

IBM Cúram Social Program Management



Cúram XML Infrastructure Guide

Version 6.05

IBM Cúram Social Program Management



Cúram XML Infrastructure Guide

Version 6.0.5

Note

Before using this information and the product it supports, read the information in "Notices" on page 49

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This edition applies to IBM Cúram Social Program Management v6.0.5 and to all subsequent releases unless otherwise indicated in new editions.

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Contents

Figures v

Tables vii

Chapter 1. Introduction 1

- 1.1 Objective 1
- 1.2 Prerequisites 1
- 1.3 Introduction 1
- 1.4 Third-Party Libraries 1

Chapter 2. XML Concepts 3

- 2.1 Objective 3
- 2.2 Prerequisites 3
- 2.3 Introduction 3
- 2.4 XML 3
- 2.5 Document Type Definition 4
- 2.6 XML Documents 5
- 2.7 Summary 5
- 2.8 Further Reading 5

Chapter 3. Developing for XML 7

- 3.1 Objective 7
- 3.2 Prerequisites 7
- 3.3 Introduction 7
- 3.4 XML Documents 7
 - 3.4.1 Documents 7
 - 3.4.2 The XMLDocument Class 7
 - 3.4.3 Encoding 8
 - 3.4.4 Creating an XMLDocument 9
 - 3.4.5 Opening an XMLDocument Object 10
 - 3.4.6 Adding Data to an XMLDocument Object 10
 - 3.4.7 Closing an XMLDocument Object 10
 - 3.4.8 Saving an XMLDocument Object 11
 - 3.4.9 Loading an XMLDocument Object 11
- 3.5 The XML Print Stream 11
 - 3.5.1 Overview 11
 - 3.5.2 The XMLPrintStream Class 12
 - 3.5.3 Default Configuration for XMLPrintStream 12
 - 3.5.4 Creating an XMLPrintStream Object 12
 - 3.5.5 Configuring an XMLPrintStream Object 13
 - 3.5.6 Opening an XMLPrintStream Object 15
 - 3.5.7 Closing an XMLPrintStream Object 15
 - 3.5.8 Print Previewing 15
- 3.6 Sample Usage 16
 - 3.6.1 Overview 16
 - 3.6.2 Saving XML Data to a File 16
 - 3.6.3 Printing an XML Document 16
 - 3.6.4 Saving and Loading XML Documents 17
 - 3.6.5 Previewing an XML Print Job 19
 - 3.6.6 Building a Document from a List 21
- 3.7 Load Balancing and Fail-over 22

3.8 Summary 22

Chapter 4. The XML Server 25

- 4.1 Objective 25
- 4.2 Prerequisites 25
- 4.3 Introduction 25
- 4.4 The XML Server 25
- 4.5 Configuring the XML Server 26
 - 4.5.1 Overview 26
 - 4.5.2 Network Configuration 28
 - 4.5.3 Default Value Configuration 28
 - 4.5.4 Server Command Configuration 28
 - 4.5.5 Template Cache Configuration 30
 - 4.5.6 Debug Configuration 30
 - 4.5.7 Log4j Logging 30
 - 4.5.8 RenderX Configuration 31
 - 4.5.9 Custom Configuration 31
 - 4.5.10 Font Configuration 32
 - 4.5.11 Sample Configuration Files 33
- 4.6 Running the XML Server 38
 - 4.6.1 Running the XML Server as a Windows Service or UNIX Daemon 38
- 4.7 Overriding the Default Port 39
- 4.8 Overriding the Default Configuration 39
- 4.9 Switching Off Configuration File Schema Validation 39
- 4.10 Shutting Down the XML Server 39
- 4.11 Statistics 40
- 4.12 Summary 40

Chapter 5. Cúram XML and XSL Templates 41

- 5.1 Objective 41
- 5.2 Prerequisites 41
- 5.3 Introduction 41
- 5.4 Cúram XML 41
- 5.5 Examples 42
- 5.6 Job Types and Template Types 44
 - 5.6.1 Overview 44
 - 5.6.2 Templates for PDF Documents 44
 - 5.6.3 Templates for RTF Documents 44
 - 5.6.4 Templates for HTML Documents 45
 - 5.6.5 Templates for Plain Text Documents 45
- 5.7 XSL Template Example 45
- 5.8 Generating Templates from RTF Documents 47
- 5.9 Globalization Considerations 47
- 5.10 Summary 47
- 5.11 Further Reading 47

Notices 49

Trademarks 51

Figures

1. XMLDocument Constructor	9	18. XML Processing Architecture.	25
2. Opening an XMLDocument	10	19. Sample FOP Configuration File	32
3. Adding to an XMLDocument	10	20. Batch File for Printing a Document (Windows)	34
4. Closing an XMLDocument	10	21. Configuration for Printing a Document (Windows)	34
5. Saving an XMLDocument	11	22. Displaying a Document for Testing (Windows)	35
6. Loading an XMLDocument	11	23. Setting up RenderX as the rendering tool for Right To Left Document processing	35
7. XMLPrintStream Constructor.	12	24. Sample Shell Script for Printing a Document (UNIX and z/OS)	37
8. Configuring an XMLPrintStream	13	25. Configuration for Printing a Document (UNIX and z/OS)	38
9. Opening an XMLPrintStream.	15	26. Cúram XML Document Type Definition (DTD)	42
10. Closing an XMLPrintStream	15	27. An Example XML Document.	43
11. Configuring an XMLPrintStream for Previewing.	15	28. An Example XML Document with a List	43
12. Saving XML Data to a File: Method 1	16	29. An Example XSL Template	46
13. Printing an XML Document: Method 1	17	30. Example output	46
14. Saving and Loading an XML Document	18		
15. Previewing an XML Print Job	20		
16. Adding a List to a Document	21		
17. Adding Elements of a List to a Document	22		

Tables

1. XML Character Encoding Constants	8	4. XMLPrintStream Job Types	14
2. The application prx settings for XMLPrintStream	12	5. Configuration Options	26
3. Right-to-Left Supported Languages and Locale Codes	13	6. XML Server Command Tokens	29

Chapter 1. Introduction

1.1 Objective

In this guide you will learn how to develop applications that use the XML¹ features of the IBM® Cúram Social Program Management Server Development Environment (SDEJ).

1.2 Prerequisites

Before reading this guide you should be familiar with application server development and the Server Development Environment (SDEJ). These topics are covered in the following guides in the IBM Cúram Social Program Management documentation:

- *Cúram Modeling Reference Guide*;
- *Cúram Server Developer's Guide*.

This document makes a number of references to struct classes which are fully defined in the *Cúram Server Modeling Guide*.

1.3 Introduction

This guide presents all aspects of the IBM Cúram Social Program Management XML functionality provided with the Server Development Environment (SDEJ), from modeling to development to runtime management.

Chapter 2, “XML Concepts,” on page 3 provides a brief introduction to XML. Chapter 3, “Developing for XML,” on page 7 presents the application server development infrastructure elements that allow you to create XML documents and send them to the XML Server. Chapter 4, “The XML Server,” on page 25 describes the IBM Cúram Social Program Management XML Server and how it can be used to convert XML data into formatted PDF², RTF³, HTML⁴ or plain text documents and then manipulate these documents for printing, e-mailing, etc. Chapter 5, “Cúram XML and XSL Templates,” on page 41 describes the XML format used by IBM Cúram Social Program Management and provides instructions on how it can be used to create XSL⁵ templates.

This breakdown should be considered when reading the document as terms may be introduced in an early chapter and detailed in the succeeding chapters, without a specific cross reference being provided.

1.4 Third-Party Libraries

This product includes software developed by the Apache Software Foundation (<http://www.apache.org/>). The IBM Cúram Social Program Management XML infrastructure is based on the Apache XML Project's suite of Java™ XML libraries. These libraries are the *de facto* standard implementation of XML. Apache Xerces is the XML parser used; Apache Xalan is used for XSL processing; and Apache FOP (Formatting Objects Processor) for the PDF rendering

1. XML means Extensible Markup Language.

2. PDF is the Adobe Portable Document Format. For more information about PDF, or to download free software to read PDF files on most platforms, go to the Adobe PDF web site: <http://www.adobe.com/products/acrobat/adobe.pdf.html>

3. RTF is the *Rich Text Format*, a format developed by Microsoft and that can be read by most common work processing applications.

4. HTML means Hypertext Markup Language and is a document format used on the World-Wide Web.

5. XSL means Extensible Stylesheet Language and is a W3C standard defining stylesheets for (and in) XML.

Bertrand Delacrétaiz's JFOR library (now part of the Apache FOP) is used for rendering documents in RTF format (<http://www.jfor.org/>).

Chapter 2. XML Concepts

2.1 Objective

In this chapter, you will be introduced to the *Extensible Markup Language* (XML), what it is and how it is used to represent data.

2.2 Prerequisites

There are no prerequisites for this chapter.

2.3 Introduction

This chapter presents a brief overview of the Extensible Markup Language (XML). XML is a data representation standard that is growing enormously in popularity as the growth of the Internet requires that more and more data be readable on a multitude of different systems.

IBM Cúram Social Program Management can generate XML data from struct classes at runtime, a typical use of which is to print documents based on XSL templates and the contents of these classes. It is useful to know what XML is prior to seeing how it fits into IBM Cúram Social Program Management and the next section presents a brief overview of the standard. Chapter 5, “Cúram XML and XSL Templates,” on page 41 provides an introduction to XSL templates.

2.4 XML

XML is a meta-markup language that defines how to write your own markup languages. Unlike HTML, XML markup languages are case-sensitive and all documents must be *well-formed* (more about this below). Well-formed XML-based markup can be parsed by generic parsers and processors regardless of the tags and attributes chosen for the application.

A *tag* is an entity in XML that defines an element. Tags are identifiers that are enclosed in angle brackets (< and >). For every opening tag there must be a closing tag. Closing tags are similar to opening tags except that there is a slash (/) before the tag name. In between the tags is the value of the element defined by the tag. For example, here is a <NAME> element defined using NAME tags:

```
<NAME>Joe Bloggs</NAME>
```

XML elements can be nested to define structure and white-space can be used to make the structure easier to identify:

```
<PERSON>
  <FIRST_NAME>Joe</FIRST_NAME>
  <SURNAME>Bloggs</SURNAME>
  <E_MAIL>jbloggs@acme.com</E_MAIL>
</PERSON>
```

XML is deemed to be well-formed:

- a. If every element has an opening and closing tag.
- b. Elements do not overlap (i.e. the elements delimited by opening and closing tags nest properly within each other).
- c. There is a root element.

- d. Case-sensitivity is respected and
- e. <, >, &, , and " characters are escaped.

The following is not-well-formed XML because the elements overlap:

```
<BOLD>The quick brown <ITALICS>fox  
jumps</BOLD> over the lazy dog.</ITALICS>
```

Characters with meaning in XML are escaped using & for a &, < for a <, > for a >, ' for a ', and " for a ". These are called *character entities*.

The requirement for a root element makes this XML invalid:

```
<NAME>Joe Bloggs</NAME>  
<NAME>Jane Doe</NAME>
```

as no single element forms the root. The following is valid, however, as NAME_LIST forms the root element:

```
<NAME_LIST>  
  <NAME>Joe Bloggs</NAME>  
  <NAME>Jane Doe</NAME>  
</NAME_LIST>
```

XML elements can have attributes. Attributes are specified as part of the tag and can be used to hold meta-data about the elements (this is what they are usually used for but there is no prescription for their use).

```
<NAME_LIST ELEMENTS="4" RANGE="A-D">  
  <NAME SEX="MALE">Hop Along</NAME>  
  <NAME SEX="MALE">Joe Bloggs</NAME>  
  <NAME SEX="MALE">P Cutter</NAME>  
  <NAME SEX="FEMALE">Jane Doe</NAME>  
</NAME_LIST>
```

XML supports *empty tags*. These are tags where the start tag and end tag are combined into one and there is no element data. These tags start with a < and end with a />. Typically attributes are used to store the data in these tags. For example, here is an empty PERSON tag with NAME and SEX attributes:

```
<PERSON NAME="Joe Bloggs" SEX="MALE"/>
```

Comments can be entered in an XML document using an opening <!-- tag and a closing --> tag. For example:

```
<!--This is an empty PERSON tag-->  
<PERSON NAME="Joe Bloggs" SEX="MALE"/>
```

That was XML in a nutshell.

