **People to Import.xml** file and creates instances of the **Person** class, populating them with the details contained in the file.

3. Select the **JadeScript** class **listPeople** method.

   The output of this script shows the details of all people, including those added to the database by the **importPeople** method.

Explanation

This section and its subsections covers what happened when you ran the scripts in previous sections of this white paper, and illustrates how easily the JADE XML framework enables production and interpretation of XML.

Export Explanation

JadeScript::createPeopleXMLDocument Method

The **JadeScript** class **createPeopleXMLDocument** method begins by creating a transient instance of the **JadeXMLDocument** class, adding a comment and a document type declaration. The next step is to add a root element to the document.

As the document will contain details of person objects, the element will be named **PEOPLE_DETAILS**; that is:

```
rootElement := xmlDoc.addElement("PEOPLE_DETAILS");
```

The **addElement** method is available on both the **JadeXMLDocument** and **JadeXMLElement** classes and is explained further in "JadeXMLElement Class", earlier in this white paper.

The next step is to move through each instance of **Person** and add the details under the root element in a logical structure, as shown in the following code fragment.

```
foreach person in root.allPersons do
    pers := rootElement.addElement("PERSON_DETAILS");
    elmnt := pers.addElement("PERSON_FIRST_NAME");
    elmnt.setText(person.firstName);
    elmnt := pers.addElement("PERSON_LAST_NAME");
    elmnt.setText(person.lastName);
```

In the above code fragment, **pers** is used to denote the element that frames the information associated with an individual person. For every **Person** instance, an element of **PERSON_DETAILS** is therefore added to the root element **(PEOPLE_DETAILS)** of the document.

Details directly associated with the person are then added as child nodes of the **PERSON_DETAILS** element. In the above code fragment, **PERSON_FIRST_NAME** is added as a child node of **PERSON_DETAILS**. The created element is then assigned to the **elmnt** variable. The text for **elmnt** is then set to the database value of **firstName** for the **Person** instance. The **elmnt** variable is then changed with the addition of the **PERSON_LAST_NAME** element as a child node of the **PERSON_DETAILS** element, and the process is repeated.

We next step through each of the contact details for the person record and then group those details together. Consideration needs to be given to the different types of contact details, as shown in the following code fragment.

```
contact := pers.addElement("CONTACT_DETAILS");
foreach contDet in person.allContactDetails do
    if contDet.isKindOf(Address) then
        address := contDet.Address;
        addr := contact.addElement("ADDRESS_DETAILS");
        addr.addAttribute("TYPE", address.contactType);
        elmnt := addr.addElement("ADDRESS_LINE_1");
        elmnt.setText(address.addressLine1);
        elmnt := addr.addElement("ADDRESS_LINE_2");
        elmnt.setText(address.addressLine2);
```

The above code fragment creates an element of **CONTACT_DETAILS** under the **PERSON_DETAILS** element within which to group address, phone, and e-mail information.

Once the method has iterated through all instances of the **Person** class, the XML document tree that has been created is written to file by the **JadeXMLDocument** class **writeToFile** method. In this example, it is written to the **People Exported.xml** file in the **c:\JadeXMLWhitePaper** directory.

Import Explanation

JadeScript::importPeople Method

The **JadeScript** class **importPeople** method parses the XML document and creates an XML tree structure with transient JADE objects.

Once this is done, instances of **Person** are created and updated based on the details of those JADE objects.

```
vars
    xmlDoc : JadeXMLDocument;
    parser : JadeXMLDocumentParser;
begin
    create xmlDoc transient;
    create parser transient;
    parser.parseDocumentFile(xmlDoc, "c:\JadeXMLWhitePaper\People to
        Import 1.xml");
    createPeopleRecords(xmlDoc);
epilog
    delete xmlDoc;
    delete parser;
end;
```

JadeXMLDocumentParser::parseDocumentFile Method

The **JadeXMLDocumentParser** class **parseDocumentFile** method parses the specified file and builds a tree structure of XML node objects in JADE, based on the information the file contains. The resulting instance of the **JadeXMLDocument** class is then returned for further use.

JadeScript::createPeopleRecords Method

The **JadeScript** class **createPeopleRecords** method begins by assigning a value to the root variable and then creates transient instances of the **JadeXMLElementArray** class.

The next step is to evaluate the **JadeXMLDocument** provided in the method's parameter, as follows.

```
pXMLDocument.getElementsByTagName("PERSON_DETAILS", people);
```

All of the elements in the XML document with a **tagName** value of **PERSON_DETAILS** are found and added into the **JadeXMLElementArray** object represented by the **people** variable.

