

# Docx4j - Getting Started

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This guide is for docx4j **8.0.0**. The 8.x series will be the last series to run under Java 1.8 (hence the name).

There are 2 significant changes in docx4j 8.0.0:

1. The project is now structured as a maven multi-module project
2. You'll need one and only one of the docx4j-JAXB-[Internal|MOXy|ReferenceImpl] artifacts and its deps

The latest version of this document can always be found in [docx4j on GitHub in /docs](#).

There is also a handy 1 page summary at [https://www.docx4java.org/docx4j/plutext-docx4j\\_on\\_a\\_page-v300.pdf](https://www.docx4java.org/docx4j/plutext-docx4j_on_a_page-v300.pdf) (look out for an update soon).

The most up to date copy of this document is in English. There is also a Russian version. From time to time, it may be machine translated into other languages. Please let us know if you are interested in writing some basic documentation in your own language (either as a contribution, or for a fee).

## What is docx4j?

docx4j is a library for working with docx, pptx and xlsx files in Java. In essence, it can unzip a docx (or pptx/xlsx) "package", and parse the XML to create an in-memory representation in Java using developer friendly classes (as opposed to DOM or SAX).

docx4j is usually deployed as part of a web application (eg on Tomcat, JBOSS, WebSphere etc – see the deployment forums).

docx4j is similar in concept to Microsoft's OpenXML SDK, which is for .NET. docx4j.NET is available for the NET platform; see further below.

A distinctive strength of docx4j is that its in-memory representation uses **JAXB**, the JCP standard for Java - XML binding. Docx4j is the only library for working with OpenXML files which uses/supports JAXB (each of the Sun/Oracle, MOXy and IBM<sup>1</sup> implementations). In contrast, Apache POI uses XML Beans. (Aspose in contrast, does not provide low-level access to the underlying XML or a corresponding object model, so "you can't do it" unless Aspose provides support for it).

docx4j is open source, available under the Apache License (v2). As an open source project, docx4j has been substantially improved by a number of contributions (see the README or POM file for contributors), and further contributions are always welcome. Please see the docx4j forum at <http://www.docx4java.org/forums/> for details.

The docx4j project is sponsored by Plutext ([www.plutext.com](http://www.plutext.com)).

There is also a commercial enterprise edition of docx4j, which comes with commercial support and additional functionality not found in the community edition. Additional functionality includes:

- Merging documents or presentations
- OLE embedding of files in docx, pptx, xlsx
- Digital signatures

## What sorts of things can you do with docx4j?

- Open existing docx (from filesystem, SMB/CIFS, WebDAV using VFS), pptx, xlsx
- Create new docx, pptx, xlsx
- Programmatically manipulate the above (of course)
- Save to various media zipped, or unzipped
- Protection settings
- Produce/consume the Flat OPC XML format
- Do all this on Android.

Specific to docx4j (as opposed to pptx4j, xlsx4j):

- Import XHTML
- Export as (X)HTML or PDF
- Template substitution; CustomXML binding

---

<sup>1</sup> IBM has their own proprietary JAXB implementation. By default, WebSphere uses com.ibm.xml.xlsp2.jaxb, which has the concept of fallback/ MarshallerProxy. The actual implementation it uses is in com.ibm.jaxb.tools.jar.

- Mail merge
- Apply transforms, including common filters
- Diff/compare documents, paragraphs or sdt (content controls)
- Font support (font substitution, and use of any fonts embedded in the document)

This document focuses primarily on docx4j, but the general principles are equally applicable to pptx4j and xlsx4j.

## Is docx4j for you?

Docx4j is for processing docx documents (and pptx presentations and xlsx spreadsheets) in Java.

It isn't for old binary (.doc) files. If you wish to invest your effort around docx (as is wise), but you also need to be able to handle old doc files, see further below for your options.

Nor is it for RTF files.

## GraalVM

Programs based on docx4j can be converted to a Graal native image, and run "serverless" on AWS Lambda.

## docx4j.NET

If you want to process docx/pptx/xlsx on the .NET platform, you should consider Microsoft's OpenXML SDK. That said, docx4j can be used in a .NET environment via IKVM, and there are several reasons you might wish to do this:

- Where you need docx4j's capabilities, for example:
  - XHTML import/export/roundtrip
  - PDF export
  - OpenDoPE processing
- Capabilities provided by docx4j enterprise edition (as to which see above)
- Where you need to work in both Java and .NET, and want to use a single API in both environments
- Where you need the source code (Microsoft doesn't provide that)

You can use docx4j.NET and the OpenXML SDK together; see [InteropDocx](#)

As on the Java platform, docx4j.NET comes in community and commercial editions.

See <https://www.nuget.org/packages/docx4j.NET/>

## What Word documents does it support?

Docx4j can read/write docx documents created by or for Word 2007 or later, plus earlier versions which have the compatibility pack installed. (Same goes for xlsx spreadsheets and pptx presentations).

The relevant parts of docx4j are generated from the ECMA schemas, with the addition of the key Microsoft proprietary extensions. For unsupported extensions, docx4j gracefully degrades to the specified 2007 substitutes.

It is not really intended read/write Word 2003 XML documents, although `package org.docx4j.convert.in.word2003xml` is a proof of concept of importing such documents.

For more information, please see *Specification versions* below.

## Handling legacy binary .doc files

An effective approach is to use LibreOffice or OpenOffice (via jodconverter) to convert the doc to docx, which docx4j can then process. If you need to return a binary .doc, LibreOffice or OpenOffice/jodconverter can convert the docx back to .doc.

## Getting Help: the docx4j forum

Free community support is available in the docx4j forum, at <http://www.docx4java.org/forums/> and on Stack Overflow.

Before posting, please:

- check this document doesn't answer your question
- try to help yourself: people are unlikely to help you if it looks like you are asking someone else to do lots of work you presumably are being paid to do!
- ensure your post says which version of docx4j you are using, and contains your Java code (between [java] .. and .. [/java]) and XML (between [xml] .. and .. [/xml]), and if appropriate a docx/pptx/xlsx attachment
- consider browsing relevant docx4j source code

This discussion is generally in English. If you would like to moderate a forum in another language (for example, French, Chinese, Spanish...), please let us know.

## A word about Jaxb

docx4j uses JAXB to marshal and unmarshal the XML parts in a docx/pptx/xlsx.

Docx4j supports each of the 3 JAXB implementations:

- the JAXB in Java 8 implementation; to use this, you need the docx4j-JAXB-Internal jar. You can also use this with Java 9. But not Java 11, since Java 11 does not ship JAXB anymore.
- the Sun/Oracle/"Reference" implementation; to use this you need docx4j-JAXB-ReferenceImpl

You can also use the JAXB reference implementation (eg v2.2.4). If you want to use that in preference to the version included in the JDK, do so using the endorsed directory mechanism.

- Moxy. To use this, you need docx4j-JAXB-MOXY.
- IBM's (in WebSphere). By default, WebSphere uses com.ibm.xml.xlsp2.jaxb, which has the concept of fallback/ MarshallerProxy. The actual implementation it uses is in com.ibm.jaxb.tools.jar.

## Using docx4j via Maven

docx4j is in Maven Central. For Maven users, this makes it really easy to get going with docx4j.

To use docx4j 8.0.0, add one and only one of the following to your project:

```
<!-- use the JAXB shipped in Java 8 -->
<dependency>
  <groupId>org.docx4j</groupId>
  <artifactId>docx4j-JAXB-Internal</artifactId>
  <version>8.0.0</version>
</dependency>

<!-- use the JAXB Reference Implementation -->
<dependency>
  <groupId>org.docx4j</groupId>
  <artifactId>docx4j-JAXB-ReferenceImpl</artifactId>
  <version>8.0.0</version>
</dependency>

<!-- use the MOXY JAXB implementation -->
<dependency>
  <groupId>org.docx4j</groupId>
  <artifactId>docx4j-JAXB-MOXY</artifactId>
  <version>8.0.0</version>
</dependency>
```

The blog entry [hello-maven-central](#) [needs to be updated per above] shows you what to do, starting with a fresh OS (Win 7 is used, but these steps would work equally well on OSX or Linux).

## Using docx4j binaries

If Maven is not for you, you can download the latest version of docx4j from <http://www.docx4java.org/docx4j/>

Supporting jars can be found in the .tar.gz or zip version, or in the relevant subdirectory.

You'll need the jars from one and only one of these directories:

- docx4j-JAXB-Internal,
- docx4j-JAXB-ReferenceImpl,
- docx4j-JAXB-MOXy

## docx4j dependencies

### *slf4j*

To do anything with docx4j, you need **slf4j** on your classpath. As the slf4j website puts it:

The Simple Logging Facade for Java (SLF4J) serves as a simple facade or abstraction for various logging frameworks (e.g. java.util.logging, logback, log4j) allowing the end user to plug in the desired logging framework at *deployment* time.