2.5 Document Type Definition

As described in the previous section an XML document is an entity that contains XML data of a particular type. The primary requirement is that a document have a *root element*, and XML defines some simple rules for data representation. To make sense of data represented in XML, it is necessary to know what the chosen element tags, etc. mean. This meaning is provided by a *Document Type Definition* (DTD) that defines what tags can be used and where they can be used. A unit of XML data that conforms to the rules defined in a DTD is an XML document

2.6 XML Documents

A particular set of XML tags has been defined to allow any data in IBM Cúram Social Program Management to be represented as XML⁶. All XML is from struct classes defined in the application model. The IBM Cúram Social Program Management XML definition uses tags to generically identify the parts of these model entities. So, these XML includes tags for structs, fields, values, types, lists, etc. These tags are described in an IBM Cúram Social Program Management -specific *Document Type Definition* (DTD) which is shown in 5.4, “Cúram XML,” on page 41.

This DTD is shown for the sake of completeness. The only area of the XML infrastructure where the developer requires knowledge of the exact format of the XML is in XSL template development although they may wish to manipulate the XML directly for some unforeseen reason.

2.7 Summary

- XML stands for Extensible Markup Language.
- XML allows data to be defined in plain text and structured using nested elements defined using tags that appear within angle-brackets < >. Elements can be defined with attributes.
- XML is case-sensitive and requires that documents be well-formed: they must have a root element and elements cannot overlap.
- XML uses several character entities to avoid confusing data with the XML markup.
- In IBM Cúram Social Program Management a specific set of tags has been chosen to generically represent data that is generated from an applications struct classes at runtime. These tags are contained in a supplied Document Type Definition.

2.8 Further Reading

The World-Wide-Web Consortium (<http://www.w3c.org/>) is responsible for the development of the XML and related standards. There is much more detailed information on their web-site about XML that is worth reading.

6. An input field that contains a period (".") on a line by itself (i.e., "." surrounded by "\n" or "\r") will cause the XML Server, when the data is processed, to throw an error. This is because, as documented in 4.5.6, “Debug Configuration,” on page 30, the XML Server uses this particular character sequence to mark the end of client transmission; but, in the particular context of data entered from a web client this is undesirable behavior.

Chapter 3. Developing for XML

3.1 Objective

In this chapter, you will learn how to incorporate XML support into your application servers and produce XML documents

3.2 Prerequisites

Before reading this chapter, you should be familiar with the IBM Cúram Social Program Management application server development with UML Modeling and the Server Development Environment (SDEJ). These topics are covered in the following guides in IBM Cúram Social Program Management documentation:

- *Cúram Modeling Reference Guide*;
- *Cúram Server Developer's Guide*.

You should also have read the previous chapter which provided a brief introduction to XML.

3.3 Introduction

This chapter describes the two most important classes you need when adding XML functionality to your applications: `curam.util.xml.impl.XMLDocument` and `curam.util.xml.impl.XMLPrintStream`. The classes are presented in depth before samples of their use are presented to demonstrate how they can be used together to generate XML and print documents.

3.4 XML Documents

3.4.1 Documents

A number of operations can be performed on XML documents.

- A document can be created and stored in memory. This document can then be stored in the database, or written to a stream, or both.
- A document can be created and written to a stream directly to reduce storage requirements. This is particularly useful for very large documents that do not require an archived copy.
- A previously archived document can be retrieved from the database and written to a stream.

As streams are flexible, there are many things you can do with them.

- You can use a stream to save the XML data to a file.
- You can use the `XMLPrintStream` class to request that a document should be printed.
- You can use a stream to transfer information over a network via a socket connection.
- You can use a `java.io.BufferedOutputStream` to buffer all the XML data.
- You can create your own stream classes (or use any of the standard stream classes) to do just about anything you want with the XML data!

3.4.2 The XMLDocument Class

IBM Cúram Social Program Management XML data is generated according to the rules of a simple DTD. The `XMLDocument` class is used to hold the generated XML and wraps the data in the necessary root element. This class is central to all XML operations that you can perform in IBM Cúram Social Program

Management. Its interface can be found in the `curam.util.xml.impl` package within the supplied SDEJ JavaDoc. In the rest of this section, you will learn how to use this interface to create XML documents from your application data.

The use of the `XMLDocument` class follows the following broad pattern:

1. Create a new instance of the `XMLDocument` class.
2. Open the XML document to create the root element and provide a context for the XML data that you want to create.
3. Add a struct class (or struct classes) to the open XML document to create the XML data.
4. Close the XML document to complete the root element.

These steps will be covered in the following sub-sections. First, however, you must be aware of the importance of XML data encoding.

3.4.3 Encoding

All XML data are represented in plain-text. A small number of characters have a particular meaning to XML ("`<`", "`>`", "`\"`", "`'`", "`&`") and if these occur in your data they are automatically converted to their corresponding XML character entities to avoid problems. However, if you use characters outside the normal US-ASCII range (characters 0-127), even plain-text becomes ambiguous. For example, in Western Europe, you might typically store your data using the ISO-8859-1 character set also known as "Latin 1". In this character set, the character "è" (e-umlaut) is character number 235. However if you sent this XML data to a person in Greece who would typically use the ISO-8859-7 (Greek) character set, the same character 235 would appear as the lower-case Greek letter lambda.

To avoid this problem, XML allows the character encoding used for a document to be stated in the XML processing instruction found at the top of all XML documents. Now, when you create your document you can explicitly state that you want to use ISO-8859-1 for your data because that is the form in which it is stored in your database. When you send the file to Greece, the person there knows not to use the ISO-8859-7 character set to interpret the data but ISO-8859-1 instead. In general, this will be handled by their XML parsing software which will read the encoding information from the document.

By default, XML uses an encoding scheme known as UTF-8. This modified Unicode scheme creates a document that uses two bytes to represent characters greater than 127. However, you will need to set the encoding explicitly if the data stored in your database uses a different encoding scheme.

IBM Cúram Social Program Management XML provides a range of constants for the common encoding schemes. The available schemes are shown in 3.4.3, "Encoding" below.

Table 1. XML Character Encoding Constants

Constant	Alternative Constant	Encoding Scheme
<code>kEncodeUTF8</code>		UTF-8
<code>kEncodeISO10646UCS2</code>		ISO-10646-UCS-2
<code>kEncodeISO10646UCS4</code>		ISO-10646-UCS-4
<code>kEncodeISO88591</code>	<code>kEncodeISOLATIN1</code>	ISO-8859-1
<code>kEncodeISO88592</code>	<code>kEncodeISOLATIN2</code>	ISO-8859-2
<code>kEncodeISO88593</code>	<code>kEncodeISOLATIN3</code>	ISO-8859-3
<code>kEncodeISO88594</code>	<code>kEncodeISOLATIN4</code>	ISO-8859-4
<code>kEncodeISO88595</code>	<code>kEncodeISOCYRILLIC</code>	ISO-8859-5
<code>kEncodeISO88596</code>	<code>kEncodeISOARABIC</code>	ISO-8859-6
<code>kEncodeISO88597</code>	<code>kEncodeISOGREEK</code>	ISO-8859-7

Table 1. XML Character Encoding Constants (continued)

Constant	Alternative Constant	Encoding Scheme
kEncodeISO88598	kEncodeISOHEBREW	ISO-8859-8
kEncodeISO88599	kEncodeISOLATIN5	ISO-8859-9
kEncodeISO885910	kEncodeISOLATIN6	ISO-8859-10
kEncodeISO885913	kEncodeISOLATIN7	ISO-8859-13
kEncodeISO885914	kEncodeISOLATIN8	ISO-8859-14
kEncodeISO885915	kEncodeISOLATIN9	ISO-8859-15
kEncodeISO2022JP		ISO-2022-JP
kEncodeSHIFTJIS		Shift_JIS
kEncodeEUCJP		EUC-JP

The relevant constant should be specified when constructing a new `XMLDocument` in order to set the encoding scheme as appropriate for the XML document. This encoding will be used for the XML document declaration as well as for the XML document itself. If loading an XML document from the database, the encoding of that document should match the encoding used to construct the `XMLDocument` class. If you supply no value, no encoding scheme will be specified in the XML and XML parsers will thus assume UTF-8 according to the XML standard. If the encoding scheme you wish to use is not among those listed, you may supply a string containing the encoding value you wish to use.

All of the encoding constants are within the `XMLEncodingConstants` interface. To use, for example, the Latin 1 set, you would use `XMLEncodingConstants.kEncodeISOLATIN1` or `XMLEncodingConstants.kEncodeISO88591`.

3.4.4 Creating an XMLDocument

As XML data is created it is written to a stream. By default, an instance of the `XMLDocument` class maintains an internal stream that will hold the XML data. By allowing the document to store the data in this stream, you may later save the document to the database or write it to another stream. If you have no wish to save the document, you can specify an alternative stream where the XML data should be written as it is created. This can help to reduce memory overhead if the data stream is very large. For example, data for a large report may not need to be stored in the database. This data can be generated and processed on-the-fly without any intermediate storage.

```
XMLDocument(String encoding);
XMLDocument(OutputStream stream, String encoding);
```

Figure 1. XMLDocument Constructor

Both constructors take a parameter to set the character encoding. You can set the encoding value using one of the encoding constants or an encoding string of your own choosing.

The first constructor is used when you want the XML document to use its internal string buffer to store the XML data. This allows you to save the document to the database later or to write to another stream once it is complete. If you intend to load an XML document from the database, you should also use this constructor. In that event, the encoding string is irrelevant.

The second constructor allows you to specify an output stream that the document should be written to *as it is created*. This precludes the possibility of storing the document in the database once it is complete. However, for large documents that do not need to be stored but rather printed, saved to a file, or transferred over a network, this is a more efficient method than the first. For streams such as file and print streams that are required to be explicitly opened, it is important that the stream passed to this constructor is already open as the document will expect to be able to write to it immediately.

3.4.5 Opening an XMLDocument Object

```
open(String generatedBy, String generatedDate, String version,  
      String comment);  
openForList(String generatedBy, String generatedDate,  
            String version, String comment);
```

Figure 2. Opening an XMLDocument

Once you have instantiated an XMLDocument object, you need to open it in one of two ways. If you want to write the details of a single struct class to the XML document, you must open the document with the `open()` method. If you want to write the details of several different struct classes of the same type to the document, you must open the document with the `openForList()` method. This latter method allows you to create a document that contains a list of struct classes where each one is added in turn. All the struct classes must be of the same type. The former method allows you to add only a single struct class to the document before closing it. This single struct class can, however, contain fields that are lists of struct classes.

Both of the open methods take several parameters that can be used to set meta-data for the document. You can include the name of the entity that generated the document, the date and time on which it was generated, the version of the document, and any other comments you wish to associate with the document. Each parameter is a string and you can use any length of data formatted in any way you wish. You must, however, respect the requirement of XML that certain characters be converted to character entities. If your strings contain any of the following characters: `"", "'", "<", ">",` or `"&"`, you must convert them to their character entity values. This can be done by calling the `XMLDocument.escape()` method. The method takes a string parameter and returns a new string with the character entity conversions done for you.

Once opened, you can begin adding struct classes to your XML document.

3.4.6 Adding Data to an XMLDocument Object

```
add(Object value);  
addFromXML(String xmlFragment);
```

Figure 3. Adding to an XMLDocument

The `add()` method of the XMLDocument class can be used to produce XML data from an instance of a struct class.

For documents opened with the `open()` method, you may only issue a single call to `add()` before closing your document. For documents opened with `openForList()`, you may use several calls to `add()` but should ensure that you only add instances of the same struct class type.

`addFromXML()` is a convenience method allowing an XML fragment to be directly added to the document, rather than using the struct class. It is the responsibility of the caller to ensure this fragment respects the DTD.

3.4.7 Closing an XMLDocument Object

```
close();
```

Figure 4. Closing an XMLDocument

Once you have finished adding data to an XML document, you need to close it. The `close` method of the XMLDocument class takes no parameters. Calling the `close` method will *not* close the output stream you specified as a parameter to the XML document. You must close this stream separately.

Once closed, a document will write all remaining XML information to the stream to complete a well formed XML document. If the document object is using an internal string stream buffer, you may save the document to the database or write it to another stream.

3.4.8 Saving an XMLDocument Object

```
save(String name, XSLTemplateInstanceKey templateKey);
```

Figure 5. Saving an XMLDocument

Once closed, any XML document you created to write to the default internal string stream buffer can be saved to the database. This is useful if you want to print information yet keep a record of what was printed. As information in the database may change, it will not always be possible to simply print out the same form, letter, etc., and expect it to contain the same data as before. Using the XML document archive, however, you are guaranteed that the data will be identical as it represents a snapshot of the values at a particular point in time.