Because each **PERSON_DETAILS** element represents details associated with an individual person, a persistent instance of the **Person** class is created for each one, as shown in the following code fragment.

```
foreach elmnt in people do
    create person persistent;
```

The method then assigns values to the properties of the **Person** instance based on the **childNodes** of the **PERSON_DETAILS** element, as shown in the following code fragment.

```
firstName := elmnt.getElementByTagName("PERSON_FIRST_NAME").textData;
lastName := elmnt.getElementByTagName("PERSON_LAST_NAME").textData;
occupation := elmnt.getElementByTagName("OCCUPATION").textData;
person.setDetails(firstName, lastName, occupation);
```

The contact details of the person are then added one by one. First the parent contact details node is found and assigned to the **contDet** variable, as shown in the following code fragment.

```
contDet := elmnt.getElementByTagName("CONTACT_DETAILS");
```

Of the contact details, the address is processed first, as follows.

```
eladdr := contDet.getElementByTagName("ADDRESS_DETAILS");
if eladdr <> null then
```

```
create address persistent;
contactType := eladdr.getAttributeByName("TYPE").value;
addressLine1 := eladdr.getElementByTagName("ADDRESS_LINE_1").textData;
addressLine2 := eladdr.getElementByTagName("ADDRESS_LINE_2").textData;

suburb := eladdr.getElementByTagName("SUBURB").textData;
city := eladdr.getElementByTagName("CITY").textData;
country := eladdr.getElementByTagName("COUNTRY").textData;
postCode := eladdr.getElementByTagName("POSTCODE").textData;
address.setDetails(contactType, addressLine1, addressLine2,
    suburb, city, country, postCode);
```

The values of the **textData** properties of the various address elements are assigned to the properties of the **Address** instance that is created. When the address details have been updated, it is added to the **allContactDetails** collection on the **Person**, as follows.

```
person.allContactDetails.add(address);
```

All of the other contact details are processed in a similar way.

Data Streaming

While the preceding file in/file out example goes some way to demonstrating how to create and interpret XML files using JADE code, it is important for you to be able to interact on a real-time basis.

Note This example is designed only to work on a Windows operating system and to operate on the local host computer, rather than across a network.

Scenario

Using the same details as the file in/file out example, you require the ability to search over the **Person** objects in your database over the Internet. A Web browser will be used as the application with which to interact with your database.

Following good design practice, you want to decouple the database and presentation by returning XML from the server and using EXtensible Stylesheet Language (XSL) to generate the HTML.

You will search by first name and last name for the **Person** objects you want. An option will be included that allows you to produce an XML file based on the results of your search.

An import facility allows you to import an XML file, from which the application will create **Person** objects.

Note For this example to work, Microsoft Internet Information Server (IIS) must be installed on your machine.

Instructions

This section and its subsections contain the instructions that enable you to interact with XML files on a real-time basis.

General set-up instructions are covered first, followed by setting up IIS and an introduction to the application. The "Explanation" section later in this white paper explains the actions that are carried out, reviews the code, and explains how this communication takes place.

General Setup

If you haven't already done so, complete the general set-up steps, as follows.

1. Download the XML white paper files from the **JADE-WP-XML** link at https://github.com/jadesoftwarenz. to your **c:** drive.

   As a new directory is created, we recommend that you don't change the extract path to anything other than **c:**, because instructions and methods throughout this "Examples" section rely on the path remaining the same.

2. Navigate to **c:\JadeXMLWhitePaper**.

   This new directory contains:

   - People to Import 1.xml
   - People to Import 2.xml
   - Persistent XML Structure.xml
   - XMLWhitePaper.scm
   - XMLWhitePaper.ddb
   - XMLWeb (directory)
   - XMLWeb_jadehttp (directory)

3. Load the **XMLWhitePaper** schema and forms definition files into your JADE development environment.
4. Navigate to the **JadeScript** class, select the **setupAllData** method, and then execute the script by pressing the F9 key.

Setting Up IIS

» To set up IIS

1. In the **Administrative Tools** in the Windows Control Panel, select the **Internet Information Services (IIS) Manager** option.
2. Select **Default Web Site**, right-click, and then select **New, Virtual Directory**.
3. Specify **xmlweb** as the alias.
4. Click Next.
5. Browse to the **XMLWeb** subdirectory of your **c:\JadeXMLWhitePaper** directory, click OK, and then click Next.
6. Ensure that **Read**, **Run Scripts**, **Execute**, and **Browse** are selected.
7. Click Next, and then click Finish.

Application Introduction

» To access the application

1. From the JADE development environment, click the **Run Application** toolbar button and ensure that the **XMLWhitePaper** application is selected.
2. Click OK.
3. Navigate to the **XMLWeb** subdirectory of your **c:\JadeXMLWhitePaper** directory.

To authenticate your access to the application

1. Open **index.htm** in your Web browser.
2. Enter **test** in the **User Name** field, **xmlweb** in the **Password** field, and then click **Login**.

   At this point, a page is presented that enables you to search for people and optionally produce the results as an XML file that is created locally, or to import people from an XML file.

Note If you experience any problems, copy the **jadehttp.dll** file from your **bin** directory into the **XMLWeb** subdirectory of your **c:\JadeXMLWhitePaper** directory.