So you need the slf4j api jar on your classpath:

```
<dependency>
  <groupId>org.slf4j</groupId>
  <artifactId>slf4j-api</artifactId>
  <version>1.7.5</version>
</dependency>
```

If you want to use logback, then include it:

```
<dependency>
  <groupId>ch.qos.logback</groupId>
  <artifactId>logback-classic</artifactId>
  <version>1.3.0-alpha4</version>
</dependency>
```

If you want to use log4j, then include it, and:

```
<dependency>
  <groupId>org.slf4j</groupId>
  <artifactId>slf4j-log4j12</artifactId>
  <version>1.7.5</version>
</dependency>
```



## ***other dependencies***

Depending what you want to do, the other dependencies will be required.

Best practice is to include all dependencies on your class path, and be done with it.

In your development environment, you can do this using Maven, or by physically copying them all to your classpath.

For your deployment environment, your build process ought to be set up to do this for you.

## **Docx4j source code**

Docx4j source is on GitHub at <https://github.com/plutext/docx4j> .

We accept pull requests; pull requests are presumed to be contributions under ASLv2 per our contributor agreement.

See [docx4j-from-github-in-eclipse](#) for details.

Source code can also be downloaded from Maven Central (search for docx4j at search.maven.org).

## **Javadoc**

Javadoc can be downloaded from Maven Central (search for docx4j at search.maven.org), but you'll find the source code much more useful! See above.

## **Building docx4j from source**

Get the source code from GitHub (see above), then... (you probably want to skip down to the next page, to get it working in Eclipse).

### ***Command line -via Maven***

```
export MAVEN_OPTS=-Xmx512m
mvn install
```

### ***Eclipse***

See [docx4j-from-github-in-eclipse](#).

Not working?

Enable Maven (make sure you have Maven and its plugin installed - see Prerequisites above):

- with Eclipse Indigo
  - Right click on the project
  - Click "Configure > Convert to Maven Project"

compiler version & system library:

- Right click on the project (or Alt-Enter)
- Choose "Java Compiler", then set JDK compliance to 1.8
- Choose "Java Build Path", and check you are using 1.8 "JRE System Library". If not, remove, then click "Add Library"

The project should now be working in Eclipse without errors<sup>2</sup>.

## *Using a different IDE?*

Please post setup instructions in the forum, or as a wiki page on GitHub. Thanks!

## Open an existing docx/pptx/xlsx document

`org.docx4j.openpackaging.packages.WordprocessingMLPackage` represents a docx document.

To load a document or "Flat OPC" XML file, all you have to do is:

```
WordprocessingMLPackage wordMLPackage =  
    WordprocessingMLPackage.load(new java.io.File(inputfilepath));
```

You can use the façade:

```
WordprocessingMLPackage wordMLPackage =  
    Docx4J.load(new java.io.File(inputfilepath));
```

which does the same thing under the covers.

There are similar signatures to load from an input stream.

You can then get the main document part (word/document.xml):

```
MainDocumentPart documentPart = wordMLPackage.getMainDocumentPart();
```

---

<sup>2</sup> If you get the error 'Access restriction: The type is not accessible due to restriction on required library rt.jar' (perhaps using some combination of Eclipse 3.4 and/or JDK 6 update 10?), you need to go into the Build Path for the project, Libraries tab, select the JRE System Library, and add an access rule, "Accessible, \*\*".

After that, you can manipulate its contents.

A similar approach works for pptx files:

```
PresentationMLPackage presentationMLPackage =  
    (PresentationMLPackage)OpcPackage.Load(new java.io.File(inputfilepath));
```

And similarly for xlsx files.

## OpenXML concepts

To do anything much beyond this, you need to have an understanding of basic WordML concepts (or PresentationML or SpreadsheetML).

According to the Microsoft Open Packaging spec, each docx document is made up of a number of "Part" files, zipped up.

An easy way to get an understanding of this is to unzip a docx/pptx/xlsx using your favourite zip utility. Even easier is to visit <http://webapp.docx4java.org> and explore your file using "PartsList". You can also generate code that way.

A Part is usually XML, but might not be (an image part, for example, isn't).

The parts form a tree. If a part has child parts, it must have a relationships part which identifies these.

The part which contains the main text of the document is the Main Document Part. Each Part has a name. The name of the Main Document Part is usually "/word/document.xml".

If the document has a header, then the main document part would have a header child part, and this would be described in the main document part's relationships (part).

Similarly for any images. To see the structure of any given document, [upload it to the PartsList webapp](#), or run the "Parts List" sample (see further below).

An introduction to WordML is beyond the scope of this document. You can find a very readable introduction in 1<sup>st</sup> edition Part 3 (Primer) at <http://www.ecma-international.org/publications/standards/Ecma-376.htm> or [http://www.ecma-international.org/news/TC45\\_current\\_work/TC45\\_available\\_docs.htm](http://www.ecma-international.org/news/TC45_current_work/TC45_available_docs.htm) (a better link for the 1st edition (Dec 2006), since its not zipped up).

See also the free ["Open XML Explained" ebook](#) by Wouter Van Vugt.

# Specification versions

From Wikipedia:

The [Office Open XML](#) file formats were standardised between December 2006 and November 2008,

first by the [Ecma International](#) consortium (where they became **ECMA-376**),

and subsequently .. by the [ISO/IEC's Joint Technical Committee 1](#) (where they became **ISO/IEC 29500:2008**).

The [Ecma-376.htm](#) link also contains the 2nd edition documents (of Dec 2008), which are "technically aligned with ISO/IEC 29500".

Office 2007 SP2 implements ECMA-376 1st Edition<sup>3</sup>; this is what docx4j started with

ISO/IEC 29500 (ECMA-376 2nd Edition) has *Strict* and *Transitional* conformance classes. Office 2010 supports<sup>4</sup> transitional, and also has read only support for strict.

docx4j started with ECMA-376 1st Edition. Where appropriate later versions of the schemas are used. docx4j 3.0 uses MathML 2ed, PresentationML 2ed, and SpreadsheemML 4ed transitional.

Docx4j can open documents which contain Word 2010, 2013 specific content. The key extensions are supported. For other stuff, for example, `<w14:glow w14:rad="101600">` it will look for and try to use `mc:AlternateContent` contained in the document. If you use docx4j to save the document, the `w14:glow` won't be there any more (ie the docx will effectively be a Word 2007 docx).

## Architecture

Docx4j has 3 layers:

1. **org.docx4j.openpackaging**

OpenPackaging handles things at the Open Packaging Conventions level.

It includes objects corresponding to each Office file type:

docx	org.docx4j.openpackaging.packages. <b>WordprocessingMLPackage</b>
pptx	org.docx4j.openpackaging.packages. <b>PresentationMLPackage</b>
xlsx	org.docx4j.openpackaging.packages. <b>SpreadsheetMLPackage</b>

---

<sup>3</sup> <http://blogs.msdn.com/b/dmahugh/archive/2009/01/16/ecma-376-implementation-notes-for-office-2007-sp2.aspx>

<sup>4</sup> <http://blogs.msdn.com/b/dmahugh/archive/2010/04/06/office-s-support-for-iso-iec-29500-strict.aspx>

and is responsible for unzipping the file into a set of objects inheriting from Part;

**openpackaging** also includes functionality allowing parts to be added/deleted; saving the docx/pptx/xlsx etc

This layer is based originally on OpenXML4J (which is also used by Apache POI).

## 2. Parts are generally subclasses of **org.docx4j.openpackaging.parts.JaxbXmlPart**

This (the **jaxb content tree**) is the second level of the three layered model. To explore these first two layers for a given document, [upload it to the PartsList webapp](#).

Parts are arranged in a tree. If a part has descendants, it will have a **org.docx4j.openpackaging.parts.relationships.RelationshipsPart** which identifies those descendant parts.

A JaxbXmlPart has a content tree:

```
public Object getJaxbElement() {
    return jaxbElement;
}

public void setJaxbElement(Object jaxbElement) {
    this.jaxbElement = jaxbElement;
}
```

Most parts (including MainDocumentPart, styles, headers/footers, comments, endnotes/footnotes) use **org.docx4j.wml** (WordprocessingML); wml references **org.docx4j.dml** (DrawingML) as necessary.

These classes were generated from the Open XML schemas

## 3. **org.docx4j.model**

This package builds on the lower two layers to provide extra functionality, and is being progressively further developed.

## Jaxb: marshalling and unmarshalling

Docx4j contains a class representing each part. For example, there is a `MainDocumentPart` class. XML parts inherit from `JaxbXmlPart`, which contains a member called `jaxbElement`. When you want to work with the contents of a part, you work with its `jaxbElement` by using the `get|setContent`s method.

When you open a docx document using docx4j, docx4j automatically *unmarshals* the contents of each XML part to a strongly-type Java object tree (the `jaxbElement`). Actually, docx4j 3.0 is lazy; it only does this when first needed.

Similarly, if/when you tell docx4j to save these Java objects as a docx, docx4j automatically *marshals* the `jaxbElement` in each Part.

