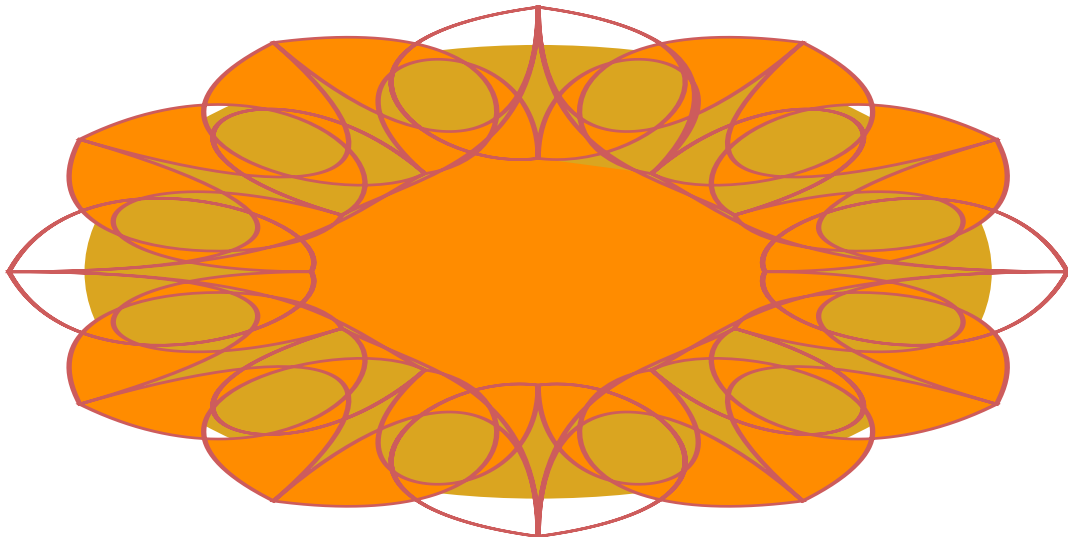




RML User Guide

Report Markup Language

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1. Introduction

1.1. ReportLab PLUS

ReportLab's solution solves several central problems that ebusinesses face in creating publishing caliber reports that are customized, produced in real time, in volume, and platform independent. Existing reporting tools are limited to database reports, are typically Windows-based, have problematic restrictions on layout and graphic design, and go straight to a printer. More complex publishing systems involve pipelines of applications which are simply too unwieldy for real-time use in large scale environments

ReportLab's product suite allows direct creation of rich PDF reports on web or application servers in real time. The tools run on any platform, can actively acquire data from any source (XML, flat files, databases, COM/Corba/Java), place no limits on the output, and facilitate electronic delivery and archival. The ReportLab suite lets you define your own business rules to automatically create custom online reports, catalogs, business forms, and other documents

RML2PDF is a central component of the toolkit: a translator which converts high level XML markup into PDF documents. Report Markup Language describes the precise layout of a printed document, and RML2PDF converts this to a finished document in one step. In a dedicated reporting application, other components of our toolkit handle data acquisition and preparation of the RML document.

RML2PDF on its own also fills a key technology gap. Our full toolkit relies heavily on the Python scripting language. Nevertheless we recognize that IT departments and software houses have their own distinct skill sets and development tools. A company may already have developed a rich 3-tier architecture with the key business data in Java or COM objects on an application server. All they need is the formatting component. They can use exactly the same techniques they use to generate HTML (XSLT, JSP, ASP or anything else) to generate an RML file, and the program turns this into a finished document. Fast.

Unlike a number of other formatting languages, RML aims squarely at corporate needs. Paragraph, table and page styles are kept in independent 'stylesheets', allowing reuse and global changes across a family of documents. The table model has been designed for efficient rendering of business data. And a plug-in architecture lets you easily develop and add in custom vector graphics or page templates within the same tool set.

RML2PDF can also work in tandem with our PageCatcher product. PageCatcher is a support tool which extracts graphical elements from PDF files for inclusion in documents generated by RML2PDF or the ReportLab core API. Since any external program with the ability to print can produce PDF files, this means that a ReportLab document can include graphical elements created by virtually any program. These imported elements can be combined freely with text or graphics drawn directly into the document. For example an application can import pages from a government tax form and draw text in the spaces provided to fill in the form. The resulting document can then be combined with a cover letter at the beginning and supporting tabular data at the end -- all in a single PDF document.

1.2. Installation and Use

To avoid duplication, the full installation instructions are always on ReportLab's web site at this address:

<http://www.reportlab.com/software/installation/>

RML2PDF is a compiled Python programming language module. It can be used with options from a command line, and also has a programmable API interface and may be used as a component of a larger Python language installation. Since Python integrates with a wide variety of other languages, it is also possible to access RML2PDF from C and C++ programs, COM and many other environments.