To search for a person

1. Enter **Dolce** in the **Last Name** field and then click **Person Search**.
2. Right-click in the results area of the page and then click **View Source**.

   You will see that the source is an XML document despite its formatted presentation in the Web browser. How this is achieved is explained later in this white paper.
3. Click the **Back** button in your browser.

To export an XML file

1. Ensure that the **First Name** and **Last Name** search criteria fields are blank.
2. Check the **Create File** check box and then enter **c:\JadeXMLWhitePaper\Search Results.xml** in the **File Name** text box.
3. Click the **Person Search** button.

   The details of the **Person** objects returned in the search have also been produced as an XML document called **Search Results.xml** in your **c:\JadeXMLWhitePaper** directory.
4. Click the **Back** button in your browser.

To import an XML file

1. Navigate to your **c:\JadeXMLWhitePaper** directory.
2. Open the **People to Import 2.xml** file and then review its contents.
3. Close the file.
4. In your Web browser, click the **Browse** button so that you can select a file to import.
5. Browse to your **c:\JadeXMLWhitePaper** directory and then select **People to Import 2.xml**.
6. Click the **Import** button.

   A confirmation screen then lists the people who have been imported.
7. Click the **Back** button in your browser.
8. Clear all of the search fields, including the **Create File** and **File Name** fields.
9. Click the **Person Search** button.

   The details of those people in the **People to Import 2.xml** file is now displayed among the search results.

Explanation

How exactly does all of the above happen? You have a Web page within a Web browser, and a JADE application. How are they communicating? How is it that raw XML can be passed back to the browser and be interpreted and displayed in a formatted way?

This section and its subsections explore each of the actions carried out in the previous data streaming instruction steps, reviews the code, and explains how this communication takes place.

Common Behavior

While each of the actions results in a different logical process, there are some common behaviors across all actions. Broadly speaking, these common behaviors are encapsulated in three separate actions.

- The request
- The response
- The formatting

For details, see the following sections.

The Request

In this scenario, the request of the JADE application is being made through a Web browser. This is the case for authentication, searching for people, and for both exporting and importing files.

How does the browser place this request? If you are familiar with HTML, you will be familiar with the **<form>** tag. These typically take details entered by users and execute an action on those details. The action is often defined by some kind of script, such as a CGI. In this example, all forms presented in the Web browser have the same action attribute value; that is:

```
http://localhost/xmlweb/jadehttp.dll?XMLWhitePaper
```

This is effectively providing the destination to which details entered in the various forms are sent once their submit buttons have been clicked.

A subclass of **JadeWebServiceProvider** has been created to act as the entry point for this information once it arrives. It is important to note that we are merely using the Web services framework to facilitate HTTP communications. No WSDL or SOAP functionality has been utilized.

WPXMLWebServiceProvider::processRequest Method

Navigate to the **WPXMLWebServiceProvider** class **processRequest** method, which is the first to receive the **incomingMessage** and is a re-implementation of a superclass method. However, **inheritMethod** has been commented out, meaning that we have overridden the standard Web service provider processing. Our goal is simply to receive the message and carry out a series of actions based on that message.

```
vars
    message : String;
begin
    rawXML := true;
    message := incomingMessage;
    procMessage(message);
    // inheritMethod();
end;
```

This method takes the information received and passes it into the **WPXMLWebServiceProvider** class **procMessage** method.

WPXMLWebServiceProvider::procMessage Method

The procMessage method takes the information received as a **String** and separates it out into its substrings that contain the separate components of the request. The method then assigns the values of these components to properties of the global transient **Application** object for later use.

The Response

WPXMLWebServiceProvider::reply Method

A re-implementation of a superclass method, the **WPXMLWebServiceProvider** class **reply** method sends an XML string back to the Web browser. Before it is ready to do this, however, it must carry out the necessary processing based on the information received in the request phase, and then build the response, as follows.

```
vars
    xml : String;
begin
    xml := buildXMLReply;
    return xml;
    // return inheritMethod();
end;
```

WPXMLWebServiceProvider::buildXMLReply Method

With details of the request stored in the **Application** object, the **WPXMLWebServiceProvider** class **buildXMLReply** method can:

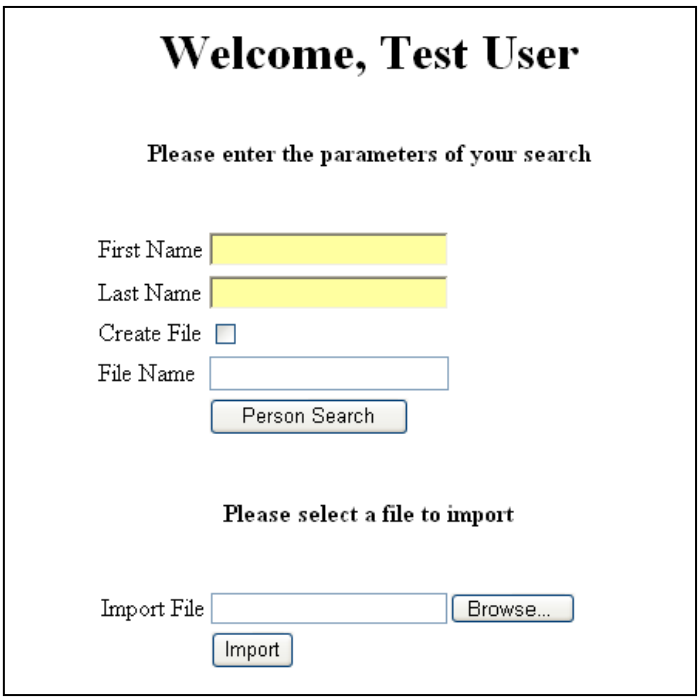
- Authenticate users
- Perform person searches
- Export details of person records to an XML file
- Import details of person records from an XML file