Sometimes you will want to marshal or unmarshal things yourself. The class `org.docx4j.jaxb.Context` defines all the JAXBContexts used in docx4j. Here is representative (non-exhaustive) content:

Jc	<code>org.docx4j.wml</code> <code>org.docx4j.dml</code> <code>org.docx4j.dml.picture</code> <code>org.docx4j.dml.wordprocessingDrawing</code> <code>org.docx4j.vml</code> <code>org.docx4j.vml.officedrawing</code> <code>org.docx4j.math</code>
jcThemePart	<code>org.docx4j.dml</code>
jcDocPropsCore	<code>org.docx4j.docProps.core</code> <code>org.docx4j.docProps.core.dc.elements</code> <code>org.docx4j.docProps.core.dc.terms</code>
jcDocPropsCustom	<code>org.docx4j.docProps.custom</code>
jcDocPropsExtended	<code>org.docx4j.docProps.extended</code>
jcXmlPackage	<code>org.docx4j.xmlPackage</code>
jcRelationships	<code>org.docx4j.relationships</code>
jcCustomXmlProperties	<code>org.docx4j.customXmlProperties</code>
jcContentTypes	<code>org.docx4j.openpackaging.contenttype</code>
jcPML	<code>org.docx4j.pml</code> <code>org.docx4j.dml</code> <code>org.docx4j.dml.picture</code>

You'll find `XmlUtils.marshalToString` very useful as you put your code together. With this, you can easily output the content of a JAXB object, to see what XML it represents.

## Parts List

To get a better understanding of how docx4j works – and the structure of a docx document – you can run the `PartsList` sample on a docx (or a pptx or xlsx). If you do, it will list the hierarchy of parts used in that package. It will tell you which class is used to represent each part, and where that part is a `JaxbXmlPart`, it will also tell you what class the `jaxbElement` is.

So it's a bit like unzipping the docx/pptx/xlsx file, but it tells you what Java objects are being used for each part.

A more fully featured tool is [the PartsList online webapp](#). With this, you can:

- browse through the package,
- look up what elements mean in the spec, and
- generate code.

Alternatively, you can install the [Docx4j Helper Word AddIn](#), to generate code from within Word. See also forum <http://www.docx4java.org/forums/docx4jhelper-addin-f30/>

You can run PartsList locally from a command line:

```
java -cp docx4j-3.0.1.jar;log4j-1.2.17.jar;slf4j-api-1.7.5.jar;slf4j-log4j12-1.7.5.jar
org.docx4j.samples.PartsList [input.docx]
```

though I always find it easier to run it from my IDE. Example output:

```
Part /_rels/.rels [org.docx4j.openpackaging.parts.relationships.RelationshipsPart]
  containing JaxbElement:org.docx4j.relationships.Relationships

Part /docProps/app.xml [org.docx4j.openpackaging.parts.DocPropsExtendedPart]
  containing JaxbElement:org.docx4j.docProps.extended.Properties

Part /docProps/core.xml [org.docx4j.openpackaging.parts.DocPropsCorePart]
  containing JaxbElement:org.docx4j.docProps.core.CoreProperties

Part /word/document.xml [org.docx4j.openpackaging.parts.WordprocessingML.MainDocumentPart]
  containing JaxbElement:org.docx4j.wml.Document

Part /word/settings.xml [org.docx4j.openpackaging.parts.WordprocessingML.DocumentSettingsPart]
  containing JaxbElement:org.docx4j.wml.CTSettings

Part /word/styles.xml [org.docx4j.openpackaging.parts.WordprocessingML.StyleDefinitionsPart]
  containing JaxbElement:org.docx4j.wml.Styles

Part /word/media/image1.jpeg [org.docx4j.openpackaging.parts.WordprocessingML.ImageJpegPart]
```

docx4j includes convenience methods to make it easy to access commonly used parts. These include, on the package:

```
public MainDocumentPart getMainDocumentPart()

public DocPropsCorePart getDocPropsCorePart()
public DocPropsExtendedPart getDocPropsExtendedPart()
public DocPropsCustomPart getDocPropsCustomPart()
```

on the document part:

```
public StyleDefinitionsPart getStyleDefinitionsPart()
public NumberingDefinitionsPart getNumberingDefinitionsPart()
public ThemePart getThemePart()
public FontTablePart getFontTablePart()

public CommentsPart getCommentsPart()

public EndnotesPart getEndNotesPart()
```

```

public FootnotesPart getFootnotesPart()

public DocumentSettingsPart getDocumentSettingsPart()
public WebSettingsPart getWebSettingsPart()

```

If a part points to any other parts, it will have a relationships part listing these other parts.

```
RelationshipsPart rp = part.getRelationshipsPart();
```

You can access those, and from there, get the part you want:

```

for ( Relationship r : rp.getRelationships().getRelationship() ) {

    log.info("\nFor Relationship Id=" + r.getId()
            + " Source is " + rp.getSourceP().getPartName()
            + ", Target is " + r.getTarget()
            + " type " + r.getType() + "\n");

    Part part = rp.getPart(r);
}

```

That gives access to just the parts this part points to. `RelationshipsPart` contains various useful utility methods, for example:

```

/** Gets a loaded Part by its id */
public Part getPart(String id)

public Part getPart(Relationship r ) {

```

The `RelationshipsPart` is the key player when it comes to adding/removing images and other parts from your document.

There is also a list of **all** parts, in the package object:

```
Parts parts = wordMLPackage.getParts();
```

The Parts object encapsulates a map of parts, keyed by `PartName`, but you generally shouldn't add/remove things here directly!

To add a part, see the section Adding a Part below.

## MainDocumentPart

The text of the document is to be found in the main document part.

Its XML will look something like:

```

<w:document xmlns:w="http://schemas.openxmlformats.org/wordprocessingml/2006/main" >
  <w:body>
    <w:p >
      <w:pPr>
        <w:pStyle w:val="Heading1"/>

```



```

    </w:pPr>
    <w:r>
      <w:t>Hello World</w:t>
    </w:r>
  </w:p>
  :
  <w:sectPr >
    <w:pgSz w:w="12240" w:h="15840"/>
    <w:pgMar w:top="1440" w:right="1440" w:bottom="1440" w:left="1440" w:header="708"
w:footer="708" w:gutter="0"/>
  </w:sectPr>
</w:body>
</w:document>

```

Given:

```
WordprocessingMLPackage wordMLPackage
```

you can access:

```
MainDocumentPart documentPart = wordMLPackage.getMainDocumentPart();
```

Classically, you'd then do:

```
org.docx4j.wml.Document wmlDocumentEl
    = (org.docx4j.wml.Document) documentPart.getJaxbElement();
Body body = wmlDocumentEl.getBody();
```

But you can skip some of that with:

```
/**
 * Convenience method to getJaxbElement().getBody().getContent()
 */
public List<Object> getContent()
```

A paragraph is org.docx4j.wml.P; a paragraph is basically made up of runs of text.

```
@XmlElement(name = "p")
public class P implements Child, ContentAccessor
```

The ContentAccessor interface is simply:

```
/**
 * @since 2.7
 */
public interface ContentAccessor {
    public List<Object> getContent();
}
```

it is implemented by a number of objects, including:

Body	w:body	document body
P	w:p	paragraph
R	w:r	run
Tbl	w:tbl	table
Tr	w:tr	table row
Tc	w:tc	table cell
SdtBlock	w:sdt	content controls; see the method <code>getSdtContent()</code>
SdtRun	w:sdt	
CTSdtRow	w:sdt	
CTSdtCell	w:sdt	

As well as

- Hdr, Ftr

Content is generally stored in a plain old Java List. So there are familiar methods for inserting content at the end of the list, or other location in it.

Read on for how to add text etc.

## Samples

The modules:

- docx4j-samples-docx4j
- docx4j-samples-docx-diffx
- docx4j-samples-docx-export-fo
- docx4j-samples-pptx4j
- docx4j-samples-xlsx4j
- docx4j-samples-glox4

contains examples of how to do things with docx4j. You can find them in the GitHub repo.

The docx4j samples include:

Basics

- CreateWordprocessingMLDocument
- DisplayMainDocumentPartXml
- OpenAndSaveRoundTripTest
- PartsList

Navigating the document body

- OpenMainDocumentAndTraverse
- XPathQuery

Output/Transformation

- ConvertOutHtml
- ConvertOutPDF

#### Import (X)HTML

- AltChunkXHTMLRoundTrip
- AltChunkAddOfTypeHtml
- ConvertInXHTMLDocument
- ConvertInXHTMLFragment

#### Image handling

- ImageAdd
- ImageConvertEmbeddedToLinked

#### Part Handling

- PartCopy
- PartLoadFromFileSystem
- PartsList
- PartsStrip

#### Document generation/document assembly using content controls

- ContentControlsAddCustomXmlDataStoragePart
- ContentControlsXmlEdit
- ContentControlsApplyBindings
- ContentControlBindingExtensions
- ContentControlsPartsInfo
- AltChunkAddOfTypeDocx
- VariableReplace (not recommended)

#### Specific docx features

- BookmarkAdd
- CommentsSample
- HeaderFooterCreate
- HeaderFooterList
- HyperlinkTest
- NumberingRestart
- SubDocument
- TableOfContentsAdd
- TemplateAttach (attach your.dotx)

#### Miscellaneous

- CompareDocuments (in docx4j-samples-docx-diffx)

- DocProps
- Filter (remove proof errors, w:rsid)
- MergeDocx
- UnmarshallFromTemplate

#### Flat OPC XML

- ConvertOutFlatOpenPackage
- ConvertInFlatOpenPackage

## Creating a new docx

To create a new docx:

```
// Create the package
WordprocessingMLPackage wordMLPackage = WordprocessingMLPackage.createPackage();

// Save it
wordMLPackage.save(new java.io.File("helloworld.docx") );
```

That's it.