Each document can be saved along with the details of an associated template. This allows any print job, for example, to be rerun in the future with the same data and the same version of the template. The save method takes two input parameters and has one return value. The input parameters allow you to specify a name for this saved document. This can be any string-type information that you want. The maximum length is 100 characters. The second parameter is the template instance (version of a template) that you want to associate with this document.

The return value is the key value of the new archived document record that will be created to hold the XML data. This key value can be stored elsewhere to keep track of what documents are available. For example, if you print a letter to send to a client, you could associate this key with a diary entry recording the sending of the letter. The letter could then be reprinted at any time in the future by accessing the key stored with the diary entry.

3.4.9 Loading an XMLDocument Object

```
load(XMLArchiveDocumentID key);
```

Figure 6. Loading an XMLDocument

To load an XML document from the document archive, you should first create a default XMLDocument object. The load method takes one parameter which is the key to the archive document. The details returned include the template information that you saved with the document such as its version and locale, and the XML representation of the data in the document.

Once loaded, the XML document object can be treated like any other document object that was created, opened, had data added and was closed.

3.5 The XML Print Stream

3.5.1 Overview

The SDEJ includes the XML Server (see Chapter 4, “The XML Server,” on page 25). For developers, the interface to this server is via the XMLPrintStream class. This class allows you to send print job requests (and more besides) to the IBM Cúram Social Program Management XML Server.

This section describes the use of the print stream and how XML documents can be printed using its facilities.

3.5.2 The XMLPrintStream Class

The public interface to the XMLPrintStream class can be found in the curam.util.xml.impl package within the SDEJ JavaDoc.

In use the following basic pattern will be followed:

1. Create a new instance of the XMLPrintStream class.
2. Set the various printing options.
3. Open the connection to the XML Server.
4. Write to the print stream object. (This will usually be done by an XMLDocument object).
5. Close the print stream object to initiate the print job.

The following subsections will look at these steps in detail, but first there are steps you can take to configure default values for your print streams.

3.5.3 Default Configuration for XMLPrintStream

The XMLPrintStream class lets you set a number of options when you want to submit a print job. These are the printer name, the paper tray name, the server host name, and the server port number. Each of these options can be set in your project's properties as described in the *Cúram Server Developer's Guide*. The values required are shown in the 3.5.3, "Default Configuration for XMLPrintStream." All are entered as strings and are not converted to any other data-type. You must make sure to convert any special characters with a meaning in XML to character entities.

Table 2. The application prx settings for XMLPrintStream

Variable Name	Description
curam.xmlserver.printer	The name of the default printer to use for jobs submitted by this application. On Microsoft Windows, this might be, for example, \\myhost\printer1, or lpt1:.
curam.xmlserver.tray	The name of the paper tray to use for jobs submitted by this application.
curam.xmlserver.host	The host on which the XML Print Server resides. The property may also be specified as a '/' separated list of host names in order to use multiple XML Servers.
curam.xmlserver.port	The port on which the XML Print Server is listening. The property may also be specified as a '/' separated list of ports in order to use multiple XML Servers.
curam.xmlserver.fileencoding	The default encoding used for the encoding of files provided to the XMLServer. This value can be overridden for individual instances of XMLPrintStream using the setEncoding method. The default value for this property is UTF-8.
curam.xmlserver.serializeLocalNeutral	Specify that XML Server data will be serialized in a locale-neutral way instead of being based on the locale properties on the server.

When your application submits a print job, these values will be used as the defaults for the job. You can use the individual setter methods to override these defaults.

3.5.4 Creating an XMLPrintStream Object

```
XMLPrintStream(String host, int port)
XMLPrintStream(final XMLServerEndPoint[] endpoints)
XMLPrintStream()
```

Figure 7. XMLPrintStream Constructor

An XMLPrintStream object can be instantiated by providing the name of the host on which the XML Server resides and the port on which the XML Server is listening. However, as documented in the Java documentation, these properties are not used and it is recommended to use the empty constructor.

3.5.5 Configuring an XMLPrintStream Object

```
setPrinterName(String name);  
setPaperTray(String tray);  
setUserName(String user);  
setEmailAddress(String email);  
setEncoding(String encoding);  
setJobType(String job);
```

Figure 8. Configuring an XMLPrintStream

Once instantiated, an XMLPrintStream object can be configured. In 3.5.3, “Default Configuration for XMLPrintStream,” on page 12 the default configuration was covered. You can override the printer name and paper tray values using the setPrinterName and setPaperTray methods respectively. In addition, you can also set a user name and an e-mail address for the print job. The user name might be that of the user who initiated the print job, or any other user name you prefer to use. The e-mail address, similarly, can be any e-mail address you want to associate with the job.

The encoding can also be set here. This encoding is used within the XMLServer for such purposes as printing documents in the specific encoding. If the encoding is not explicitly set through the setEncoding method, then the value will be taken from the curam.xmlserver.fileencoding configuration property. If this property is not set, then the default encoding of UTF-8 will be used.

Note: It is important to set the encoding correctly when using XMLDocument and XMLPrintStream classes together. For example, if you create an XMLDocument class with an encoding of UTF-8 and you create the XMLPrintStream class setting the encoding to be US-ASCII, there may be some issues with the document being printed. As US-ASCII contains a smaller character code set than UTF-8, some characters may not be supported and therefore when printing the document, the resulting document may contain unrecognizable characters. Therefore, if you wish to have the UTF-8 document printed correctly, you should set the encoding of the XMLPrintStream instance to use UTF-8 encoding. Please see 3.4.3, “Encoding,” on page 8 for further information on encoding.

All the parameters are strings and you must respect the requirement of XML that certain characters must be replaced with character entities. You can use the XMLDocument.escape(String value) method for this conversion.

Overriding the default values allows you, for example, to print a document to a printer nearest the current user, rather than to a default printer.

By default, the XML Server will combine your XML data with an XSL template and attempt to render the resulting document as a PDF document. The XML is transformed based on the template locale and for Right-to-Left languages. These are the supported languages, which are specified by locale code:

Table 3. Right-to-Left Supported Languages and Locale Codes

Language	Locale Code
Arabic	ar
Farsi	fa
Hebrew	he
Hebrew	iw
Yiddish	ji
Yiddish	yi

Table 3. Right-to-Left Supported Languages and Locale Codes (continued)

Language	Locale Code
Pashto/Pushto	ps
Urdu	ur

Due to the limitations of FOP, you must have a supporting Right-to-Left implementation in the XML Server configuration (e.g., see 4.5.8, “RenderX Configuration,” on page 31). For this rendering step to work, the combination of the XML data and XSL template should produce a document marked up using XSL Formatting Objects. As an alternative to PDF output, you can specify RTF, HTML or plain text output using the `setJobType()` method. This method can be used to specify any of the supported output formats using the appropriate constant as shown in 3.5.5, “Configuring an XMLPrintStream Object,” on page 13. All the constants are within the `XMLPrintStreamConstants` class and should be prefixed with `XMLPrintStreamConstants` in your code unless you have implemented this class as an interface.

Table 4. XMLPrintStream Job Types

Job Type	Description
<code>kJobTypePDF</code>	This is the default job type. The XML data will be combined with the XSL template and the resulting document will be rendered as a PDF document. The template should be developed to produce a document marked up with XSL Formatting Objects. Temporary files will be given the extension “.pdf”.
<code>kJobTypeRTF</code>	The XML data will be combined with the XSL template and the resulting document will be rendered as an RTF document. The template should be developed to produce a document marked up with XSL Formatting Objects. Temporary files will be given the extension “.rtf”.
<code>kJobTypeHtml</code>	The XML data will be combined with the XSL template and the resulting document is assumed to be HTML. Appropriate indentation will be applied automatically. The <code><xml></code> declaration at the top of the file will be omitted. The template should be developed to produce a document marked up with HTML. Temporary files will be given the extension “.html”.
<code>kJobTypeText</code>	The XML data will be combined with the XSL template and the resulting document is assumed to be plain text. The <code><xml></code> declaration at the top of the file will be omitted. Temporary files will be given the extension “.txt”.

In addition to the predefined job types it is possible to define a custom job type. If a custom job type is to be used the `setJobType()` method should be passed a string matching the new job type, where the job type is defined in the XML Server configuration file. For more information on defining and implementing custom job types consult 4.5.9, “Custom Configuration,” on page 31.

3.5.6 Opening an XMLPrintStream Object

```
open(XSLTemplateInstanceKey key);
open(String xslTemplate);
open(XSLTemplateInstanceKey key,
     String host,
     int port);
open(String xslTemplate,
     String host,
     int port);
open(XSLTemplateInstanceKey key,
     XMLServerEndPoint[] endpoints)
open(String xslTemplate,
     XMLServerEndPoint[] endpoints)
```

Figure 9. Opening an XMLPrintStream

Opening an XMLPrintStream object, establishes a connection with the chosen XML Server, sends the job configuration information, and the XSL template. Once open, the XML data can be written to the connection. In general, you will let an XMLDocument object write the data to the stream. All XML documents must be accompanied with an XSL template to allow the data to be formatted.

There are a number of open() methods. The main difference between these is that you can specify a key to an XSL template in the database or provide the XSL template document directly in a string. Also, you can provide the connection information for the XML Server (host and port) or alternatively leave these values to be picked up from the curam.xmlserver.host and curam.xmlserver.port properties.

Once opened, you should immediately begin writing data to the connection. A long delay will cause a time-out to occur and the connection will be lost.

3.5.7 Closing an XMLPrintStream Object

```
close();
```

Figure 10. Closing an XMLPrintStream

Closing an XMLPrintStream object causes the print job to be started. Before closing the object, a well-formed XML document must have been written to it. The close method takes no parameters.

3.5.8 Print Previewing

```
setPreviewStream(OutputStream preview);
```

Figure 11. Configuring an XMLPrintStream for Previewing

The XML Server takes an XML document and an XSL template and processes the two to produce another document which could be in PDF, RTF, HTML, or plain text format. Normally, the XML Server will run a further command to print, or otherwise process, the document. However, you can instead direct the XML Server to return the document to your application server rather than process it further. This allows you to preview the document before printing it or just store the document in the database for later retrieval.

To preview a document, you must specify a preview stream when configuring the print stream object. After the XML Server has generated the PDF it will return it to the print stream object which will in turn write it to the stream specified as a parameter to the setPreviewStream method. This stream could be a simple string stream buffer or a file stream, whatever is required. If no stream is specified, the XML Server will assume that a preview is not required.

Once the print stream object is closed, the preview stream will contain the document and the application server can manipulate it in any way required. For example, it could be returned to the client application and displayed in an appropriate viewer of some kind.

Note: If a preview stream has been specified, the XML Server will not print anything, nor will it create a temporary file containing the document.

3.6 Sample Usage

3.6.1 Overview

This section presents some samples of the way the `XMLDocument` and `XMLPrintStream` objects can be used together. The samples included cover the following scenarios:

- Saving XML data to a file.
- Printing a simple XML document.
- Saving and loading XML documents using the archive.
- Previewing an XML print job's output.
- Building a document from a list.

Along with the code samples are suggestions of how they be further developed and used.

All the methods are developed as methods of process stereotyped classes in the application model.

3.6.2 Saving XML Data to a File

This sample demonstrates how XML data can be created and written to a stream, in this case a file stream. The function assumes that a file name and an instance of a struct class are passed as parameters.