We will look at each of theses actions in more detail, considering the HTML, XSL, and most importantly, the JADE code involved in providing the required behavior.

The Format

If JADE is passing back raw XML to the browser, how does it present it in the browser in the way it does?

This is the only part that is handled externally from JADE, and it decouples the server-side from the presentation. For example, upon a successful login, the following dialog is displayed.



However, the source of this page and the information passed back from JADE is simply:

```
<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="welcome.xsl"?>
<!—Welcome Details-->
<USER>
    <FIRSTNAME>Test</FIRSTNAME>
    <LASTNAME>User</LASTNAME>
</USER>
```

The key to the formatting is in the **href="welcome.xsl"** part of the XML processing instruction. Your browser recognizes this statement and applies the **welcome.xsl** style sheet to the XML in the document, which results in the Welcome, Test User parameter search dialog shown in the previous image.

All responses sent to the Web browser in this example have an XSL style sheet to apply. The separation of the presentation from the data results in increased flexibility for the customer and for you. This way, the responsibility of the system is to provide the data and the customers are free to format it in their own way with their own branding, without requiring development extensions to the application.

Authentication

Having covered the common behavior, this section looks at what the JADE code is doing in the **XMLWhitePaper** application to authenticate the user and how it is building the XML response.

WPXMLWebServiceProvider::buildXMLReply Method

As stated in "Common Behavior", earlier in this white paper, the **WPXMLWebServiceProvider** class **buildXMLReply** method takes the values set on the global transient instance of **Application** and carries out the appropriate actions. In this case, we are looking at what happens when you log on.

When information is received from the search form, the **procMessage** method set the **xmlAction** value of **Application to AUTHENTICATE** (an Integer global constant of 1), so this is where we begin the review.

```
if app.xmlAction = AUTHENTICATE then
    username := app.login_username;
    password := app.login_password;
    if username <> null and password <> null then
        xmldoc := buildLoginResponse(username, password);
        xmlReply := xmldoc.writeToString;
    endif;
app.resetValues;
```

WPXMLWebServiceProvider::buildLoginResponse Method

The applicable values from the **Application** instance are assigned to local variables. These are then used as parameters in calling the **WPXMLWebServiceProvider** class **buildLoginResponse** method.

```
user := root.allUsers.getAtKey(pUsername);
create xmlDoc transient;
if user <> null then
    if user.password = pPassword then
       xmlDoc.addProcessingInstruction('xml:stylesheet
       type="text/xsl"', 'href="welcome.xsl"');
       xmlDoc.addComment('Welcome Details');
       rootElmnt := xmlDoc.addElement('USER');
       // the root element elmnt := rootElmnt.addElement('FIRSTNAME');
       elmnt.setText(user.firstname);
       elmnt := rootElmnt.addElement('LASTNAME');
       elmnt.setText(user.lastname);
```

This method begins by finding a **User** object with a user name that matches that received as a parameter from the **buildXMLReply** method. It then creates a transient instance of **JadeXMLDocument**. The method then carries out different actions. depending on whether there is a:

- User with the provided user name
- User and the provided password matches the actual password

In all cases, information is added to the **JadeXMLDocument** object.

The previous code fragment shows what happens when a matching user is found and the supplied password matches the value of the **password** property of the **User** object.

The first thing that happens is that a processing instruction is added to the document, followed by a comment. The next step is to add a root element to the document. To that root element, two further elements are added: **FIRSTNAME** and **LASTNAME**. The **User** details from the database are used to populate the **textData** properties of these elements.

WPXMLWebServiceProvider::buildXMLReply Method

The resulting **JadeXMLDocument** is then returned to the **WPXMLWebServiceProvider** class **buildXMLReply** method.

```
xmldoc := buildLoginResponse(username, password);
xmlReply := xmldoc.writeToString;
```

The instance of **JadeXMLDocument** returned by the **buildLoginResponse** method is then assigned to the **xmldoc** local variable. This is then written to a **String** and assigned to the **xmlReply** variable that is returned to the **reply** method.

As stated in "Common Behavior", earlier in this white paper, the **reply** method then sends this string to the browser.