There's a sample you can try locally from a command line:

```
java -cp docx4j-3.0.1.jar:log4j-1.2.17.jar;slf4j-api-1.7.5.jar;slf4j-log4j12-1.7.5.jar
org.docx4j.samples.CreateDocx [input.docx]
```

createPackage() is a convenience method, which does:

```
// Create the package
WordprocessingMLPackage wordMLPackage = new WordprocessingMLPackage();

// Create the main document part (word/document.xml)
MainDocumentPart wordDocumentPart = new MainDocumentPart();

// Create main document part content
ObjectFactory factory = Context.getWmlObjectFactory();
org.docx4j.wml.Body body = factory.createBody();
org.docx4j.wml.Document wmlDocumentEl = factory.createDocument();
wmlDocumentEl.setBody(body);

// Put the content in the part
wordDocumentPart.setJaxbElement(wmlDocumentEl);

// Add the main document part to the package relationships
// (creating it if necessary)
wmlPack.addTargetPart(wordDocumentPart);
```

## docx4j.properties

Here is a sample short docx4j.properties file (a complete one may be copied from docx4j-samples-resources module):

```
# Page size: use a value from org.docx4j.model.structure.PageSizePaper enum
# eg A4, LETTER
docx4j.PageSize=LETTER
# Page size: use a value from org.docx4j.model.structure.MarginsWellKnown enum
docx4j.PageMargins=NORMAL
docx4j.PageOrientationLandscape=false

# Page size: use a value from org.pptx4j.model.SlideSizesWellKnown enum
# eg A4, LETTER
pptx4j.PageSize=LETTER
pptx4j.PageOrientationLandscape=false

# These will be injected into docProps/app.xml
```

```

# if App.Write=true
docx4j.App.write=true
docx4j.Application=docx4j
docx4j.AppVersion=2.7
# of the form XX.YYYY where X and Y represent numerical values

# These will be injected into docProps/core.xml
docx4j.dc.write=true
docx4j.dc.creator.value=docx4j
docx4j.dc.lastModifiedBy.value=docx4j

#
#docx4j.McPreprocessor=true

# If you haven't configured log4j yourself
# docx4j will autoconfigure it. Set this to true to disable that
docx4j.Log4j.Configurator.disabled=false

```

The page size, margin & orientation values are used when new documents are created; naturally they don't affect an existing document you open with docx4j.

If no docx4j.properties file is found on your class path, docx4j has hard coded defaults.

## Adding a paragraph of text

MainDocumentPart contains a method:

```
public org.docx4j.wml.P addStyledParagraphOfText(String styleId, String text)
```

You can use that method to add a paragraph using the specified style.

The XML we are looking to create will be something like:

```

<w:p xmlns:w="http://schemas.openxmlformats.org/wordprocessingml/2006/main">
  <w:r>
    <w:t>Hello world</w:t>
  </w:r>
</w:p>

```

addStyledParagraphOfText builds the object structure “the JAXB way”, and adds it to the document.

It is based on:

```

public org.docx4j.wml.P createParagraphOfText(String simpleText) {
    org.docx4j.wml.ObjectFactory factory = Context.getWmlObjectFactory();
    org.docx4j.wml.P para = factory.createP();

    if (simpleText!=null) {
        org.docx4j.wml.Text t = factory.createText();
        t.setValue(simpleText);

        org.docx4j.wml.R run = factory.createR();
        run.getContent().add(t); // ContentAccessor

        para.getContent().add(run); // ContentAccessor
    }
}

```

```

        return para;
    }

```

Notice that the paragraph, the run, and indeed the Body, all implement the `ContentAccessor` interface:

```

/**
 * @since 2.7
 */
public interface ContentAccessor {

    public List<Object> getContent();

}

```

The `add` method adds the content at the end of the document. If you want to insert it somewhere else, you could use something like:

```

public org.docx4j.wml.P addParaAtIndex(MainDocumentPart mdp,
    String simpleText, int index) {

    org.docx4j.wml.ObjectFactory factory = Context.getWmlObjectFactory();
    org.docx4j.wml.P para = factory.createP();

    if (simpleText != null) {
        org.docx4j.wml.Text t = factory.createText();
        t.setValue(simpleText);

        org.docx4j.wml.R run = factory.createR();
        run.getContent().add(t);

        para.getContent().add(run);
    }

    mdp.getContent().add(index, para);

    return para;
}

```

Alternatively, you can create the paragraph by marshalling XML:

```

// Assuming String xml contains the XML above
org.docx4j.wml.P para = XmlUtils.unmarshalString(xml);

```

For this to work, you need to ensure that all namespaces are declared properly in the string.

See further below for adding images, and tables.

## General strategy/approach for creating stuff

The first thing you need to know is what the XML you are trying to create looks like.

To figure this out, start with a docx that contains the construct (create it in Word if necessary).

Now look at its XML. Choices:

- You can unzip it to do this blagh
- upload it to [the PartsList online webapp](#) (which can also generate code for you)
- save it as Flat OPC XML from Word (or use the `ExportInPackageFormat` sample), so you have just a single XML file which you don't need to unzip
- you can use the `DisplayMainDocumentPartXml` to get it
- you can open it with docx4all, and look at the source view
- on Windows, if you have Visual Studio 2010, you can drag the docx onto it
- if you use Google's Chrome web browser, try [OOXML Viewer for Chrome](#).

Now you are ready to create this XML using JAXB. There are 2 basic ways.

The classic JAXB way is to use the ObjectFactory's `.createX` methods. For example:

```
ObjectFactory factory = Context.getWmlObjectFactory();
P p = factory.createP();
```

The challenge with this is to know what object it is you are trying to create. To find this out, the easiest way by far is to use [the PartsList online webapp](#). Alternatively, you could run `OpenMainDocumentAndTraverse` on your document, or use Eclipse to search the relevant schema (in `/xsd`) or source code.

Here are the names for some common objects:

Object	XML element	docx4j class	Factory method
Document body	w:body	org.docx4j.wml.Body	factory.createBody();
Paragraph	w:p	org.docx4j.wml.P	factory.createP()
Paragraph props	w:pPr	org.docx4j.wml.PPr	factory.createPPr()
Run	w:r	org.docx4j.wml.R	factory.createR()
Run props	w:rPr	org.docx4j.wml.RPr	factory.createRPr()
Text	w:t	org.docx4j.wml.Text	factory.createText()
Table	w:tbl	org.docx4j.wml.Tbl	factory.createTbl()
Table row	w:tr	org.docx4j.wml.Tr	factory.createTr()
Table cell	w:tc	org.docx4j.wml.Tc	factory.createTc()
Drawing	w:drawing	org.docx4j.wml.Drawing	factory.createDrawing()
Page break	w:br	org.docx4j.wml.Br	factory.createBr()
Footnote or endnote ref	?	org.docx4j.wml.CTFtnEdnRef	factory.createCTFtnEdnRef()

An easier way to create stuff may be to just unmarshal the XML (eg a String representing a paragraph to be inserted into the document).

For example, given:

```
<w:p xmlns:w="http://schemas.openxmlformats.org/wordprocessingml/2006/main">
  <w:r>
    <w:t>Hello world</w:t>
  </w:r>
</w:p>
```

you can simply:

```
// Assuming String xml contains the XML above
org.docx4j.wml.P para = XmlUtils.unmarshalString(xml);
```

The [PartsList online webapp](#) can generate appropriate code for you, using both of these approaches. It also links to the Open XML spec documentation for the element.

Alternatively, you can install the [Docx4j Helper Word Addin](#), to generate code from within Word. See also forum <http://www.docx4java.org/forums/docx4jhelper-addin-f30/>

If you need to be explicit about the type, you can use:

```
public static Object unmarshalString(String str, JAXBContext jc, Class declaredType)
```

## Formatting Properties

Usually you format the appearance of things via an object's properties element:

Object	Method
Paragraph	P.getPPr()
Run	R.getRPr()
Table	Tbl.getTblPr()
Table row	Tr.getTrPr()
Table cell	Tc.getTcPr()

In a docx, the appearance of text is basically determined by the style in the styles part which applies to it (styles can inherit from other styles), plus any direct formatting.

Docx4j contains code for working out the effective formatting, which is used in its PDF output.

In XHTML import, docx4j converts CSS into formatting properties.

## Creating and adding a table

org.docx4j.model.table.TblFactory provides an easy way to create a simple table. For an example of its use, see the CreateWordprocessingMLDocument sample. If you want to add content, see **General strategy/approach for creating stuff** above. If you want format your table (make it prettier), see Formatting Properties immediately above.

Or you can use the [PartsList online webapp](#) to generate the code.

If you are looking to fill table rows with data, consider OpenDoPE content control data binding (in which you "repeat" a table row).