This method demonstrates the use of a `FileWriter`.

```
import curam.util.xml.impl.XMLDocument;
import curam.util.xml.impl.XMLEncodingConstants;
import java.io.FileWriter;

public class XMLSample {

    void saveToFile(String fname, MyStruct myStruct) {
        FileWriter myFile = new FileWriter(fname);

        XMLDocument myDoc =
            new XMLDocument(XMLEncodingConstants.kEncodeISOLATIN1);

        myDoc.open(A User, 31-Dec-2002, 1.0, Sample 1);
        myDoc.add(myStruct);
        myDoc.close();

        myFile.write(myDoc.toString());
        myFile.close();
    }
}
```

Figure 12. Saving XML Data to a File: Method 1

3.6.3 Printing an XML Document

This sample shows how the struct class used in the previous sample could be written to an `XMLPrintStream` object to print the data. It is assumed that a template instance key is supplied to the function and that the default configuration values will be used.

```

import curam.util.xml.impl.XMLDocument;
import curam.util.xml.impl.XMLEncodingConstants;
import curam.util.xml.impl.XMLPrintStream;
import
    curam.util.administration.struct.XSLTemplateInstanceKey;

public class XMLSample {

    void printDoc1(XSLTemplateInstanceKey tempKey,
                  MyStruct myStruct) {

        XMLPrintStream myPrintStream = new XMLPrintStream();
        myPrintStream.open(tempKey, MyPC, 1234);
        myPrintStream.setEncoding(
            XMLEncodingConstants.kEncodeISOLATIN1);
        XMLDocument myDoc =
            new XMLDocument(myPrintStream.getStream(),
                           XMLEncodingConstants.kEncodeISOLATIN1);

        myDoc.open("A User", "31-Dec-1999", "1.0", "Sample 1");
        myDoc.add(myStruct);
        myDoc.close();

        myPrintStream.close();
    }
}

```

Figure 13. Printing an XML Document: Method 1

3.6.4 Saving and Loading XML Documents

In this sample, two functions are presented. The first, based on the previous sample, saves a document to the archive. The second retrieves the document and prints it again. The direct streaming method cannot be used to create the document if it is to be saved.

```

import curam.util.administration.struct.XSLTemplateInstanceKey;
import curam.util.xml.impl.XMLDocument;
import curam.util.xml.impl.XMLEncodingConstants;
import curam.util.xml.impl.XMLPrintStream;
import curam.util.xml.struct.XMLArchiveDocumentID;
import curam.util.xml.struct.XMLArchiveDocDetails;

public class XMLSample {

    /*
     * Creates an XMLDocument and saves it to the database.
     */
    XMLArchiveDocumentID saveDoc(
        XSLTemplateInstanceKey tempKey, MyStruct myStruct) {

        XMLDocument myDoc = new XMLDocument(
            XMLEncodingConstants.kEncodeISOLATIN1);

        myDoc.open("A User", "31-Dec-1999", "1.0", "Sample 1");
        myDoc.add(myStruct);
        myDoc.close();

        // Save the document to the database.
        final XMLArchiveDocumentID docKey =
            myDoc.save("Sample Saved Document 1", tempKey);
        return docKey;
    }

    /*
     * Loads an XMLDocument from the database and prints it.
     */
    void loadDoc(XMLArchiveDocumentID docKey) {

        // First load the archived data for the document and get
        // its template details and data content.
        final XMLDocument docForLoading = new XMLDocument(
            XMLEncodingConstants.kEncodeISOLATIN1);
        final XMLArchiveDocDetails docDetails =
            docForLoading.load(docKey);

        final XSLTemplateInstanceKey tempKey =
            new XSLTemplateInstanceKey();
        tempKey.templateID = docDetails.templateID;
        tempKey.templateVersion = docDetails.templateVersion;
        tempKey.locale = docDetails.locale;

        final String xmlContent = docDetails.document;

        docForLoading.close();

        // Now use this information to reconstruct a new
        // XMLDocument and print it.
        final XMLPrintStream myPrintStream =
            new XMLPrintStream();
        myPrintStream.open(tempKey, MyPC, 1234);
        myPrintStream.setEncoding(
            XMLEncodingConstants.kEncodeISOLATIN1);
        XMLDocument docForPrinting = new XMLDocument(
            myPrintStream.getStream(),
            XMLEncodingConstants.kEncodeISOLATIN1);
        docForPrinting.addFromXML(xmlContent);
        myPrintStream.close();
    }
}

```

Figure 14. Saving and Loading an XML Document

3.6.5 Previewing an XML Print Job

This sample demonstrates how you can process an XML print job and receive a preview of the data that would have been printed for that XML document and XSL template.

```

import curam.util.administration.struct.XSLTemplateInstanceKey;
import curam.util.exception.AppException;
import curam.util.exception.DatabaseException;
import curam.util.exception.InformationalException;
import curam.util.internal.xml.impl.XMLPrintStreamConstants;
import curam.util.type.Blob;
import curam.util.xml.impl.XMLDocument;
import curam.util.xml.impl.XMLEncodingConstants;
import curam.util.xml.impl.XMLPrintStream;
import java.io.ByteArrayOutputStream;
import java.io.FileOutputStream;
import java.io.IOException;

public class XMLServerTest {

    MyResult previewJob(
        final XSLTemplateInstanceKey tempKey,
        final MyStruct myStruct)
        throws DatabaseException, AppException,
        InformationalException, IOException {

        final XMLPrintStream myPrintStream =
            new XMLPrintStream();
        final ByteArrayOutputStream previewBuffer =
            new ByteArrayOutputStream();
        myPrintStream.setPreviewStream(previewBuffer);

        // Explicitly specify that a PDF document be created:
        myPrintStream.setJobType(
            XMLPrintStreamConstants.kJobTypePDF);

        myPrintStream.open(tempKey, MyPC, 1234);
        final XMLDocument myDoc =
            new XMLDocument(
                myPrintStream.getStream(),
                XMLEncodingConstants.kEncodeISOLATIN1);
        myDoc.open("A User", "31-Dec-1999", "1.0", "Sample 1");
        myDoc.add(myStruct);
        myDoc.close();
        myPrintStream.close();

        // Now that we have created the PDF document the
        // following code illustrates three things that
        // can be done with it.

        // (1) Save the document to disk.
        final FileOutputStream previewFile =
            new FileOutputStream("/preview.pdf");
        previewBuffer.writeTo(previewFile);
        previewFile.close();

        // This class contains both a String and
        // a Blob for demonstration purposes.
        final MyResult result = new MyResult();

        // (2) Store the PDF preview in a String:
        result.previewDocString = previewBuffer.toString();

        // (3) Store the PDF document in a Blob:
        result.previewDocBlob =
            new curam.util.type.Blob(previewBuffer.toByteArray());

        return result;
    }
}

```

Figure 15. Previewing an XML Print Job

Having received the PDF preview of the data, this sample illustrates three ways in which the preview can be used:

1. Save it to disk.
2. Store it in a String variable.
3. Store it in a Blob. This is recommended if the document is to be stored on the database.

This example used an `java.io.ByteArrayOutputStream` as a buffer to hold the generated PDF document because this class was most suited to the three examples above. However any sub-class of `java.io.OutputStream` can be used, depending on your needs. For example, a `java.io.FileOutputStream` could be used if you wish to write the data to a file.

3.6.6 Building a Document from a List

In these final samples, the use of list documents is demonstrated. Once an XML document built from a list has been closed, it may be manipulated in the same manner as any other XML document.

The first sample shows how a vector of struct classes can be added to an XML document.

```
import curam.util.xml.impl.XMLEncodingConstants;
import curam.util.xml.impl.XMLDocument;

public class XMLSample {
    void listDoc1(MyStructList myStructList) {
        XMLDocument myDoc =
            new XMLDocument(XMLEncodingConstants.kEncodeISOLATIN1);

        myDoc.openForList("A User",
            "31-Dec-1999",
            "1.0",
            "Sample 1");

        myDoc.add(myStructList);
        myDoc.close();

        // The document may now be manipulated as before.
    }
}
```

Figure 16. Adding a List to a Document

In the second sample below, the list of struct classes is iterated over and only those elements whose *value* field is greater than 100 are added to the document. You can, of course, apply any condition you like to this basic pattern. In IBM Cúram Social Program Management, the list of a type called `MyStruct` is called `MyStructList`, and the *dtls* field of the list is a `java.util.Vector` of the basic struct class type, this is assumed below.

```

import curam.util.xml.impl.XMLEncodingConstants;
import curam.util.xml.impl.XMLDocument;

public class XMLSample {
    void listDoc2(MyStructList myStructList) {

        XMLDocument myDoc = new XMLDocument(
            XMLEncodingConstants.kEncodeISOLATIN1);

        myDoc.openForList("A User",
            "31-Dec-1999",
            "1.0",
            "Sample 1");

        for (int i = 0; i < myStructList.dtls.size(); i++) {
            if (myStructList.dtls.item(i).value > 100) {
                myDoc.add(myStructList.dtls.item(i));
            }
        }
        myDoc.close();

        // The document may now be manipulated as before.
    }
}

```

Figure 17. Adding Elements of a List to a Document

3.7 Load Balancing and Fail-over

The XMLPrintStream supports load balancing and fail-over. Load balancing increases the capacity of the XML Server by sharing the load among a number of replicated XML Servers and making them appear as one large virtual server. Fail-over provides the capability to switch over automatically to a redundant XML Server upon the failure or abnormal termination of the previously active XML Server.

Load balancing and fail-over are implemented in the XMLPrintStream, and XMLServerEndPoint classes. An instance of the XMLServerEndPoint class contains the endpoint details such as server name, port number and a weight between 0 and 1 which dictates the percentage of requests that are directed to this server. The open() method of the XMLPrintStream class can optionally take a list of XMLServerEndpoints as parameter. The connection will be performed to one of these endpoints based on the weight attached to it as well as its availability.

Load balancing and fail-over can also be configured using the curam.xmlserver.host and curam.xmlserver.port properties. The curam.xmlserver.host property specifies the machine names hosting the XML Server as a '/' separated list of host names. For example:

```
curam.xmlserver.host="server1/server2/server3"
```

The curam.xmlserver.port property specifies the ports the XML Server is running on as a '/' separated list of entries in the following format: port[#weight], where the part in square brackets is optional and weight is a number between 0 and 1. The weight dictates the percentage of requests that are directed to the particular server and port. For example:

```
curam.xmlserver.port="1801#0.6/1802#0.2/1803#0.3"
```

There is a one to one mapping between the servers and ports specified. For example, server1 is running the XML Server on port 1801 and server3 is running the XML Server on port 1803.

3.8 Summary

- The XMLDocument class allows well-formed XML documents to be generated using struct classes or lists of struct classes.

- Care must be taken to ensure that the character encoding scheme used for your data is specified for the XML document.
- Instances of `XMLDocument` can be created, saved, loaded, and written to arbitrary output streams.
- The `XMLPrintStream` class is a type of output stream that allows jobs to be submitted to the XML Server for processing. Used in combination with the `XMLDocument` class and XSL templates, it allows XML data to be formatted and printed
- The `XMLPrintStream` can be configured on a per-server or per-job basis for maximum flexibility.
- The `XMLPrintStream` class includes features for previewing documents generated by the server.

Chapter 4. The XML Server

4.1 Objective

In this chapter, you will learn about the IBM Cúram Social Program Management XML Server, the component that processes and renders XML documents.

4.2 Prerequisites

There are no prerequisites for this chapter.

4.3 Introduction

The XML Server is a Java application that processes XML documents generated by a IBM Cúram Social Program Management server application, applying XSL templates (which are described in more detail in Chapter 5, “Cúram XML and XSL Templates,” on page 41) and rendering to PDF, RTF, HTML, or plain text. The IBM Cúram Social Program Management server application and the XML Server do not have to be co-located; they may be hosted on different machines. There can also be any number of XML Servers, each responsible for a specific task. The XML Server was primarily designed to support printing of XML documents, however, it can be configured in a myriad of ways to perform many different tasks.

This chapter describes how the XML Server fits into the IBM Cúram Social Program Management application architecture and how the server can be configured, and also suggests many ways in which it can be used.

4.4 The XML Server

4.4, “The XML Server” below shows how the XML Server fits into the architecture of a IBM Cúram Social Program Management application. An application can read application data from a database and using `curam.util.xml.impl.XMLDocument` and `curam.util.xml.impl.XMLPrintStream` can transmit XML data to the XML Server. The XML Server processes the data and renders a document in any of a number of formats. This document is then submitted to the system allowing arbitrary commands to be executed on the document so that it can be printed, e-mailed, transferred, stored, etc. in any system-specific way.

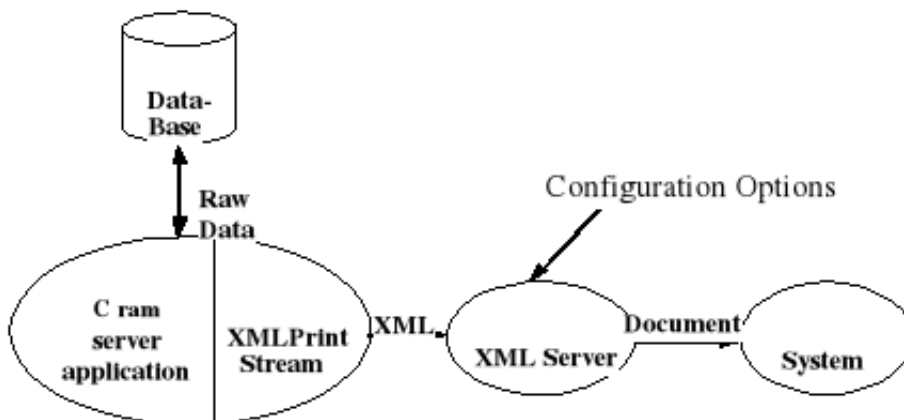


Figure 18. XML Processing Architecture

The connection from XMLPrintStream to the XML Server is over a TCP/IP socket allowing the XML Server to be located remotely. The XML Server is configured, at startup, to run a command on its host to process the document.