The browser receives the XML String, initiates the processing instruction (XSL style sheet) that runs through the XML document, and then appropriately presents the information it contains.

Person Search and Export

In addition to the common behavior outlined earlier in this white paper, this section looks at what the JADE code is doing in the **XMLWhitePaper** application to search for person records, export the details of those records to file, and how it is building the XML response.

WPXMLWebServiceProvider::buildXMLReply Method

As stated in "Common Behavior", earlier in this white paper, the **WPXMLWebServiceProvider** class **buildXMLReply** method takes the values set on the global transient instance of **Application** and carries out the appropriate actions. In this case, we are looking at what happens when you conduct a person search.

When information is received from the search form, the **procMessage** method set the **xmlAction** value of **Application to SEARCH** (an Integer global constant of 2), so this is where we begin the review.

```
elseif app.xmlAction = SEARCH then
    firstname := app.srchFirstName;
    lastname := app.srchLastName;
    createFile := app.createFile;
    filename := app.xmlFilename;
    people := findPeople(firstname, lastname);
    xmldoc := buildPersonSearchResponse(people);
    xmlReply := xmldoc.writeToString;
    if createFile = EXPORT and filename <> null then
        createXMLFile(xmldoc, filename);
    endif;
    app.resetValues;
```

The applicable values of **Application** class properties are assigned to local variables prior to calling the **findPeople** method.

WPXMLWebServiceProvider::findPeople Method

The **WPXMLWebServiceProvider** class **findPeople** method takes two of those properties (that is, **firstname** and **lastname**) to search for people who match the parameters. Those that match are added to a transient instance of **PersonsByLastNameDict** by the **WPXMLWebServiceProvider** class **buildXMLReply** method.

```
people := findPeople(firstname, lastname);
xmldoc := buildPersonSearchResponse(people);
```

WPXMLWebServiceProvider::buildXMLReply Method

The **buildXMLReply** method then takes the **PersonsByLastNameDict** collection returned by the **findPeople** method, and assigns it to the people local variable.

This collection of person objects is then passed into the **buildPersonSearchResponse** method.

WPXMLWebServiceProvider::buildPersonSearchResponse Method

It is the **WPXMLWebServiceProvider** class **buildPersonSearchResponse** method that actually constructs the XML tree structure. It begins by adding processing instructions and declarations before adding the root element of **PEOPLE_DETAILS**. This tag encapsulates all data in the XML document.

It then iterates through the objects included in the **PersonsByLastNameDict** collection passed into it as a parameter from the **buildXMLReply** method. For every member of the collection, it creates a **PERSON_DETAILS** element under which it adds a tree structure of elements containing person information from the database.

The resulting **JadeXMLDocument** is then passed back to the **buildXMLReply** method.

WPXMLWebServiceProvider::buildXMLReply Method

The **WPXMLWebServiceProvider** class **buildXMLReply** method then takes the **JadeXMLDocument** created in the **buildPersonSearchResponse** method, converts it to a String, and assigns it to the **xmlReply** local variable.

```
xmlReply := xmldoc.writeToString;
```

The **xmlReply** variable is the String value returned to the **reply** method.

As stated in "Common Behavior", earlier in this white paper, the **reply** method then returns this String to the browser. The browser receives the XML string, initiates the processing instruction (XSL style sheet) that runs through the XML document, and then presents the appropriate information it contains.

There is an additional action taken in this section of the **buildXMLReply** method that is dependent on a parameter entered by the user.

```
if createFile = EXPORT and filename <> null then
    createXMLFile(xmldoc, filename);
endif;
```

If the user has checked the **Create File** check box and provided a file name, the **createXMLFile** method is called. The XML document created by the **buildPersonSearchResponse** method is then passed to the **createXMLFile** method, along with the specified file name.

WPXMLWebServiceProvider::createXMLFile Method

The **WPXMLWebServiceProvider** class **createXMLFile** method takes the **JadeXMLDocument** it receives as a parameter and removes the processing instruction that links the XML document to the XSL style sheet. (This is done because the processing instruction is not applicable outside of a Web browser context.)

The method then calls the **writeToFile** method for the **JadeXMLDocument** class.

Import Explanation

In addition to the common behavior stated in "Common Behavior", earlier in this white paper, this section looks at what the JADE code is doing in the **XMLWhitePaper** application to import person details from an XML file, and how it is building the XML response.

WPXMLWebServiceProvider::buildXMLReply Method

The **WPXMLWebServiceProvider** class **buildXMLReply** method takes the values set on the global transient instance of **Application** and carries out the appropriate actions. In this case, we are looking at what happens when you import person details from an XML file.

When information was received from the search form, the **procMessage** method set the **xmlAction** value of **Application to IMPORT** (an Integer global constant of 3), so this is where we begin the review, as shown in the following code fragment.

```
elseif app.xmlAction = IMPORT then
    filename := app.xmlFilename;
    if filename <> null then
        xmldoc := importPeople(filename);
    endif;
```

```
xmlReply := xmldoc.writeToString;
app.resetValues;
```

This method sets the **filename** local variable to that set on the **Application** earlier by the **procMessage** method. When it is set, the **importPeople** method is called and it is provided with the specified file name as a parameter.