## Selecting your insertion/editing point; accessing JAXB nodes via XPath

Sometimes, XPath is a succinct way to select the things you need to change.

You can use XPath to select JAXB nodes:

```
MainDocumentPart documentPart = wordMLPackage.getMainDocumentPart();
String xpath = "//w:p";
List<Object> list = documentPart.getJAXBNodesViaXPath(xpath, false);
```

These JAXB nodes are live, in the sense that if you change them, your document changes.

There are a few limitations however in the JAXB reference implementation:

- the xpath expressions are evaluated against the XML document as it was when first opened in docx4j. You can update the associated XML document once only, by passing true into `getJAXBNodesViaXPath`. Updating it again (with current JAXB 2.1.x or 2.2.x) will cause an error.
- For some documents, JAXB can't set up the XPath

If these limitations are causing you problems, try using MOXy as your JAXB implementation, or see [Traversing](#) immediately below for a different approach.

## Traversing a document

[OpenMainDocumentAndTraverse.java](#) in the samples directory shows you how to traverse the JAXB representation of a docx.

This is an alternative to XSLT, which doesn't require marshalling to a DOM document and unmarshalling again.

The sample uses `TraversalUtil`, which is a general approach for traversing the JAXB object tree in the main document part. It can also be applied to headers, footers etc. `TraversalUtil` has an `interface callback`, which you use to specify how you want to traverse the nodes, and what you want to do to them.

As noted earlier, many objects (eg the document body, a paragraph, a run), have a `List` containing their content. Traversal works by iterating over these lists.

Traversing is a very useful approach for finding and altering parts of the document.

For example, it is used in docx4j 2.8.0, to provide a way of producing HTML output without using XSLT/Xalan.

The [org.docx4j.finders](#) package contains classes which make it convenient to find various objects.

It is often superior to using XPath (owing to the limitations in the JAXB reference implementation noted above).

Note also, in `package org.docx4j.utils`:

```
/**
 * Use this if there is only a single object type (eg just P's)
 * you are interested in doing something with.
public class SingleTraversalUtilVisitorCallback
```

`ImageConvertEmbeddedToLinked` sample contains an example of the use of the above.

```
/**
 * Use this if there is more than one object type (eg Tables and Paragraphs)
 * you are interested in doing something with during the traversal.
public class CompoundTraversalUtilVisitorCallback
```

## Adding a Part

What if you wanted to add a new styles part? Here's how:

```
// Create a styles part
StyleDefinitionsPart stylesPart = new StyleDefinitionsPart();

// Populate it with default styles
stylesPart.unmarshalDefaultStyles();

// Add the styles part to the main document part relationships
wordDocumentPart.addTargetPart(stylesPart);
```

You'd take the same approach to add a header or footer.

When you add a part this way, it is automatically added to the source part's relationships part.

Generally, you'll also need to add a reference to the part (using its relationship id) to the Main Document Part. This applies to images, headers and footers. (Comments, footnotes and endnotes are a bit different, in that what you add to the main document part are references to individual comments/footnotes/endnotes).

## Importing XHTML

docx4j can convert XHTML content (paragraphs, tables, images) into native WordML, reproducing much of the formatting.

From v3, the XHTML Import functionality is a [separate project on GitHub](#).

The reason being that its main dependency – Flying Saucer - is licensed under LGPL v2.1 (as opposed to ASL v2, which docx4j's other dependencies use).

If you want this functionality, you have to add these jars to your classpath.

See the samples at <https://github.com/plutext/docx4j-ImportXHTML/tree/master/src/samples>

## docx to (X)HTML

docx4j can convert a docx to HTML or XHTML. You will find the generated HTML is clean (in comparison to the HTML Word produces).

Docx4j's HTML output is suitable for documents which contain paragraphs, tables and images. It can't handle more exotic features, such as equations, SmartArt, or WordArt (DrawingML or VML).

Elsewhere on the web, you'll find XSLT which can convert docx to HTML. That XSLT is very complex, since it has to derive effective formatting from the hierarchy.

In contrast, in docx4j, that logic is implemented in Java. Because of this, docx4j's XSLT is simple (Java XSLT extension functions do the heavy lifting).

In docx4j, you can create output using XSLT, or by traversing the document in Java. The façade lets you specify which:

```
//Prefer the exporter, that uses a xsl transformation
Docx4J.toHTML(htmlSettings, os, Docx4J.FLAG_EXPORT_PREFER_XSL);
//Prefer the exporter, that doesn't use a xsl transformation (= uses a visitor)
//
Docx4J.toHTML(htmlSettings, os, Docx4J.FLAG_EXPORT_PREFER_NONXSL);
```

See the sample on GitHub at [src/samples/docx4j/org/docx4j/samples/ConvertOutHtml.java](https://github.com/docx4j/org.docx4j.samples/blob/master/ConvertOutHtml.java)

If you have output logging enabled, anything which is not implemented will be obvious in the output document. ***If debug level logging is not switched on, unsupported elements will be silently dropped.***

## docx to PDF

Use the Docx4J facade to convert to PDF:

```
public static void toPDF(WordprocessingMLPackage wmlPackage, OutputStream outputStream)
    throws Docx4JException
```

Docx4j offers several ways under the covers to create a PDF from a docx.

The best results are achieved using Plutext's commercial PDF Converter, so from version 3.3.0, docx4j defaults to using this.

From 6.1.0, docx4j defaults to localhost endpoint for PDF Converter to avoid information leakage.

This is controlled by docx4j property `com.plutext.converter.URL`

The localhost endpoint will only work if you download and install the converter there! You can download an installer from <http://converter-eval.plutext.com/>

If you choose to use the `converter-eval.plutext.com` endpoint, please only use it for light testing purposes:-

```
com.plutext.converter.URL=http://converter-eval.plutext.com:80/v1/00000000-0000-0000-0000-000000000000/convert
```

Legacy XSL FO based PDF output is in the docx4j-export-fo module:

```
<groupId>org.docx4j</groupId>  
<artifactId>docx4j-export-fo</artifactId>
```

If you want to use the existing XSL FO + Apache FOP PDF Conversion, just add docx4j-export-fo (+ deps) to your classpath. If docx4j detects that they are present, it will revert to this FO based conversion.

These jars are in the zip file, in dir optional/export-fo

## Image Handling - DOCX

When you add an image to a document in Word 2007, it is generally added as a new Part (ie you'll find a part in the resulting docx, containing the image in base 64 format).

When you open the document in docx4j, docx4j will create an image part representing it.

It is also possible to create a "linked" image. In this case, the image is not embedded in the docx package, but rather, is referenced at its external location.

Docx4j's `BinaryPartAbstractImage` class contains methods to allow you to create both embedded and linked images (along with appropriate relationships).

```
/**  
 * Create an image part from the provided byte array, attach it to the  
 * main document part, and return it.*/  
public static BinaryPartAbstractImage createImagePart(WordprocessingMLPackage  
wordMLPackage,  
byte[] bytes)  
  
/**  
 * Create an image part from the provided byte array, attach it to the source part  
 * (eg the main document part, a header part etc), and return it.*/  
public static BinaryPartAbstractImage createImagePart(WordprocessingMLPackage  
wordMLPackage,  
Part sourcePart, byte[] bytes)  
  
/**  
 * Create a linked image part, and attach it as a rel of the specified source part  
 * (eg a header part) */  
public static BinaryPartAbstractImage createLinkedImagePart(  
WordprocessingMLPackage wordMLPackage, Part sourcePart, String fileurl)
```

For an image to appear in the document, there also needs to be appropriate XML in the main document part. This XML can take 2 basic forms:

- the Word 2007 **w:drawing** form

```
<w:p>  
  <w:r>
```

```

    <w:drawing>
      <wp:inline distT="0" distB="0" distL="0" distR="0">
        <wp:extent cx="3238500" cy="2362200" />
        <wp:effectExtent l="19050" t="0" r="0" b="0" />
        :
        <a:graphic >
          <a:graphicData ..>
            <pic:pic >
              :
              <pic:blipFill>
                <a:blip r:embed="rId5" />
                :
              </pic:blipFill>
              :
            </pic:pic>
          </a:graphicData>
        </a:graphic>
      </wp:inline>
    </w:drawing>
  </w:r>
</w:p>

```

- the Word 2003 VML-based **w:pict** form

```

<w:p>
  <w:r>
    <w:pict>
      <v:shapetype id="_x0000_t75" coordsize="21600,21600" .. >
        <v:stroke joinstyle="miter" />
        <v:formulas>
          :
        </v:formulas>
        :
      </v:shapetype>
      <v:shape .. style="width:428.25pt;height:321pt">
        <v:imagedata r:id="rId4" o:title="" />
      </v:shape>
    </w:pict>
  </w:r>
</w:p>

```

Docx4j can create the Word 2007 **w:drawing/wp:inline** form for you:

```

/**
 * Create a <wp:inline> element suitable for this image,
 * which can be linked or embedded in w:p/w:r/w:drawing.
 * If the image is wider than the page, it will be scaled
 * automatically. See Javadoc for other signatures.
 * @param filenameHint Any text, for example the original filename
 * @param altText Like HTML's alt text
 * @param id1 An id unique in the document
 * @param id2 Another id unique in the document
 * @param link true if this is to be linked not embedded */
public Inline createImageInline(String filenameHint, String altText,
    int id1, int id2, boolean link)

```

which you can then add to a **w:r/w:drawing**.