The XML Server is fully threaded, allowing it to process multiple jobs simultaneously.

4.5 Configuring the XML Server

4.5.1 Overview

The XML Server has a number of configuration options used to specify how it should work. All the options are set in a configuration file written using XML notation. This file is picked up when the XML Server is started and as such the configuration cannot be changed without stopping and starting the server. There are a number of areas of the operation of the server that can be configured:

- Network;
- Default Values;
- Server Command;
- Template Cache;
- Debugging;
- Apache log4j Logging;
- RenderX Configuration;
- Custom.

These categories are covered in the following sub-sections. The final sub-section presents some samples to help you develop your own configuration files. All the configuration options are enclosed in an XML root element <XML_SERVER_CONFIG>. As with all XML documents, you must ensure that the characters,, <, >, and & used in the values of your options in the configuration file are replaced with their respective character entities: ', ", <, >, and &.

Table 5. Configuration Options

Option	Category	Description
<SERVER_PORT>	Network	The TCP/IP port number that the XML Server will use to listen for client connections.
<SO_TIMEOUT>	Network	A positive integer value specifying the timeout (in milliseconds) on socket operations. If zero value is specified then it will be interpreted as an infinite timeout. If this option is not specified a default value of 60000 milliseconds will be used.
<DEFAULT_PRINTER>	Default Values	The name of the default printer. The format used should be that required by the server command.
<DEFAULT_TRAY>	Default Values	The name of the default printer tray. The format used should be that required by the server command.
<DEFAULT_USERNAME>	Default Values	The name of the default user. The format used should be that required by the server command.
<DEFAULT_EMAIL>	Default Values	The default e-mail address. The format used should be that required by the server command.
<SERVER_COMMAND>	Server Command	The command string to use to process the document. If the command string is empty, no processing will be attempted.

Table 5. Configuration Options (continued)

Option	Category	Description
<USE_PIPE>	Server Command	Indicate that the output document from the XML Server should be piped to the standard input of the server command when it is executed. One of USE_PIPE or USE_TMP_FILE is required to be true.
<USE_TMP_FILE>	Server Command	Indicate that the output document from the XML Server should be written to a temporary file before the server command is executed. One of USE_PIPE or USE_TMP_FILE is required to be true.
<USE_STDOUT_SINK>	Server Command	Start a thread to read and discard any data written to standard output by the server command.
<USE_STDERR_SINK>	Server Command	Start a thread to read and discard any data written to standard error by the server command.
<TMP_DIRECTORY>	Server Command	Specifies the directory into which temporary files containing the document data should be written. Required only if USE_TMP_FILE is true.
<TMP_FILE_ROOT>	Server Command	Specifies the root part of the file name to use to create the temporary file. A sequence number and the appropriate extension will be appended to create the full file name. Required only if USE_TMP_FILE is true.
<FOP_CONFIG_FILE>	Server Command	The name and location of a FOP configuration file. This can be used to add additional fonts for use when processing PDF files. Consult the Apache FOP documentation for more information.
<RENDERX_CONFIG_FILE>	RenderX Configuration	The name and location of a RenderX configuration file. This is required to initiate the RenderX rendering engine. RenderX can be used as an alternative to Apache FOP. Consult the RenderX documentation for more information.
<RENDERX_LOGGING>	RenderX Configuration	Specifies how RenderX's internal logging should be configured. Consult the RenderX documentation for more information.
<USE_TEMPLATE_CACHE>	Template Cache	Indicates that the template cache should be used to avoid having to read templates each time a job is submitted.
<TEMPLATE_CACHE_DIR>	Template Cache	The name of the directory in which to store the cached template files. Required only if USE_TEMPLATE_CACHE is true.
<CLEAR_TEMPLATE_CACHE>	Template Cache	When the server is started, this option will force all files in the template cache directory to be deleted.
<TRACE_TRAFFIC>	Debug	A debug option to echo all data received by the server to the server's standard output.
<STATISTICS_FOLDER>	Debug	This option will output statistics for the XML Server in the folder specified by the option.
<THREAD_POOL_SIZE>	Sizing	The amount of threads in the pool.

Table 5. Configuration Options (continued)

Option	Category	Description
<THREAD_POOL_QUEUE_SIZE>	Sizing	This can be tuned if needed so that requests are held inside the XMLServer rather than out in the TCP backlog queue. The process memory space required for an accepted TCP/IP connection should be taken into consideration when setting this configuration parameter.
<JOBS>	Custom	The parent element of <JOB> children elements which specify a job type for the XML Server.
<JOB>	Custom	Specifies a job type for the XML Server. Multiple <JOB> elements can be defined, each detailing a new job type and the implementing class.

4.5.2 Network Configuration

There are two network settings that can be set to all XML Server s.

The TCP/IP port number on which to listen for connections. Clients of the XML Server connect to the host on which the server is running and must specify which port should be used for communications. The <SERVER_PORT> element is used to specify the port number. The number should be that of an available port on the system. Generally, this means a port number between about 1000 and 32767. If the server is started with a port that is already in use, this will be reported and you can select a different port.

A timeout value can be specified for network socket operations to ensure that the job threads are not blocked indefinitely, while reading template files across the network and in the event of any network problems. The <SO_TIMEOUT> element is used to specify the timeout value (in milliseconds). This option allows a network socket operation to block for the time specified. If the timeout expires, a *java.net.SocketTimeoutException* is raised, although the socket is still valid. A timeout value of zero is interpreted as an infinite timeout. If this option is not specified, a default value of 60000 (i.e. one minute) is used.

4.5.3 Default Value Configuration

There are a number of default values that can be specified for the server. These are the default printer name, the default paper tray, the default e-mail address, and the default user name. They are specified using the elements <DEFAULT_PRINTER>, <DEFAULT_TRAY>, <DEFAULT_EMAIL>, <DEFAULT_USERNAME> respectively. The values can be anything you wish.

If a job submitted to the XML Server via an instance of the XMLPrintStream class includes these values, the defaults will be overridden for that job.

4.5.4 Server Command Configuration

Once a job has been processed by the XML Server (providing the client did not request a preview), the server will run its *server command*.

Note: The *server command* cannot be set per invocation, if multiple commands are required multiple XML Server s must be used

The *server command* is a command that is sent to the system to manipulate the output document. Usually this will involve printing or e-mailing the document, but there are no restrictions on what the command can do other than those imposed by your system. No built in *server commands* are provided. The command is free-form and is specified using the <SERVER_COMMAND> element.

The server command uses token substitution to pass parameters to the system. The tokens consist of a % character followed by a letter (it is case-insensitive). Tokens that appear in the server command string are substituted with the relevant value of the token just before the server command is executed for each job. The tokens are listed in 4.5.4, “Server Command Configuration,” on page 28 below.

Table 6. XML Server Command Tokens

Token	Meaning
%p	The name of the printer is being set to either the default printer ID attribute on the Users table (i.e. the user trying to print the document) or the default printer name as specified in the XML server configuration.
%t	The name of the paper tray as specified in the job configuration received from the client, or the default paper tray as specified in the server configuration.
%u	The name of the connecting user, or the default username specified in the server configuration. This could be the application username that the user logged in as.
%e	The e-mail address of the connecting user, or the default e-mail address specified in the server configuration. This can be used if you want to e-mail the result of the XML job back to the user. For example, you could configure a server to e-mail PDF to a user as well as print the PostScript output. You could even use this to configure two servers where one supplies e-mailed copies and the other generates hard-copies.
%f	The name of the file where the document was saved. This will be a generated temporary file name and will not include that path to the file. The file extension will depend on the specified job type and will default to.pdf.
%d	The directory where the temporary file is located. You may use a trailing directory separator character and then specify %d%f or you can leave out the character and use, for example, %d/%f. The XML Server will not insert one for you. Care should be taken to use the correct separator character for your system.
%%	If you want to use a % character in a command but not as a token, use %% instead. The first % will be removed before invoking the command.

For example, if the server command is specified as:

```
mail -s 'Your Print Job' %e
```

the %e token will be replaced with the e-mail address specified for the job (or the default e-mail address if none was supplied).

For more complex server commands it may be necessary to wrap the actual commands in a batch/script files. This batch file is then executed via a server command such as:

```
<SomeLocation>/MyBatch.bat 'Your Print Job' %e
```

The server command tokens are not available in the batch file but are only replaced in the server command specified in the server configuration file and must be passed into the batch program as normal parameters.

The main consideration when writing a server command is to identify whether you want the output document of the XML Server piped to your command or stored in a temporary file for your command to process. This can be chosen by setting one of the mutually exclusive <USE_TMP_FILE> or <USE_PIPE> elements in your configuration.

If you opt to use a temporary file. The document data will be written to the temporary file and then the server command will be executed. The XML Server will *not* delete the temporary file for you. You should have your server command do that if that is what you wish. The temporary file will be named using the value of the TMP_FILE_ROOT element with a sequence number and the appropriate extension appended

according to the job type. For example, if the value was temp, and the job type was XMLPrintStreamConstants.kJobTypePDF the first file generated by the XML Server would be temp0.pdf, the next file temp1.pdf, etc. This is useful if you start several XML Servers that all share the same temporary directory to avoid servers over-writing each others temporary files. The file will be created in the directory specified by the <TMP_DIRECTORY> element in the configuration. This element should contain an absolute path or a path relative to the directory in which the XML Server was started. The directory name and the generated file name are made available to your command using the %d and %f tokens respectively.

If you opt to use a pipe, your command will be executed and the XML Server will begin to write document data to the standard input of the command. No temporary file will be created. There is, however, an issue that must be resolved when using pipes: if the command write buffered data to standard error or standard output that is not read by any process, once the buffer is full, the command may block. As no process will ever read from the streams, the command will remain blocked indefinitely; in other words, it hangs. There are two methods that can be employed to avoid this. The first is to ensure that all unused output from your command is redirected to a device that will read all the output and ensure the process does not block. The second is to have the XML Server do this for you using the <USE_STDOUT_SINK> and <USE_STDERR_SINK> elements. While the former method is recommended where possible, the use of the XML Server sinks can help in situations or on systems where it is not possible. Both elements cause threads to be created in the XML Server to read and discard data output by the server command.

More details on how to write server commands are provided in the section including samples below.

4.5.5 Template Cache Configuration

Each job submitted to the XML Server requires an XSL template to be applied to an XML document. Both the template and the document must be supplied by the client. As it is likely that a template may be used more than once, the server can be instructed to store copies of the templates in local files rather than request that the client send a new copy of a template each time it is used.

The cache is enabled using the element <USE_TEMPLATE_CACHE>. The templates are then stored in the directory specified using the TEMPLATE_CACHE_DIR element. Only templates that are supplied to the XMLPrintStream with a template ID and template version number will be cached.

The files in the template cache are not deleted when the XML Server is shut down. They will be reused the next time the server is started. If this behavior is not desired, the <CLEAR_TEMPLATE_CACHE> element will ensure that all files in the template cache directory are deleted on server start up.

4.5.6 Debug Configuration

If the server complains that your XSL template or XML document contain errors, you can take a look at what the server sees by tracing all network traffic received by the server. Use the element <TRACE_TRAFFIC> to enable this debugging feature. The output will be written to the servers standard output. For server communications, lines in the template that start with a period or full-stop character. have an extra period character inserted. The end of the client transmission is marked by a line containing only a single period. You should just ignore these extra periods.

4.5.7 Log4j Logging

Logging with log4j is used to improve the performance of logging. This can be configured via the log4j.properties file in the XML Server directory. Further information on how to configure log4j can be found on the Apache website, <http://logging.apache.org/log4j>.

4.5.8 RenderX Configuration

The XML Server provides support for RenderX as an alternative to the Apache FOP document rendering engine. It must be installed on the machine on which XML Server is running before it can be used within the XML Server. Further information on RenderX as a rendering tool can be found on the RenderX website, <http://www.renderx.com>.

`<RENDERX_CONFIG_FILE>` is used to locate the configuration file required by RenderX engine to start up.

`<RENDERX_LOGGING>` is used to configure RenderX 's internal logging.

- `default` - RenderX 's `DEFAULT_LOGGER` will be used to log information.
- `null` - RenderX 's `NULL_LOGGER` will be used to log information.
- `File Path` - RenderX 's `DEFAULT_LOGGER` will be used, but the logging stream will be redirected to the file specified.