WPXMLWebServiceProvider::importPeople Method

To begin with, the **WPXMLWebServiceProvider** class **importPeople** method needs to create three transient instances of two different classes; that is, **JadeXMLDocument** and **JadeXMLDocumentParser**.

```
create xmlDoc transient;
create parser transient;
create response transient;
parser.parseDocumentFile(xmlDoc, pFilename);
persDict := createPeopleRecords(xmlDoc);
```

The next step is to create a JADE XML tree structure from the specified file. This is done by calling the **parseDocumentFile** method for the **JadeXMLDocumentParser** class. The **parseDocumentFile** method reads the specified file and populates the instance of **JadeXMLDocument** passed into it as a parameter with nodes based on the information in that file.

When we have the XML tree structure, the next step is to navigate through it, creating database information based on the data it contains. The **createPeopleRecords** method does this.

WPXMLWebServiceProvider::createPeopleRecords Method

The **WPXMLWebServiceProvider** class **createPeopleRecords** method takes the XML tree structure (that is, **JadeXMLDocument**) as a parameter, as shown in the following code fragment.

```
create persDict transient;
create people transient;
create contacts transient;
pXMLDocument.getElementsByTagName("PERSON_DETAILS", people);
beginTransaction;
foreach elmnt in people do
```

This method begins by creating transient instances of the **PersonsByLastNameDict** and **JadeXMLElementArray** classes. Next, all elements with a **tagName** of **PERSON_DETAILS** are collected and placed into the **JadeXMLElementArray**. In the previous code fragment, this is represented by the **people** local variable.

As each **PERSON_DETAILS** element contains details for one person, the method then moves through each of these elements and processes its **childNodes**, as shown in the following code fragment.

```
create person persistent;
firstName := elmnt.getElementByTagName("PERSON_FIRST_NAME").textData;
lastName := elmnt.getElementByTagName("PERSON_LAST_NAME").textData;
occupation := elmnt.getElementByTagName("OCCUPATION").textData;
person.setDetails(firstName, lastName, occupation);
```

To begin with, a persistent instance of **Person** is created. The **getElementByTagName** method is then used to retrieve the data associated with child node elements by tag name. This data is then assigned to the appropriate property of the **Person** instance, as shown in the following code fragment.

```
contDet := elmnt.getElementByTagName("CONTACT_DETAILS");
eladdr := contDet.getElementByTagName("ADDRESS_DETAILS");
```

With the details of the **Person** set, the next step is to add contact information. The code then navigates its way to the **ADDRESS_DETAILS** element, as shown in the following code fragment.

```
if eladdr <> null then
    create address persistent;
    contactType := eladdr.getAttributeByName("TYPE").value;
    addressLine1 :=
        eladdr.getElementByTagName("ADDRESS_LINE_1").textData;
    addressLine2 :=
        eladdr.getElementByTagName("ADDRESS_LINE_2").textData;
    suburb := eladdr.getElementByTagName("SUBURB").textData;
    city := eladdr.getElementByTagName("CITY").textData;
    country := eladdr.getElementByTagName("COUNTRY").textData;
    postCode := eladdr.getElementByTagName("POSTCODE").textData;
    address.setDetails(contactType, addressLine1, addressLine2, suburb,
        city, country, postCode); person.allContactDetails.add(address);
endif;
```

Where an **ADDRESS_DETAILS** element is found, a persistent instance of **Address** is created. The values of the **textData** properties of the child node elements are then assigned to the **Address** properties.

When complete, the address is added to the **allContactDetails** collection against the **Person**. The same process is followed for phone and e-mail details, as shown in the following code fragment.

```
persDict.add(person);
```

At the conclusion of processing each **PERSON_DETAILS** element, they are added to **persDict**. When all **PERSON_DETAILS** elements are processed, this instance of **PersonsByLastNameDict** is returned to the **importPeople** method.

WPXMLWebServiceProvider::importPeople Method

When returned to the **WPXMLWebServiceProvider** class **importPeople** method, it is assigned to the **persDict** local variable. The **persDict** variable is then passed to the **buildImportResponse** method.

WPXMLWebServiceProvider::buildImportResponse Method

```
create xmlDoc transient;
if pPeople.size > 0 then
    xmlDoc.outputDeclaration := true;
    xmlDoc.addProcessingInstruction('xml:stylesheet type="text/xsl"',
        'href="confirmation.xsl"');
    rootElement := xmlDoc.addElement("PEOPLE_DETAILS");
    foreach person in pPeople do
        pers := rootElement.addElement("PERSON_DETAILS");
        elmnt := pers.addElement("PERSON_FIRST_NAME");
        elmnt.setText(person.firstName);
        elmnt := pers.addElement("PERSON_LAST_NAME");
        elmnt.setText(person.lastName);
        elmnt := pers.addElement("OCCUPATION");
        elmnt.setText(person.occupation);
    endforeach;
endif;
return xmlDoc;
```

The next thing the **WPXMLWebServiceProvider** class **buildImportResponse** method does is traverse the dictionary of **Person** objects that has just been created.