Finally, with docx4j, you can convert images from formats unsupported by Word (eg PDF), to PNG, which is a supported format. For this, docx4j uses **ImageMagick**. So if you want to use this feature, you need to install ImageMagick. Docx4j invokes ImageMagick using:

```
Process p = Runtime.getRuntime().exec("imconvert -density " + density + " -units PixelsPerInch -  
png:-");
```

Note the name **imconvert**, which is used so that we don't have to supply a full path to exec. You'll need to accommodate that.

## Manual Image Manipulation

Images involve three things:

- the image part itself
- a relationship, in the relationships part of the main document part (or header part etc). This relationship includes:
  - the name of the image part (for example, /word/media/image1.jpeg)
  - the relationship ID
- some XML in the main document part (or header part etc), referencing the relationship ID (see **w:drawing** and **w:pict** examples above)

This means that if you are moving images around, you need to take care to ensure that the relationships remain valid.

You can manually manipulate the relationship, and you can manually manipulate the XML referencing the relationship IDs.

Given an image part, you can get the relationship pointing to it

```
Relationship rel = copiedImagePart.getSourceRelationship();  
String id = rel.getId();
```

You can then ensure the reference matches.

## Image Handling – PPTX

See the pptx4j [InsertPicture](#) sample.

## Adding Headers/Footers

See the HeaderFooter sample for how to do this.

## Protection Settings

There is a family of features the Office UI groups under “Protection Settings”. These include:

- mark as final
- encrypt with password

- digital signatures

Most protection settings can be manipulated using docx4j 3.3. It contains a class ProtectionSettings:

```
/**
 * The Protection Settings which are common across
 * docx, pptx, xlsx, namely mark as final, encrypt with password,
 * and digital signature. Subclasses implement the
 * docx and xlsx format specific features.
 *
 * @author jharrop
 * @since 3.3.0
 */
public abstract class ProtectionSettings
```

The relevant subclass is accessed via the package object:

- WordprocessingMLPackage:
   
  
 ProtectDocument getProtectionSettings()
- PresentationMLPackage
   
  
 ProtectPresentation getProtectionSettings()
- SpreadsheetMLPackage
   
  
 ProtectWorkbook getProtectionSettings()

Note: support for digital signatures is in Plutext's Enterprise edition.

## docx Table of Contents

From v3.3.0, docx4j can generate/update a ToC, including update its page numbers. See the ToC\* samples.

### *Introduction*

A table of contents is often included in a docx file.

Where docx4j or other code is used to modify the document, the TOC may need updating since page numbers may be wrong, or entries added, deleted or modified.

In some cases, it is sufficient to leave the TOC updating until the docx is opened in Microsoft Word. In Word, the user can manually issue the command to update the table. Or an AutoOpen macro can be used. For more on this, see

<http://openxmldeveloper.org/blog/b/openxmldeveloper/archive/2011/08/24/updating-the-toc-in-a-wordprocessingml-document-using-an-autoopen-macro.aspx>

In other scenarios, it is desirable to update the TOC programmatically. For example, prior to PDF output. This TOC helper is intended to help here.

## ***Field background***

Historically, Word has used a *field code* to specify a table of contents.

A table of contents field is just one type of field, amongst many:

*date-and-time:*

CREATEDATE | DATE | EDITTIME | PRINTDATE | SAVEDATE | TIME

*document-automation:*

COMPARE | DOCVARIABLE | GOTOBUTTON | IF | MACROBUTTON | PRINT

*document-information:*

AUTHOR | COMMENTS | DOCPROPERTY | FILENAME | FILESIZE | INFO  
| KEYWORDS | LASTSAVEDBY | NUMCHARS | NUMPAGES | NUMWORDS | SUBJECT  
| TEMPLATE | TITLE

*equations-and-formulas:*

=formula | ADVANCE | EQ | SYMBOL

***index-and-tables:***

INDEX | RD | TA | TC | TOA | **TOC** | XE

*links-and-references:*

AUTOTEXT | AUTOTEXTLIST | BIBLIOGRAPHY | CITATION | HYPERLINK | INCLUDEPICTURE |  
INCLUDETEXT  
| LINK | NOTEREF | PAGEREF | QUOTE | REF | STYLEREF

*mail-merge:*

ADDRESSBLOCK | ASK | COMPARE | DATABASE | FILLIN | GREETINGLINE | IF  
| MERGEFIELD | MERGEREC | MERGESEQ | NEXT | NEXTIF | SET | SKIPIF

*numbering:*

AUTONUM | AUTONUMGL | AUTONUMOUT | BARCODE | LISTNUM | PAGE | REVNUM  
| SECTION | SECTIONPAGES | SEQ

*user-information:*

USERADDRESS | USERINITIALS | USERNAME

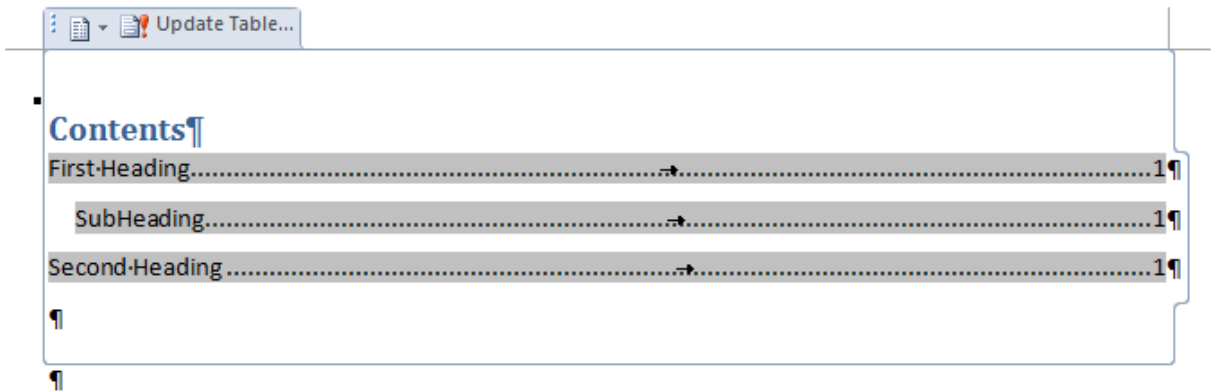
*form-field:*

FORMCHECKBOX | FORMDROPDOWN | FORMTEXT

## ***TOC Content Control***

Since the introduction of content controls in Word 2007, Word (References > Table of Contents) inserts the TOC field in a content control:





When inserting a TOC, this docx4j TOC helper will insert it in a content control.

When updating a TOC, this docx4j TOC helper assumes the TOC is located in such a content control. It won't find the TOC field unless it is.

## ***TOC Field Syntax***

The TOC field instruction has the following components:

```

TOC
  field-argument
  switches
  field-argument switches
  switches field-argument
  
```

The TOC field supports a variety of field-specific-switches.

For example:

```
TOC \o "3-3" \h \z \t "Heading 1,1,Heading 2,2,Appendix 1,1,Appendix 2,2"
```

Of the switches in the Open XML specification, this TOC helper recognises:

<b>\h</b>	Makes the table of contents entries hyperlinks.
<b>\n field-argument</b>	Without field-argument, omits page numbers from the table of contents. Page numbers are omitted from all levels unless a range of entry levels is specified by text in this switch's field-argument. A range is specified as for \l.
<b>\o field-argument</b>	Uses paragraphs formatted with all or the specified range of built-in heading styles. Headings in a style range are specified by text in this switch's field-argument using the notation specified as for \l, where each integer corresponds to the style with a style ID of HeadingX (e.g. 1 corresponds to Heading1). If no heading range is specified, all heading levels used in the document are listed.

<b>\t</b> field-argument	Uses paragraphs formatted with styles other than the built-in heading styles. text in this switch's field-argument specifies those styles as a set of comma-separated doublets, with each doublet being a comma-separated set of style name and table of content level. \t can be combined with \o.
<b>\u</b>	Uses the applied paragraph outline level.

The following switches may also be supported in a future version:

<b>\b</b> field-argument	Includes entries only from the portion of the document marked by the bookmark named by text in this switch's field-argument.
<b>\p</b> field-argument	text in this switch's field-argument specifies a sequence of characters that separate an entry and its page number. The default is a tab with leader dots.
<b>\w</b>	Preserves tab entries within table entries.
<b>\x</b>	Preserves newline characters within table entries.