The default value for this property is `default`, if it's not specified. Further information on `DEFAULT_LOGGER` and `NULL_LOGGER` can be found on RenderX 's Java API.

4.5.9 Custom Configuration

The XML Server provides support for defining custom rendering implementations, which allows the use of third party rendering tools. A custom rendering implementation can be added in the form of a new job type; alternatively the default implementation can be replaced.

By default, the XML Server provides four `<JOB>` definitions catering for processing four types of documents: HTML, RTF, TEXT, PDF. The default rendering implementations are listed below:

- HTML - `curam.util.xmlserver.HTMLDocumentGenerator`
- RTF - `curam.util.xmlserver.RTFDocumentGenerator`
- TEXT - `curam.util.xmlserver.TEXTDocumentGenerator`
- PDF - `curam.util.xmlserver.PDFDocumentGenerator`

The default document formatting solution uses Apache Formatting Objects Processor (FOP) to define processing for the document types HTML, PDF, RTF, TEXT. This default implementation can be replaced with a custom implementation by implementing the `curam.util.xmlserver.DocumentGenerator` interface.

Due to FOP 's limited capabilities on processing Right-To-Left (RTL) documents, a second pdf rendering tool can be used to specifically handle RTL documents. This can be done using the `direction` attribute when defining a `<JOB>`. This attribute is optional, and only applicable for pdf job type. The possible values it may contain are: `rtl` and `ltr`. The default value is `ltr`.

4.5.9.1 Custom Job Type

A new job type is specified using a `<JOB>` element which must be created with the `<JOBS>` element. The new job type should be specified using the `type` attribute. This attribute is case insensitive, and may not contain spaces. Attribute `class` should be used to specify the fully qualified name of the class implementing the `curam.util.xmlserver.DocumentGenerator` interface.

For example:

```
<JOB type="CUSTOM_JOB_TYPE" class="custom.JobImpl" />
```

The configuration file supports the definition of any number of `<JOB>` elements.

The `curam.util.xmlserver.DocumentGenerator` interface requires the following two methods to be implemented.

```

/**
 * This method should be implemented to generate the document
 * for the custom job type. The method is provided with the
 * xml template and xml data to be merged to create the
 * document. The document result should be sent to the
 * output stream provided.
 *
 * @param xslTemplate The XSL template transformer.
 * @param xmlDataStream The input stream from which to read
 * the XML data.
 * @param docOutput The output stream for the generated
 * document.
 *
 * @throws XMLJobException Generic exception to be thrown on
 * error. Exception handling should be handled within the
 * implemented method.
 */
void generateDocument(final Transformer xslTemplate,
    final InputStreamReader xmlDataStream,
    final OutputStream docOutput)
    throws XMLJobException;

/**
 * This method should return a String containing the file
 * extension for the file to be generated. For example if
 * generating a HTML file the method should return the
 * String ".html".
 *
 * @return The extension of the file to be generated.
 */
String getFileExtension();

```

4.5.10 Font Configuration

By Default the XML Server uses FOP (Formatting Objects Processor) for rendering documents in various formats. FOP supports a default set of fonts, including Helvetica, Times and Courier, and it is possible using a FOP configuration file to include support for additional fonts, for example a simplified Chinese font. The `<FOP_CONFIG_FILE>` configuration option allows you to specify the name and location of a FOP configuration file. The path specified for the configuration file can be absolute (`c:/directory/fop-config-file.xml`) or relative (`./fop-config-file.xml`) to the `xmlserver` directory. Any references to files within the FOP configuration file can also be absolute or relative to the `xmlserver` directory.

```

<fop>
  <renderers>
    <renderer mime="application/pdf">
      <font>
        <font metrics-url=".\\chinese\\pmingliu.xml" kerning="yes"
          embed-url=".\\chinese\\mingliu.ttc">
          <font-triplet name="PMingLiu" style="normal"
            weight="normal"/>
        </font>
      </font>
    </renderers>
  </fop>

```

Figure 19. Sample FOP Configuration File

The example FOP configuration file above references a font metrics file (`pmingliu.xml`) and an embed file (`mingliu.ttc`). The embed file is the true type collection font file. True type collection font files can be found on a Windows machine in the installed fonts directory, for example `c:/Windows/Fonts`. Apache provides utilities to generate the necessary font metrics file from a true type collection font file and also from other formats. The Apache FOP documentation should be consulted for more information on font configuration.

4.5.11 Sample Configuration Files

4.5.11.1 Overview

In this section a number of samples are presented to illustrate ways the XML Server can be configured. These configurations are dependent on the platform or operating system used and include:

- Printing a document (Windows);
- Displaying a document for testing purposes (Windows);
- Printing a document (UNIX and IBM z/OS®).

Where path names are specified (e.g. to commands) your customizations may need to be changed if you base your configurations on any of these samples.

The server command (and all other options) should be entered on a single line in the configuration file. In this document they may display with line wrapping for formatting purposes (e.g. 4.5.11.2, “Printing a Document (Windows)”); but, in your implementation they will need to be specified on a single line to be valid.

4.5.11.2 Printing a Document (Windows)

On Windows the server command (specified in the `<SERVER_COMMAND>` element) is not executed in a command shell unless explicitly invoked via the Windows command interpreter (**cmd.exe**) and this is necessary in order to use such facilities as pipes and redirection. The configuration described here is representative for Windows platforms.

Depending on the file type, your printing requirements, and the target printer there are a number of possible options and configurations for printing on Windows. For instance, your particular version of Adobe Reader may allow for direct printing or your printer may support direct PDF printing.

A convenient way to implement print functionality is to write a batch file for the Windows command interpreter to invoke and perform any necessary operations and to get the server to execute this batch file. A sample batch file is shown in 4.5.11.2, “Printing a Document (Windows)” below. Let us assume that the batch file is saved as `c:\xmlsrv\xmlserverprint.bat`⁷. The server command can pass parameters to the batch file through the command line and the batch file accesses these as `%1` for the first parameter, `%2` for the second, etc. These parameters are provided to the batch file via the server command tokens specified in the batch file invocation in the server configuration file and replaced when it is invoked. (See 4.5.4, “Server Command Configuration,” on page 28 and 4.5.11.2, “Printing a Document (Windows)” for more information on command tokens.)

While Windows applications sometimes allow the use of either forward-slash (/) or back-slash (\) characters interchangeably as a path separator, the Windows command interpreter only allows the \ character. Care must be taken to ensure that all paths that may be visible to the command interpreter use back-slash characters (\) as separators. As path information will not be available in the context of your batch file, commands must have fully specified paths. The interpreters built-in commands do not require a path.

The following example illustrates the use of the sample `SimplePrintService` class, which is implemented using the Java Print Service API. You could utilize this API for your own custom solution; for instance, to utilize specific printer features in your environment. To print a PDF file using this sample class would require the printer to have direct PDF print support.

7. Note that you should choose a target destination for setting up your XML Server and its customizations to avoid being overwritten by subsequent service pack updates.

```

@ECHO OFF

echo ----- ^
  >> XMLServer.log
REM log output
echo File:      %1      ^
  >> XMLServer.log
echo Print Server: %2      ^
  >> XMLServer.log

REM Call the system print command
echo Starting Print      ^
  >> XMLServer.log
echo %JAVA_HOME%\bin\java      ^
  -cp xmlserver.jar;xmlservercommon.jar      ^
  curam.util.xmlserver.SimplePrintService      ^
  %2 "%1" >> XMLServer.log 2>&1      ^
%JAVA_HOME%\bin\java      ^
  -cp xmlserver.jar;xmlservercommon.jar      ^
  curam.util.xmlserver.SimplePrintService      ^
  %2 "%1" >> XMLServer.log 2>&1      ^
echo Printing Completed      ^
  >> XMLServer.log
echo ----- ^
  >> XMLServer.log

```

Figure 20. Batch File for Printing a Document (Windows)

Instead of the sample Java program above any appropriate processing could be specified or additional processing prior to printing or cleanup after printing could also be implemented as needed. If you use any command that may send output to the console, make sure that you add null redirection. This output needs to be redirected to the null device or it will cause the command to block and the batch file will hang. Therefore, redirection must be added to the command pointing to the null device; e.g.: `> nul :`, which avoids the problem of blocking the XML Server. Setting the `<USE_STDOUT_SINK>` and `<USE_STDERR_SINK>` elements in the configuration will *not* work on Windows.

A sample configuration file used to launch this batch file is shown in 4.5.11.2, “Printing a Document (Windows),” on page 33 below. Note how the printer name and the details of the temporary file are passed to the batch file using the command tokens.

```

<XML_SERVER_CONFIG>
  <SERVER_PORT>6789</SERVER_PORT>
  <SERVER_COMMAND>
    c:\Windows\System32\CMD.EXE
    /C c:\xmlsrv\xmlserverprint.bat %d%\f %p
  </SERVER_COMMAND>
  <USE_TMP_FILE>true</USE_TMP_FILE>
  <TMP_FILE_ROOT>temp</TMP_FILE_ROOT>
  <TMP_DIRECTORY>c:\xmlsrv\tmp</TMP_DIRECTORY>
  <DEFAULT_PRINTER>\\MyPC\ps1</DEFAULT_PRINTER>
  ...
</XML_SERVER_CONFIG>

```

Figure 21. Configuration for Printing a Document (Windows)

The command interpreter (`cmd.exe`) uses the `/C` option to specify a batch file to execute. The batch file is passed two parameters. The first parameter is the name of the temporary PDF file created by concatenating the expanded `%d` token for the temporary directory name, a back-slash separator, and the expanded `%f` token for the name of the temporary PDF file. The second parameter is the expanded `%p` token for the name of the printer. The configuration file also includes a default printer name. But this may be overridden by the client. See 4.5.4, “Server Command Configuration,” on page 28 for a more detailed description of these tokens.

4.5.11.3 Displaying a Document for Testing (Windows)

When testing a new XSL template against XML data, it is useful to see the PDF output without printing it each time. If the code you are writing does not use the preview facilities of the XMLPrintStream class, you will need to look at the PDF output of the XML Server manually.

A simple solution is to run an XML Server on your development machine and configure it to open Adobe Reader to display the PDF data each time you submit a job. This will save you from running to a printer or manually opening PDF files. The configuration is shown in 4.5.11.3, "Displaying a Document for Testing (Windows)."

```
<XML_SERVER_CONFIG>
  <SERVER_PORT>6789</SERVER_PORT>
  <SERVER_COMMAND>c:/PROGRA~1/Adobe/AcrobatReader/AcroRd32.exe
%d/%f</SERVER_COMMAND>
  <USE_TMP_FILE>true</USE_TMP_FILE>
  <TMP_FILE_ROOT>temp</TMP_FILE_ROOT>
  <TMP_DIRECTORY>c:/xmlsrv/tmp</TMP_DIRECTORY>
  ...
</XML_SERVER_CONFIG>
```

Figure 22. Displaying a Document for Testing (Windows)

You cannot include space characters in the path to the server command as Java will interpret these as the end of the command file name and there is no way of escaping them. To avoid the problem, the above configuration file shows how the DOS short name of the directory containing the space character is used: PROGRA~1 instead of Program Files. As the command was not passed to a command interpreter, the choice of / or \ as a path separator character is arbitrary.

4.5.11.4 Installing RenderX for Right-To-Left (RTL) PDF Document Processing (Windows)

Due to the lack of support for RTL writing languages in Apache FOP the XML Server also provides the functionality to use alternative rendering tools.

RenderX is one of a number of third party document rendering engines that supports RTL writing languages. If RenderX is installed, and the XML Server is configured to use RenderX, the XML Server will automatically use RenderX to generate all RTL PDF documents. In order to use the default RenderX implementation in IBM Cúram Social Program Management the following steps should be completed:

- Install RenderX according to RenderX 's installation guide.
- Set a system environment variable RENDERX_HOME to point to RenderX 's installation directory.
- Customize xmlserver_config.xml to use curam.util.xmlserver.RenderXDocumentGenerator to process Right To Left PDF documents. See example below for details.

```
<XML_SERVER_CONFIG>
  ...
  <RENDERX_CONFIG_FILE>C:/RENDERX/xep.xml</RENDERX_CONFIG_FILE>
  <RENDERX_LOGGING>off</RENDERX_LOGGING>
  ...
  <JOBS>
    ...
    <JOB type="pdf" direction="RTL"
      class="curam.util.xmlserver.RenderXDocumentGenerator"/>
  </JOBS>
</XML_SERVER_CONFIG>
```

The customizations in this example assume RenderX is installed to c:/RenderX directory
Figure 23. Setting up RenderX as the rendering tool for Right To Left Document processing

Note: In order to use a relative path with a default installation of RenderX, the images should be stored relative to the RenderX location. For example, if the RENDERX_HOME is C:\projects\RenderX\, and the

images are stored in C:\projects\RenderX\images, then the relative path to an image would be ".\images\curam\curam.jpg" which is the equivalent of C:\projects\RenderX\images\curam\curam.jpg.