The details of these **Person** objects are then used to create an XML document to confirm creation, as shown in the previous code fragment. The **href="confirmation.xsl"** statement indicates the XSL style sheet that should be applied to the XML document created, to ensure appropriate presentation in an Web browser. This XML document is then returned to the **importPeople** method and assigned to its **response** local variable, as shown in the following code fragment.

WPXMLWebServiceProvider::importPeople Method

```
response := buildImportResponse(persDict); return response;
```

The **WPXMLWebServiceProvider** class **importPeople** method takes the **JadeXMLDocument** represented by the **response** local variable and returns it to the **builXMLReply** method.

WPXMLWebServiceProvider::buildXMLReply Method

The **WPXMLWebServiceProvider** class **buildXMLReply** method takes the **JadeXMLDocument** and writes it to a String for the **reply** method to send back to the browser, as shown in the following code fragment.

```
xmlReply := xmldoc.writeToString;
```

Conclusion

JADE enables the rapid development of XML applications with a framework that is intuitive in its use and powerful in its application. The XML framework in JADE takes advantage of all benefits of XML, while exploiting the very best JADE has to offer.

Using JADE, the creation, manipulation, and interpretation of XML just got easier.

For more details about using the JADE XML framework, see the JADE product information library available from https://www.jadeworld.com/jade-platform/developer-centre/learn/documentation.

Appendix A - Persisting XML

This appendix covers two examples of how a persistent structure of JADE objects is created through parsing an XML document. One of the advantages of this approach is that you do not need to store an XML document in its raw format and re-parse it every time you need to use its contents. When created, you can use the created tree structure in the same way you would any other set of JADE objects.

The two examples provided in this appendix demonstrate how an:

- Entire XML document can be parsed into a persistent structure
- XML document can be parsed, with JADE creating persistent structures based on sections of the raw XML document

Parsing an XML Document into a Persistent Structure

The XML document file contains details of staff working within two departments. This exercise imports the document in its entirety.

JadeScript::persistentImport Method

The **JadeScript** class **persistentImport** method parses the XML document and creates an XML tree structure with persistent JADE objects, as shown in the following code fragment.

```
vars
    parser : JadeXMLDocumentParser;
    xmlDoc : WPXMLDocument;
    root   : Root;
begin
    root := Root.firstInstance;
    beginTransaction;
    create xmlDoc persistent;
    create parser transient;
```

We begin by creating a persistent instance of **WPXMLDocument** represented by the **xmlDoc** variable and a transient instance of **JadeXMLDocumentParser** represented by the **parser** variable, as shown in the following code fragment.

```
parser.setClassMapping(JadeXMLAttribute, WPXMLAttribute);
parser.setClassMapping(JadeXMLCDATA, WPXMLCDATA);
parser.setClassMapping(JadeXMLComment, WPXMLComment);
parser.setClassMapping(JadeXMLText, WPXMLText);
parser.setClassMapping(JadeXMLDocumentType, WPXMLDocumentType);
parser.setClassMapping(JadeXMLElement, WPXMLElement);
parser.setClassMapping(JadeXMLProcessingInstruction, WPXMLProcessingInstruction);
```

Class mapping is a necessary part of parsing XML documents into a structure composed of instances of persistent user subclasses. As a system class such as **JadeXMLElement** can have multiple user subclasses, JADE needs to know which subclass should be used to create persistent objects when an XML element is found in the document; for example, you may have two persistent user subclasses of **JadeXMLElement**, one to store information regarding cars and one related to car manufacturers. When parsing an XML document containing car information, the **setClassMapping** method is used to tell JADE to create instances of the car-related subclass of **JadeXMLElement**, rather than that related to car manufacturers.

To parse XML documents into a persistent structure, JADE requires you to specify the mapping for all real **JadeXMLNode** system subclasses, regardless of whether there is an intent to use them all. This is done to prevent runtime exceptions if the file does in fact contain an XML node for which no mapping has been specified. Needless to say, parsing XML documents into a persistent structure requires you to have actually created user subclasses for all system subclasses first. The only exception is the **JadeXMLDocument** subclass, which is declared explicitly when the document is created prior to calling the **parseDocumentFile** method, as shown in the following code fragment.

```
parser.parseDocumentFile(xmlDoc,
    "c:\JadeXMLWhitePaper\Persistent XML Structure.xml");
xmlDoc.setName("All People");
root.allWPXMLDocuments.add(xmlDoc);
commitTransaction;
epilog
    delete parser;
end;
```

When the mapping is complete, the file is parsed and the **WPXMLDocument** is populated with an XML tree structure. As the document is stored persistently, it is added to a collection for easy retrieval later.