There are no plans to support the remaining switches:

<b>\a</b> field-argument	Includes captioned items, but omits caption labels and numbers. The identifier designated by text in this switch's field-argument corresponds to the caption label.  Use \c to build a table of captions with labels and numbers.
<b>\c</b> field-argument	Includes figures, tables, charts, and other items that are numbered by a SEQ field. The sequence identifier designated by text in this switch's field-argument, which corresponds to the caption label, shall match the identifier in the corresponding SEQ field.
<b>\d</b> field-argument	When used with \s, the text in this switch's field-argument defines the separator between sequence and page numbers. The default separator is a hyphen (-).
<b>\f</b> field-argument	Includes only those TC fields whose identifier exactly matches the text in this switch's field-argument (which is typically a letter).
<b>\l</b> field-argument	Includes TC fields that assign entries to one of the levels specified by text in this switch's field-argument as a range having the form startLevel-endLevel, where startLevel and endLevel are integers, and startLevel has a value equal-to or less-than endLevel. TC fields that assign entries to lower levels are skipped.
<b>\s</b> field-	For entries numbered with a SEQ field, adds a prefix to the page number. The

argument	prefix depends on the type of entry. text in this switch's field-argument shall match the identifier in the SEQ field.
\z	Hides tab leader and page numbers in Web layout view.

## ***Inserting/generating a TOC***

Assuming you have:

```
WordprocessingMLPackage wordMLPackage
```

create a TocGenerator object:

```
TocGenerator tocGenerator = new TocGenerator(wordMLPackage);
```

Then you can insert a TOC by invoking one of the ***generateToc*** methods.

For example:

```
tocGenerator.generateToc( 0, " TOC \\o \"1-3\" \\h \\z \\u ", false);
```

(Note the backslash is escaped with another backslash)

There are 3 signatures available:

```
/**
 * Generate Table of Contents as first element of body of document with default TOC instruction.
 * @param body of document
 * @param skipPageNumbering don't generate page numbers (useful for HTML output, or speed, or as a
 fallback in case of issues)
 * @return SdtBlock control
 */
public SdtBlock generateToc(boolean skipPageNumbering) throws TocException

/**
 * Generate Table of Contents in the given place of body of document with given TOC instruction.
 * See http://webapp.docx4java.org/OnlineDemo/ecma376/WordML/TOC.html for TOC instruction.
 * @param body
 * @param index
 * @param instruction
 * @return SdtBlock control
 */
public SdtBlock generateToc(int index, String instruction, boolean skipPageNumbering) throws
TocException

/**
 * Generate Table of Contents in the given place of body of document with given TOC instruction.
 * See http://webapp.docx4java.org/OnlineDemo/ecma376/WordML/TOC.html for TOC instruction.
 * @param body
 * @param sdt
 * @param instruction
 * @param skipPageNumbering don't generate page numbers (useful for HTML output, or speed, or as a
 fallback in case of issues)
 * @return SdtBlock control
 */
public static SdtBlock generateToc(SdtBlock sdt, String instruction, boolean skipPageNumbering)
throws TocException
```

You should ensure styles TOC1, TOC2, TOC3 etc are defined in your styles definition part, since these are used to style TOC entries. ToC Helper will fallback to hard coded defaults for these styles, if they are not defined. The hard coded defaults come from:

```
InputStream is = ResourceUtils.getResourceViaProperty(
    "org.docx4j.toc.TocStyles.xml",
    "org/docx4j/toc/TocStyles.xml");
```

You can specify a different resource of your own in docx4j.properties:

```
# Defaults to com/plutext/docx/toc/TocStyles.xml
# It provides default toc style definitions,
# for use if none are defined in the docx itself.
org.docx4j.toc.TocStyles.xml=org/docx4j/toc/TocStyles.xml
```

## Page Number Considerations

Docx4j uses Plutext's commercial PDF Converter to work out page numbering (unless you have export-FO on your class path, in which case page numbering will be slower and less accurate).

From 6.1.0, docx4j defaults to localhost endpoint for PDF Converter to avoid information leakage; to use this, you'll need to install it; You can download an installer from <http://converter-eval.plutext.com/>

The position of the right aligned tab used for page numbers is calculated from the page width and margins, which **must** be provided in a **sectPr** element somewhere following the ToC. An exception will be thrown if a sectPr element is not present, or doesn't contain the necessary page width / margin information.

## Updating a TOC

Assuming you have:

```
WordprocessingMLPackage wordMLPackage
```

create a TocGenerator object:

```
TocGenerator tocGenerator = new TocGenerator(wordMLPackage);
```

You can update an existing TOC by invoking **updateToc**.

For example:

```
tocGenerator.updateToc( false);

/**
 * Update existing TOC in the document with TOC generated by generateToc() method.
 * @param body
 * @param skipPageNumbering don't generate page numbers (useful for HTML output, or speed, or as a
 fallback in case of issues)
 * @return SdtBlock control, or null if no TOC was founds
 */
public SdtBlock updateToc(boolean skipPageNumbering) throws TocException
```

As above, `boolean skipPageNumbering` argument is provided so you can control whether the helper generates indicative page numbers or not.

## ***Known Issues***

- ToC in a table cell: the position of the right aligned tab will be calculated incorrectly.

## **Text extraction**

A quick way to extract the text from a docx, is to use `TextUtils`'

```
public static void extractText(Object o, Writer w)
```

which marshals the object it is passed via a SAX ContentHandler, in order to output the text to the Writer.

## **Text substitution**

Text substitution is easy enough, provided the string you are searching for is represented in a `org.docx4j.wml.Text` object in the form you expect.

However, that won't necessarily be the case. The string could be broken across text runs for any of the following reasons:

- part of the word is formatted differently (eg in bold)
- spelling/grammar
- editing order (rsid)

This is one reason that using data bound content controls is often a better approach (see next section).

Subject to that, you can do text substitution in a variety of ways, for example:

- traversing the main document part, and looking at the `org.docx4j.wml.Text` objects
- marshal to a string, search/replace in that, then unmarshall again

`docx4j`'s `XmlUtils` also contains:

```
/**
 * Give a string of wml containing ${key1}, ${key2}, return a suitable
 * object.*/
public static Object unmarshallFromTemplate(String wmlTemplateString,
    java.util.HashMap<String, String> mappings)
```

See the `UnmarshallFromTemplate` example, which operates on a string containing:

```

<w:p>
  <w:r>
    <w:t>My favourite colour is ${colour}.</w:t>
  </w:r>
</w:p>
<w:p />
<w:p>
  <w:r>
    <w:t>My favourite ice cream is ${icecream}.</w:t>
  </w:r>
</w:p>

```

## Text substitution via data bound content controls

If you have an XML file containing your own data, WordML has a mechanism for associating entries in that XML with content controls in the document.

Then, when you open the document in Word 2007, Word automatically populates the content controls with the relevant XML data, which could even be an image (or with docx4j, arbitrary XHTML). (This approach supersedes Word's legacy mail merge fields. Simple VBA for migrating a document is available at [http://blogs.msdn.com/b/microsoft\\_office\\_word/archive/2007/03/28/migrating-mail-merge-fields-to-content-controls.aspx](http://blogs.msdn.com/b/microsoft_office_word/archive/2007/03/28/migrating-mail-merge-fields-to-content-controls.aspx) )

This works using XPath. A data-bound content control looks something like:

```

<w:sdt>
  <w:sdtPr>
    <w:dataBinding w:xpath="/root[1]/customer[1]" w:storeId="{428C88D8-C0E3-44F0-B5D7-
F65D8B9F7EC9}" />
  </w:sdtPr>
  <w:sdtContent>
    <w:r>
      <w:rPr>
        <w:rStyle w:val="PlaceholderText" />
      </w:rPr>
      <w:t>Click here to enter text.</w:t>
    </w:r>
  </w:sdtContent>
</w:sdt>

```

Your XML file is stored as a part in the docx, typically with a path which is something like customXml/item1.xml. Note: despite the word "customXml" in the path, this functionality is not affected by the 2009 i4i patent saga.

If you have a Word document which contains data-bound content controls and your data, docx4j can fetch the data, and place it in the relevant content controls.

This is useful if you don't want to leave it to Word to do that (for example, you are creating PDFs with docx4j).

Your XML is represented using 2 parts:

```

CustomXmlDataStoragePart customXmlDataStoragePart
    = wordMLPackage.getCustomXmlDataStorageParts().get(itemId);

CustomXmlDataStorage customXmlDataStorage
    = customXmlDataStoragePart.getData();

```

To apply the bindings:

```
customXmlDataStoragePart.applyBindings(wordMLPackage.getMainDocumentPart());
```

See further the CustomXmlBinding sample.

If you want to create the same document 5 times, each populated with different data, obviously you'd need to insert new XML data first.

## ***Binding extensions for repeats and conditionals***

A content control is *conditional* if it (and its contents) are included/excluded from the document based on whether some condition is true or false.

A content control is a *repeat* if it designates that its contents are to be included more than once. For example, a row of a table for each invoice/order item, or person.

docx4j contains a mechanism for processing conditional content controls and repeats. See [http://www.opendope.org/opendope\\_conventions\\_v2.3.html](http://www.opendope.org/opendope_conventions_v2.3.html) for an explanation.

See also the docx4j sample ContentControlBindingExtensions.

## ***Binding escaped XHTML (XML + CSS)***

docx4j can also take encoded XHTML and convert this to docx content. See further OpenDoPE\_XHTML.docx in the docx4j docs directory.