4.5.11.5 Printing a Document (UNIX and z/OS)

Printing a document on UNIX and z/OS can be done similarly to Windows in that an invoked shell script can execute commands or other necessary processing. That is, you write a shell script that is invoked by the XML Server as per your configuration and the shell script performs the processing specific to the platform. For example, see 4.5.11.5, "Printing a Document (UNIX and z/OS)" below. Let us assume that the shell script is saved as /usr/local/xmlsrv/xmlserver.sh⁸. The server command can pass arguments to the shell script, which are accessed in a typical way: \$1 for the first parameter, \$2 for the second, etc. These arguments are provided to the shell script via the server command tokens specified in the script invocation in the server configuration file and replaced when the script is invoked. (See 4.5.4, "Server Command Configuration," on page 28 and 4.5.11.5, "Printing a Document (UNIX and z/OS)" for more information on command tokens.)

In general, printing capabilities vary widely by OS distribution, version, installed software, physical printer capabilities, etc. Review your local environment for requirements and how to best implement printing support. For instance, a z/OS implementation might use the IBM InfoPrint Server⁹.

The following example illustrates how printing might be done on various UNIX platforms. For instance, as on z/OS, if the software and printer hardware supports it direct printing via the the system print command (**lp** or **lpr**) may be possible. On IBM AIX[®] you would require third-party software to convert the input PDF to PostScript for printing. For ease of monitoring the script contains **echo** commands to provide progress during its execution and appends the output to a file named XMLServer.log.

Note: On the z/OS platform you will have to convert the encoding of the xmlserverprint.sh script from ASCII to EBCDIC. For example:

```
tr -d '\15\32' < xmlserverprint.sh > xmlserverprint.sh-ASCII
iconv -t IBM-1047 -f IS08859-1 xmlserverprint.sh-ASCII \
> xmlserverprint.sh
chmod a+rx xmlserverprint.sh
```

8. Note that you should choose a target destination for setting up your XML Server and its customizations to avoid being overwritten by subsequent service pack updates.

9. The installation and configuration of the InfoPrint Server is beyond the scope of this document.

```

#!/bin/sh

# Sample UNIX script for XMLServer printing.

echo ----- \
  >> XMLServer.log
# log output
echo File:      $1          >> XMLServer.log
echo Print Server: $2      >> XMLServer.log
Platform=`/bin/uname`
echo Platform:  $Platform  >> XMLServer.log

# The following illustrates some possible print solutions
# for various platforms:

case $Platform in
# z/OS:
OS/390)
# On OS/390 (z/OS) use of the lpd command as
# illustrated would be dependent on the InfoPrint
# Server installation and configuration, related
# software, and a printer with direct PDF support
# and sufficient memory.
echo Starting print... >> XMLServer.log
lp -d $2 $1
echo Printing Completed >> XMLServer.log
;;

AIX)
# AIX has no native print support for PDF files,
# so you would need to implement functionality such as
# pdf2ps to convert the generated PDF file to
# PostScript for printing with lpr; e.g.:
# see the IBM Redbook SG24-6018-00
# pdf2ps $1 $1.ps
# lpr -P $2 $1.ps
echo $Platform printing implementation is TBD. \
  >> XMLServer.log
;;

# Other platforms:
*)
# Your local print functionality to be implemented here ...
echo $Platform printing implementation is TBD. \
  >> XMLServer.log
;;
esac

echo ----- \
  >> XMLServer.log

```

Figure 24. Sample Shell Script for Printing a Document (UNIX and z/OS)

The configuration file used to launch this shell script is shown in 4.5.11.5, “Printing a Document (UNIX and z/OS),” on page 36 below. Note how the printer name (%p) and the details of the temporary file (%d and %f) are passed to the shell script using the command tokens. These are interpreted by the shell as two arguments inside the script: 1) The temporary directory and file name are concatenated with a forward-slash separator; and 2) name of the printer, which may be overridden by the client. See 4.5.4, “Server Command Configuration,” on page 28 for a more detailed description of these tokens.


```

<XML_SERVER_CONFIG>
...
<SERVER_COMMAND>
  ./xmlserverprint.sh %d/%f %p
</SERVER_COMMAND>
<USE_TMP_FILE>true</USE_TMP_FILE>
<TMP_DIRECTORY>./tmp</TMP_DIRECTORY>
<TMP_FILE_ROOT>doc</TMP_FILE_ROOT>
<DEFAULT_PRINTER>printer1</DEFAULT_PRINTER>
...
</XML_SERVER_CONFIG>

```

Figure 25. Configuration for Printing a Document (UNIX and z/OS)

4.6 Running the XML Server

The XML Server application is delivered as a separate component in IBM Cúram Social Program Management. The XML Server is started from the XML Server installation directory using Apache Ant. For example:

```
ant -file xmlserver.xml
```

A default `xmlserver_config.xml` is provided on install which contains the default configuration file for the server. You can apply changes to this file as required.

When the server starts, it displays the configuration information it has read from the configuration file and displays the status of each job it receives.

Note: In addition to running as a command line application, the XML server can also be run in the background as a Windows service as discussed in 4.6.1, “Running the XML Server as a Windows Service or UNIX Daemon.”

4.6.1 Running the XML Server as a Windows Service or UNIX Daemon

For a production environment it can be more effective, for purposes of ensuring availability at restart, avoiding accidental shutdowns via an open shell prompt, etc., to run the XML Server as a Windows service or UNIX daemon.

To run a program as a Windows service requires specific Windows infrastructure; that is, batch files and programs cannot be run this way out-of-the-box. However, there are third-party tools available to enable this functionality. One example of such a tool is the Java Service Wrapper from Tanuki Software (<http://wrapper.tanukisoftware.com>).

With Tanuki Java Service Wrapper we recommend, after installation, integrating the XML Server using the `WrapperStartStopApp` class (setting `wrapper.java.mainclass=org.tanukisoftware.wrapper.WrapperStartStopApp`) and you would need to:

- Set the classpath to include the necessary Ant libraries;
- Pass the Ant home into the environment;
- Ensure adequate memory (e.g. 768MB);
- Pass in the necessary parameters to invoke the XML Server Ant script.

Specifically, for the Java Service Wrapper the properties would look like:


```
wrapper.java.classpath.<n>=<ANT_HOME>/lib/ant.jar
wrapper.java.classpath.<n>=<ANT_HOME>/lib/ant-launcher.jar
wrapper.java.additional.<n>=-Dant.home=<ANT_HOME>
wrapper.java.maxmemory=768
wrapper.app.parameter.1=org.apache.tools.ant.launch.Launcher
wrapper.app.parameter.2=2
wrapper.app.parameter.3=-f
wrapper.app.parameter.4=<CURAMSDEJ>/xmlserver/xmlserver.xml
wrapper.app.parameter.5=org.apache.tools.ant.launch.Launcher
wrapper.app.parameter.6=true
wrapper.app.parameter.7=3
wrapper.app.parameter.8=-f
wrapper.app.parameter.9=<CURAMSDEJ>/xmlserver/xmlserver.xml
wrapper.app.parameter.10=stop
```

The values in angle brackets above would need to be substituted with the appropriate values for your local installation. See the Java Service Wrapper documentation for more details on installation, configuration and running.

Running the XML Server as a UNIX daemon is something that can typically be done with shell scripting and system facilities (e.g. **cron**); but, UNIX -compatible versions of Java Service Wrapper are available.

4.7 Overriding the Default Port

The Cúram XML Server application runs on port 1800 by default. To override the default port the **-Dxmlserver.port** option can be specified, overriding the Ant script. For example:

```
ant -file xmlserver.xml -Dxmlserver.port=1805
```

4.8 Overriding the Default Configuration

The Cúram XML Server application comes and runs with a default configuration file which it generates each time the application is started.

To override this default version, take a copy of the `xmlserverconfig.xml`¹⁰ and place in a custom location. To start the server using this custom configuration use the following Ant command:

```
ant -f xmlserver.xml -Dxmlserver.config.file=C:\Custom\xmlserverconfig.xml
```

4.9 Switching Off Configuration File Schema Validation

The Cúram XML Server application validates the XML Server configuration file at start up by default.

To switch off validation the `novalidation` option can be specified as an additional argument to the Ant script invocation. For example:

```
ant -file xmlserver.xml -Dadditional.args=novalidation
```

4.10 Shutting Down the XML Server

In an environment where few jobs are printed or you can be sure the XMLServer is idle, you can safely shut down the XML Server with a simple Control-C key combination without causing any problems. However, the recommended and safer method is to use the **XMLServerShutdown** command. This will shut down any XML Server in an orderly fashion: the server will refuse any new jobs and allow all outstanding jobs to complete before exiting. This is done through the following Ant command:

10. The `xmlserverconfig.xml` is created from the `xmlserverconfig.xml.template` file the first time the XML Server is run. This file contains all the configuration elements for the XML Server.

```
ant -file xmlserver.xml stop
```

The server will be switched into shut down mode and all outstanding jobs will be completed before the server exits and the **XMLServerShutdown** command informs you that the server has been shut down. Depending on the number of jobs being processed, this may take some time to complete.

4.11 Statistics

Once you shutdown the XMLServer various statistics data for the XML Server are collected in the statistics folder, specified in xmlserverconfig.xml.

The statistics log includes the below columns:-

- Success - Whether or not the job was successful(true, false).
- Job preview type - The job preview type (PDF,HTML,TEXT,RTF).
- Elapsed connection - the time elapsed (in milliseconds) since processing of a connection started until the connection was closed.
- Elapsed job - The time (in milliseconds) it takes to run the job.
- Elapsed job preview send - The time (in milliseconds) it takes to send the preview data to the client.
- Job preview data length - The length of the preview data (in bytes) sent to the client.
- Timestamp - The timestamp (Java time stamp value) when the connection entered the system.
- Template ID - The ID for the template being processed.
- Template version - The version number of the template being processed.
- Template locale - The locale of the template being processed.

4.12 Summary

- The Cúram XML Server processes jobs submitted by a client to produce a formatted document.
- Each job requires an XML document and an XSL template.
- Multiple servers can be run on the same host by specifying different port numbers for each server. Each server can perform a different operation, but can only perform one operation.
- Default values for a printer name, printer tray, e-mail address, and user name can be specified in the configuration.
- The server can be configured to perform any required operation on the output document such as printing, e-mailing, display, etc. by specifying a command that should be run against the document data.
- The configuration can specify whether the document should be piped to the server command or first written to a temporary file.
- The template cache can be used to improve performance where templates are reused regularly.
- Debugging options are available to help solve problems with templates or XML data.
- Custom implementations can be defined to overwrite the default job types, or to define new job types.
- The server is a Java application started from the command line and displays its configuration and status when run.
- The server can be shut down safely using the shutdown command.

Chapter 5. Cúram XML and XSL Templates

5.1 Objective

In this chapter, you will learn about the IBM Cúram Social Program Management XML format used for all XML documents generated by your application server. You will need to know this format if you wish to write XSL templates for formatting and printing the XML documents.

5.2 Prerequisites

Before reading this chapter you should be familiar with the basic concepts behind XML and *Document Type Definitions* (DTD).

5.3 Introduction

Every XML document generated by the XML infrastructure uses a fixed format regardless of the struct classes being converted. This makes the development of XSL templates easier, as the format of the XML does not change. The following sections present that format and show what IBM Cúram Social Program Management XML documents look like. This will help you when you are developing XSL templates.