Parsing an XML Document into Multiple Persistent Structures

This section covers an example of how an XML document is evaluated and multiple persistent structures created to contain separate sections of the document. This example takes the same file as that used in the previous section ("Parsing an XML Document into a Persistent Structure)" and creates two persistent XML documents (which are instances of **WPXMLDocument**), into which the details of staff for each department are separated.

JadeScript::persistentSplitImport Method

The **JadeScript** class **persistentSplitImport** method parses the XML document and creates two XML tree structures with persistent JADE objects populated from two separate sections of the XML document.

```
root := Root.firstInstance;
create xmlDoc transient;
create elmntArray transient;
create parser transient;
parser.parseDocumentFile(xmlDoc,
    "c:\JadeXMLWhitePaper\Persistent XML Structure.xml");
xmlDoc.getElementsByTagName("DEPT_PEOPLE", elmntArray);
beginTransaction;
foreach elmnt in elmntArray do
    name := elmnt.getAttributeByName("NAME").value;
    create newXMLDoc persistent;
```

This section of the script code fragment creates the following transient instances.

1. **xmlDoc**, which is passed as a parameter into the **parseDocumentFile** method and represents the transient XML tree structure created by the method
2. **elmntArray**, which is used as a transient container for the elements that delimit the sections of the XML file in which we have an interest
3. **parser**, which is used to actually parse the XML file

The specified file (that is, **Persistent XML Structure.xml**) is parsed as usual. The method then gets the delimiting elements from which we want to create our separate documents and then adds them to the **elmntArray**. As we are creating a separate document for each element in this array, the method then steps through each element and creates a persistent XML document in JADE.

A **name** attribute has been added to our subclass of **JadeXMLDocument** (that is, **WPXMLDocument**), to allow us to identify them for retrieval purposes. The name for each document is to be derived from the **NAME** attribute of the **DEPT_PEOPLE** element. We assign it to the **name** variable at this point for later use, as shown in the following code fragment.

```
rootElmnt := elmnt.makePersistent(WPXMLElement, WPXMLAttribute,
    WPXMLComment, WPXMLCDATA, WPXMLText, WPXMLDocumentType,
    WPXMLProcessingInstruction, newXMLDoc).WPXMLElement;
```

This code fragment takes the selected element from the array and calls the **makePersistent** method to, oddly enough, make it persistent.

JadeXMLNode::makePersistent Method

With the exception of new**XMLDoc**, which has a type of **WPXMLDocument**, all parameters passed into the **JadeXMLNode** class **makePersistent** method are classes. In a similar way to class mapping covered in the previous section of this appendix, it is necessary to specify what user subclasses are to be instantiated when creating a persistent copy of a transient class. It is when calling this method that those user subclasses are specified.

As we potentially need to create persistent instances of all of the different XML nodes, this method shown in the following code fragment is placed on the **JadeXMLNode** class.

```
makePersistent(elmnt, attr, comment, cdata, text, docType, pi : Class;
    xmlDoc : JadeXMLDocument input) : JadeXMLNode updating;
vars
    newNode, newChildNode, childNode : JadeXMLNode;
    attribute, newAttr               : JadeXMLAttribute;
begin
    if self.isKindOf(JadeXMLElement) then
        newNode := self.makePersistentIndividual(elmnt);
```

This method evaluates the transient object for which it is called and calls the **makePersistentIndividual** method, passing the user subclass that is used to create a persistent instance.

JadeXMLNode::makePersistentIndividual Method

The **JadeXMLNode** class **makePersistentIndividual** method actually creates the persistent JADE object based on the transient object created as a result of the parsing process. When created, it is returned to the **makePersistent** method and assigned to the **newNode** variable, as shown in the following code fragment.

```
xmlNode := copySelfAs(class, false).JadeXMLNode; return xmlNode;
```

JadeXMLNode::makePersistent Method

When the new persistent XML node has been created, it is necessary to continue traversing the transient structure to ensure that the **childNodes** (and the **childNodes** of the **childNodes**, and so on) are processed, as shown in the following code fragment.

```
foreach childNode in self.childNodes do
    newChildNode := childNode.makePersistent(elmnt, attr, comment, cdata,
        text, docType, pi, xmlDoc);
    newChildNode.parentNode := newNode;
endforeach;
```

```
foreach attribute in self.JadeXMLElement.attributes do
    newAttr := attribute.makePersistent(elmnt, attr, comment, cdata,
        text, docType, pi, xmlDoc).JadeXMLAttribute;
    newAttr.setElement(newNode.JadeXMLElement);
endforeach;
elseif self.isKindOf(JadeXMLAttribute) then
    newNode := self.makePersistentIndividual(attr);
```

It is also important to note that the **copySelfAs** method does not copy references and that collections are empty on the copy created. As a result, the **JadeXMLNode** class **makePersistent** method then assigns values to the appropriate **parentNode**, **document**, **element**, and **docType** references.