## ***Binding other rich content***

docx4j can take docx content (stored in an XML element as escaped Flat OPC XML) and convert this to docx content.

## ***Authoring***

To set up the bindings, you can use one of the Word Add-In from <http://www.opendope.org/implementations.html> Please note that you will need to install .NET Framework 4.0 ("full" - the "client profile" is not enough).

## **Mailmerge**

docx4j has quite good support for processing fields of type MERGEFIELD (ie the equivalent of doing a mailmerge operation from within Microsoft Word).

## SmartArt

docx4j supports reading docx and pptx files which contain SmartArt.

From docx4j 2.7.0, you can also generate SmartArt.

To do this, you need:

- the layout definition for the SmartArt, either in the docx already, or from a glox file
- an XML file specifying the list of text items you want to render graphically
- an XSLT which can convert a transformed version of that XML file into a SmartArt data file.

Docx4j can be used to insert the SmartArt parts into a docx; Word or Powerpoint will then render it when the document is opened.

The code can be found in:

- org.opendope.SmartArt.dataHierarchy
- org.docx4j.openpackaging.parts.DrawingML, and
- src/glox4j/java

## JAXB stuff

### Cloning

To clone a JAXB object, use one of the following methods in XmlUtils:

```
/** Clone this JAXB object, using default JAXBContext. */
public static <T> T deepCopy(T value)

/** Clone this JAXB object */
public static <T> T deepCopy(T value, JAXBContext jc)
```

### *javax.xml.bind.JAXBElement*

One annoying thing about JAXB, is that an object – say a table – could be represented as `org.docx4j.wml.Tbl` (as you would expect). Or it might be wrapped in a `javax.xml.bind.JAXBElement`, in which case to get the real table, you have to do something like:

```
if ( ((JAXBElement)o).getDeclaredType().getName().equals("org.docx4j.wml.Tbl") )
    org.docx4j.wml.Tbl tbl = (org.docx4j.wml.Tbl)((JAXBElement)o).getValue();
```

XmlUtils.**unwrap** can do this for you.

Be careful, though. If you are intend to copy an unwrapped object into your document (rather than just read it), you'll probably want the object to remain wrapped (JAXB usually wraps them for a reason; without the wrapper, you might find you need an `@XmlRootElement` annotation in order to be able to marshall ie save your document).



## @XmlRootElement

Most commonly used objects have an `@XmlRootElement` annotation, so they can be marshalled and unmarshalled.

In some cases, you might find this annotation is missing.

If you can't add the annotation to the JAXB source code, an alternative is to marshall it using code which is explicit about the resulting QName. For example, XmlUtils contains:

```
/** Marshal to a W3C document, for object
 * missing an @XmlRootElement annotation. */
public static org.w3c.dom.Document marshaltoW3CDomDocument(Object o, JAXBContext jc,
    String uri, String local, Class declaredType)
```

You could use this like so:

```
CTFootnotes footnotes =
    wmlPackage.getMainDocumentPart().getFootnotesPart().getJaxbElement().getValue();
CTFtnEdn ftn = footnotes.getFootnote().get(1);

// No @XmlRootElement on CTFtnEdn, so ..
Document d = XmlUtils.marshaltoW3CDomDocument( ftn,
    Context.jc, Namespaces.NS_WORD12, "footnote", CTFtnEdn.class );
```

Where the problematic object is something you're adding which isn't at the top of the tree, you should add it wrapped in a JAXBELEMENT. For example, suppose you wanted to add FldChar fldchar. You'd create it in the ordinary way:

```
FldChar fldchar = factory.createFldChar();
```

but then what you'd actually add to `r.getRunContent()` is:

```
new JAXBELEMENT( new QName(Namespaces.NS_WORD12, "fldChar"), FldChar.class, fldchar);
```

An easier way to do this is to find the appropriate method in the object factory (ie the method for creating it wrapped as a JAXBELEMENT). Use that method signature. In this example:

```
@XmlElementDecl(namespace = "http://schemas.openxmlformats.org/wordprocessingml/2006/main", name =
"fldChar", scope = R.class)
public JAXBELEMENT<FldChar> createRFldChar(FldChar value) {
    return new JAXBELEMENT<FldChar>(_RFLdChar_QNAME, FldChar.class, R.class, value);
}
```

The easiest way is to use the [PartsList online webapp](#) to generate the relevant code.

## Merging Documents and Presentations

As [Eric White's blog explained](#), combining multiple documents can be complicated:

This programming task is complicated by the need to keep other parts of the document in sync with the data stored in paragraphs. For example, a paragraph can contain a reference to a comment in the comments part, and if there is a problem with this reference, the

document is invalid. You must take care when moving / inserting / deleting paragraphs to maintain '*referential integrity*' within the document.

Plutext's Enterprise edition of docx4j includes "MergeDocx" code which makes merging documents as easy as invoking the method:

```
public WordprocessingMLPackage merge(List<WordprocessingMLPackage> wmlPkgs)
```

In other words, you pass a list of docx, and get a single new docx back.

To try it, visit <http://webapp.docx4java.org/>

The commercial edition of docx4j includes MergePptx, which you can use to concatenate presentations.

The MergeDocx extension can also be used to process a **docx** which is embedded as an **altChunk**. (Without the extension, you have to rely on Word to convert the altChunk to normal content, which means if your docx contains w:altChunk, you have to round trip it through Word, before docx4j can create a PDF or HTML out of it.)

To process the w:altChunk elements in a docx, you invoke:

```
public WordprocessingMLPackage process(WordprocessingMLPackage srcPackage)
```

You pass in a docx containing altChunks, and get a new docx back which doesn't.

## Other Support Options

If the free community support available in the docx4j forum does not meet your needs, or you simply want to outsource some coding, you are welcome to purchase programming, consulting or priority support from [Plutext](#)

By purchasing services from Plutext, you support the continued development of docx4j.

## Colophon

This document was written in Word 2007 (and more recently 2010), using:

- XML pretty printed using <http://www.softlion.com/webTools/XMLPrettyPrint/default.aspx> or Package Explorer
- Java source code formatted using <http://www.java2html.de> (or cut/pasted from Eclipse)

The PDF and HTML versions were generated using docx4j (PDF via XSL FO and FOP).

## Contacting Plutext

Unless you have paid for support, general “How do I” type questions should be posted directly to the [docx4j forum](#) or StackOverflow. Plutext may post to the forum any questions it receives by email which should have been directed to the forum.

Plutext can be contacted at either [jason@plutext.org](mailto:jason@plutext.org), or [jharrop@plutext.com](mailto:jharrop@plutext.com)

## Appendix 1 – Font Mapping

This section is not relevant if you are using Plutext's PDF Converter for PDF output. The PDF Converter uses the most appropriate fonts installed and available to it.

docx4j can only use fonts which are available to it.

These fonts come from 2 sources:

- those installed on the computer
- those embedded in the document

Note that Word silently performs *font substitution*. When you open an existing document in Word, and select text in a particular font, the actual font you see on the screen won't be the font reported in the ribbon if it is not installed on your computer or embedded in the document. To see whether Word 2007 is substituting a font, go into Word Options > Advanced > Show Document Content and press the "Font Substitution" button.

Word's font substitution information is not available to docx4j. As a developer, you 3 options:

- ensure the font is installed or embedded
- tell docx4j which font to use instead, or
- allow docx4j to fallback to a default font

To embed a font in a document, open it in Word on a computer which has the font installed (check no substitution is occurring), and go to Word Options > Save > Embed Fonts in File.

If you want to tell docx4j to use a different font, you need to add a font mapping. The FontMapper interface is used to do this.

On a Windows computer, font names for installed fonts are mapped 1:1 to the corresponding physical fonts via the IdentityPlusMapper.

A font mapper contains Map<String, PhysicalFont>; to add a font mapping, as per the example in the ConvertOutPDF sample:

```
// Set up font mapper
Mapper fontMapper = new IdentityPlusMapper();
wordMLPackage.setFontMapper(fontMapper);

// Example of mapping missing font Algerian to installed font Comic Sans MS
PhysicalFont font = PhysicalFonts.getPhysicalFonts().get("Comic Sans MS");
fontMapper.getFontMappings().put("Algerian", font);
```

You'll see the font names if you configure log4j debug level logging for `org.docx4j.fonts.PhysicalFonts`

To conserve resources, you can restrict to a subset of fonts installed on your system:

```
// Font regex (optional)
// Set regex if you want to restrict to some defined subset of fonts
```

```
// Here we have to do this before calling createContent,  
// since that discovers fonts  
String regex = null;  
// Windows:  
// String  
// regex="*(calibri|cour|arial|times|comic|georgia|impact|LSANS|pala|tahoma|trebuc|verdana|symbol|webdings|wingding).*";  
// Mac  
// String  
// regex="*(Courier New|Arial|Times New Roman|Comic Sans|Georgia|Impact|Lucida Console|Lucida  
Sans Unicode|Palatino Linotype|Tahoma|Trebuchet|Verdana|Symbol|Webdings|Wingdings|MS Sans Serif|MS  
Serif).*";  
PhysicalFonts.setRegex(regex);
```