5.4 Cúram XML

5.4, “Cúram XML” below presents the DTD for Cúram XML. The DTD can also be found in the `/lib` directory of the SDEJ. The structure is relatively simple and, with the comments, this needs no further explanation.

```

<!--A DOCUMENT element has an optional META element
      followed by a mandatory DATA element.-->
<!ELEMENT DOCUMENT (META?, DATA)>

<!--A META element has a number of optional elements that
      it can contain in no particular order.-->
<!ELEMENT META (GENERATED_DATE | GENERATED_BY |
                VERSION | COMMENT)*>

<!--A DATA element contains a single mandatory STRUCT_LIST
      or STRUCT element.-->
<!ELEMENT DATA ((STRUCT_LIST | STRUCT))>

<!--A STRUCT_LIST element has one or more STRUCT
      elements.-->
<!ELEMENT STRUCT_LIST (STRUCT+)>

<!--A STRUCT element has an optional SNAME element and one
      or more FIELD elements.-->
<!ELEMENT STRUCT (SNAME?, FIELD+)>

<!--A FIELD element has an FNAME and either a TYPE
      element and a VALUE element, or a STRUCT_LIST element,
      or a STRUCT element (in that order).-->
<!ELEMENT FIELD (FNAME, ((TYPE, VALUE) | STRUCT_LIST | STRUCT))>

<!--All these elements contain parsed character data only
      and do not contain sub-elements. Use ISO-8601 when
      formatting date values.-->
<!ELEMENT GENERATED_DATE (#PCDATA)>
<!ELEMENT GENERATED_BY   (#PCDATA)>
<!ELEMENT VERSION        (#PCDATA)>
<!ELEMENT COMMENT        (#PCDATA)>
<!ELEMENT SNAME          (#PCDATA)>
<!ELEMENT FNAME          (#PCDATA)>
<!ELEMENT VALUE          (#PCDATA)>
<!ELEMENT TYPE           (#PCDATA)>

<!--A TYPE element can have a SIZE attribute. If not
      supplied, the attribute will not be set by default
      and will have a null value. This is normally used
      for SVR_STRING types.-->
<!ATTLIST TYPE SIZE CDATA #IMPLIED>

```

Figure 26. *Cúram XML Document Type Definition (DTD)*

5.5 Examples

5.5, “Examples” below shows a simple XML document generated for a struct that contains two fields. Note that the field types will always be the basic types and not the domain definitions derived from those basic types.

```

<DOCUMENT>
  <META>
    <GENERATED_BY>My Server</GENERATED_BY>
  </META>
  <DATA>
    <STRUCT>
      <SNAME>DPTicketDtls</SNAME>
      <FIELD>
        <FNAME>ticketID</FNAME>
        <TYPE>SVR_INT64</TYPE>
        <VALUE>12796</VALUE>
      </FIELD>
      <FIELD>
        <FNAME>subject</FNAME>
        <TYPE SIZE="100">SVR_STRING</TYPE>
        <VALUE>This is the subject.</VALUE>
      </FIELD>
    </STRUCT>
  </DATA>
</DOCUMENT>

```

Figure 27. An Example XML Document

In the next example, the format of an XML document describing a list of structs is presented. Note that the <STRUCT> elements are the same as previously, but multiple <STRUCT> elements are contained within a <STRUCT_LIST> element.

```

<DOCUMENT>
  <META>
    <GENERATED_BY>My Server</GENERATED_BY>
  </META>
  <DATA>
    <STRUCT_LIST>
      <STRUCT>
        <SNAME>DPTicketDtls</SNAME>
        <FIELD>
          <FNAME>ticketID</FNAME>
          <TYPE>SVR_INT64</TYPE>
          <VALUE>12796</VALUE>
        </FIELD>
        <FIELD>
          <FNAME>subject</FNAME>
          <TYPE SIZE="100">SVR_STRING</TYPE>
          <VALUE>This is the subject.</VALUE>
        </FIELD>
      </STRUCT>
      <STRUCT>
        <SNAME>DPTicketDtls</SNAME>
        <FIELD>
          <FNAME>ticketID</FNAME>
          <TYPE>SVR_INT64</TYPE>
          <VALUE>35667</VALUE>
        </FIELD>
        <FIELD>
          <FNAME>subject</FNAME>
          <TYPE SIZE="100">SVR_STRING</TYPE>
          <VALUE>This is another subject.</VALUE>
        </FIELD>
      </STRUCT>
    </STRUCT_LIST>
  </DATA>
</DOCUMENT>

```

Figure 28. An Example XML Document with a List

If a field of a struct is itself a struct, then instead of a <TYPE> and <VALUE> element, the <FIELD> element will contain a whole <STRUCT> element. Fields can also contain <STRUCT_LIST> elements in the same manner.

5.6 Job Types and Template Types

5.6.1 Overview

You saw in Chapter 3, “Developing for XML,” on page 7 how different job types can be specified when using the `XMLPrintStream` class to communicate with the XML Server. These job types require different types of templates in order to be successful. While all the templates use XSL for formatting, there are two parts of that standard that are used in specific situations.

- **XSL Transformations (XSLT)**

XSLT is a standard that defines a language for transforming XML documents in other XML documents. Elements of the XSLT language allow data from one XML document to be combined with static elements of a template (or stylesheet).

- **XSL Formatting Objects (XSL-FO)**

XSL-FO defines a set of elements for describing the physical layout of a document: paper size, fonts, spacing, image locations, etc. The layout model used is based on that used for PDF documents. A formatting objects processor can convert data marked up with formatting objects into other representations such as PDF or RTF.

The following subsections outline how these standards can be used to develop templates for each of the supported job types.

XSL and XSL-FO are extensive standards and it is beyond the scope of this document to describe them in more than cursory detail. Reference to books and useful Internet sites on these topics are included at the end of this chapter. You are advised to obtain such materials to learn how to use these technologies.

5.6.2 Templates for PDF Documents

Generating PDF documents is a two stage process. It is perhaps easiest to describe the process in reverse order.

PDF documents are generated from documents marked up with XSL-FO in a process called rendering. The document contains the data that should appear in the document (text, figures, etc.) and the XSL-FO mark-up needed to define how this data should be laid out (margins, paper-size, fonts, line-spacing, location of paragraphs, etc.) This rendering stage is handled by the Apache FOP library.

To prepare an XSL-FO document for rendering, the raw data is supplied in an XML document and a template uses XSLT to combine this raw data with the XSL-FO mark-up and the other static elements of the document. In essence, the XSLT *inserts* the raw data into the template creating the XSL-FO document. This transformation stage is handled by the Apache Xalan library.

Thus, templates for rendering documents as PDF are largely XSL-FO documents with elements of XSLT used to insert values from the XML document at the appropriate point. An example of such a template is given in the next section.

5.6.3 Templates for RTF Documents

RTF templates are identical to PDF templates. The same template can be used to produce output in either format. Again, the template is mostly XSL-FO with XSLT used to insert values from the XML document in the appropriate locations.

The JFOR library is used to render RTF documents from XSL-FO documents, however, not all XSL-FO elements are supported. Unless you need to edit the documents in a word processor after they have been generated, you should use the better supported PDF generator.

5.6.4 Templates for HTML Documents

Templates for HTML documents are simpler than those for PDF or RTF. XSL-FO mark-up is not used as the HTML mark-up is used to define the formatting. As such, there is no rendering step when generating HTML documents. The templates consists of HTML mark-up and XSLT elements that insert values from the XML document in the appropriate locations to create a HTML document.

As XSLT can only convert one XML document into another, the output will include some XML elements. These elements are automatically removed for this job type so that the output is a pure HTML document. The HTML will be automatically indented during the processing.

5.6.5 Templates for Plain Text Documents

As with templates for HTML documents, templates for plain text documents contain no XSL-FO mark-up and there is no rendering step. The templates comprise plain text with embedded XSLT elements to insert values from the XML document in the appropriate locations.

Again, XML elements in the output document are stripped. As XML and XSL generally do not preserve white-space, use of the <text> element around white-space that is to be preserved is advised (for example, line breaks, indentation, etc.).

5.7 XSL Template Example

Presented here is a simple example to get your started. It shows the basic method of identifying and extracting data from an XML document containing a single struct.

```

<?xml version="1.0" standalone="yes"?>
<xsl:stylesheet
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
  xmlns:fo="http://www.w3.org/1999/XSL/Format"
  version="1.0">

  <xsl:template match="DOCUMENT">
    <xsl:apply-templates select="DATA"/>
  </xsl:template>

  <xsl:template match="DATA">
    <xsl:apply-templates select="STRUCT[SNAME='DPTicketDt1s']"/>
  </xsl:template>

  <xsl:template match="STRUCT">
    <fo:root xmlns:fo="http://www.w3.org/1999/XSL/Format">
      <fo:layout-master-set>
        <fo:simple-page-master page-master-name="only"
          page-height="297mm" page-width="210mm"
          margin-top="30mm" margin-bottom="30mm"
          margin-left="30mm" margin-right="30mm">
          <fo:region-body/>
        </fo:simple-page-master>
      </fo:layout-master-set>

      <fo:page-sequence>
        <fo:sequence-specification>
          <fo:sequence-specifier-single
            page-master-reference="only"/>
        </fo:sequence-specification>

        <fo:flow>
          <fo:block font-size="12pt" font-family="serif"
            line-height="20mm">
            Ticket ID: <xsl:apply-templates
              select="FIELD[FNAME='ticketID']"/>
          </fo:block>

          <fo:block font-size="12pt" font-family="serif"
            line-height="20mm">
            Subject: <xsl:apply-templates
              select="FIELD[FNAME='subject']"/>
          </fo:block>
        </fo:flow>
      </fo:page-sequence>
    </fo:root>
  </xsl:template>

  <xsl:template match="FIELD">
    <xsl:value-of select="VALUE"/>
  </xsl:template>

</xsl:stylesheet>

```

Figure 29. An Example XSL Template

The output is formatted for A4 paper (210x297mm) with 30mm margins and should appear like this, if the earlier sample XML document is used:

Ticket ID: 12796

Subject: This is the subject.

Figure 30. Example output

5.8 Generating Templates from RTF Documents

While templates cannot be generated directly from RTF documents, software is available to convert an RTF document created by a word processor into the corresponding XSL-FO document. Once the XSL-FO document has been generated, you can insert the appropriate XSLT mark-up to convert it into a usable template.

5.9 Globalization Considerations

As described above structs are transmitted to the XML Server for printing by calling method `curam.util.xml.impl.XMLDocument.add(your-struct)`. This data can be sensitive to locale differences.

Structs are serialized into an XML representation which is then transformed into a human-readable document using XSLT. By default the following data types are serialized by calling their `toString()` method:

- `curam.util.type.Date`
- `curam.util.type.DateTime`
- `curam.util.type.Money`

The `toString()` method of `Date` and `DateTime` returns a string dependent on the value of property `'curam.environment.default.dateformat'` and the `toString()` method of `Money` returns a value dependent on the value of property `'curam.environment.default.locale'`.

For example, if `'curam.environment.default.locale'` was set to `'en_GB'`, a `Money` amount would be serialized in the form `'12,345.67'` whereas for `'es_ES'` it would be formatted like `'12.345,67'` (i.e., commas and dots reversed). This prevents the XSLT from de-serializing the data in a locale neutral way. So if the server locale was set to English, then the XSL template for a Spanish letter would have to parse an English formatted numeric string instead of a numeric value.

Locale related problems like this can be avoided in two ways:

- Use string fields to transfer all data to the XML Server, and ensure that these string fields are correctly formatted for the appropriate locale on the server beforehand.
- Transfer fields to the XML Server in a locale-neutral way by setting property `'curam.xmlserver.serializeLocalNeutral'` to `true`. For `Date` and `DateTime` the formats are `'yyyyMMdd'` and `'yyyyMMddTHHmss'` respectively. For `Money` it is the same as for floating point decimals.

5.10 Summary

- Cúram XML uses a fixed format for all generated XML.
- The format is defined in a document type definition (DTD).
- XML documents can be formatted using XSL transformations and marked-up using XSL-FO ready for rendering as PDF or RTF.
- XML documents can be formatted using XSL transformations only to produce HTML and plain text documents.

5.11 Further Reading

Some books that cover XML, XSL, and XSL-FO are:

- Harold, Elliotte Rusty, *The XML Bible*, Hungry Minds Inc.
- Bradly, Neil, *The XSL Companion*, Addison-Wesley.
- Pawson, Dave, *XSL-FO*, O'Reilly.

Useful web-sites for information on XSL, XSLT, and XSL-FO are:

- <http://www.ibiblio.org/xml/books/bible/updates/> has all the XML chapters from *The XML Bible* book.
- <http://www.w3c.org/> is the home of the World Wide Web Consortium. This organization controls and maintains the XSL specifications.
- <http://www.dpawson.co.uk/> is a site with some nice tutorials and frequently asked question (FAQ) lists about XSL and XSL-FO.

The third-party libraries used are available from these locations:

- <http://xml.apache.org/> is the home of the Xerces, Xalan, and FOP libraries used by the XML Server.
- <http://www.jfor.org/> is the home of JFOR, the XSL-FO to RTF converter.

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