RML2PDF is delivered as part of ReportLab's 'rlextra' package and licensed under the name ReportLab PLUS. This package depends on our 'reportlab' package and some other open source libraries, all detailed on the above

installation page.

RML2PDF requires a license key file to work in production mode. Without the license key each page produced by RML2PDF will be visibly marked as an "evaluation" copy, and the file will be annotated invisibly as produced for evaluation purposes as well. With a valid license key file present, RML2PDF will run in production mode and the PDF file generated will contain the licensing information. You can purchase a ReportLab PLUS license using your user account on our website <http://www.reportlab.com>. Once we issue you a '.pyc' license file you will need to install it somewhere on your PYTHONPATH so that rml2pdf can find it.

Running RML2PDF from the command line

RML2PDF can be run from the command line, provided that you place it on your path. We normally ship this module in compiled (.pyc) format, so you need a Python interpreter of the correct version to run it, and need to know where it was installed. The installation process does not currently register a script for you. On Unix, you may wish to add the directory to your path, or create a wrapper script in your bin directory.

```
python /path/to/rlextra/rml2pdf/rml2pdf.pyc filename.rml
```

On Windows, .pyc files are normally associated with the most-recently-installed Python interpreter, so you could execute this...

```
c:\temp> c:\python26\lib\site-packages\rlextra\rml2pdf\rml2pdf.pyc filename.rml
```

After completing successfully the rml2pdf program will return to a command prompt. The output PDF file should be created in the current working directory.

Calling RML2PDF from Python

RML2PDF can also be called directly from your own Python program using the rml2pdf.go(...) entry point.

There are two main ways the 'go' function can be used - either to generate the resulting PDF file on disk in the file system, or to generate it in memory (useful for web applications returning the PDF directly to the user).

This example uses the 'go' function to create the output PDF file on disk:

```
from rlextra.rml2pdf import rml2pdf

rml = getRML() # Use your favorite templating language here to create the RML string
output = '/tmp/output.pdf'

rml2pdf.go(rml, outputFileName=output)
```

This is an example Django web application view generating a PDF in memory and returning it as the result of an HTTP request:

```
from django.http import HttpResponse
from rlextra.rml2pdf import rml2pdf
import cStringIO

def getPDF(request):
    """Returns PDF as a binary stream."""

    # Use your favourite templating language here to create the RML string.
    # The generated document might depend on the web request parameters,
    # database lookups and so on - we'll leave that up to you.
```

```

rml = getRML(request)

buf = cStringIO.StringIO()

rml2pdf.go(rml, outputFileName=buf)
buf.reset()
pdfData = buf.read()

response = HttpResponse(mimetype='application/pdf')
response.write(pdfData)
response['Content-Disposition'] = 'attachment; filename=output.pdf'
return response

```

The 'go' function has the following interface:

```

def go(xmlInputText, outputFileName=None, outDir=None, dtdDir=None,
      passLimit=2, permitEvaluations=1, ignoreDefaults=0,
      pageCallBack=None,
      progressCallBack=None,
      preppyDictionary=None, preppyIterations=1,
      dynamicRml=0, dynamicRmlNamespace={},
      encryption=None,
      saveRml=None,
      parseOnly=False,
      ):

```

- `xmlInputText` must be a string which contains the RML specification for the PDF document to be generated.
- `outputFileName` when specified overrides any output file name specified in the xml input text. You may also pass in a *file-like object* (e.g. a StringIO, file object or web request buffer), in which case nothing is written to disk.
- `outDir` (output directory) parameter when present specifies the directory in which to place the output file.
- `dtdDir` is an optional DTD directory parameter which specifies the directory containing the DTD for the current version of RML.
- `passLimit` of None means "keep trying until done", of 3 means, "try 3 times then quit".
- `permitEvaluations` when false disallows the evalString tag for security (e.g. web apps).
- `ignoreDefaults` 1 means "do one pass and use the default values where values are not found".
- `pageCallBack` is a callback to execute on final formatting of each page - used for counting number of pages.
- `progressCallBack` is a cleverer callback; see the progressCB function in reportlab/platypus/doctemplate.
- `preppyDictionary` if set to a dictionary indicates that the `xmlInputText` should be preprocessed using preppy with the `preppyDictionary` as argument. If `preppyDictionary` is not None and `preppyIterations` is >1 then the preppy preprocessing will be repeated `preppyIterations` times (max of 3) with the same dict, to generate, e.g., table of contents.
- `preppyIterations` - see `preppyDictionary`.
- `dynamicRml` is an optional boolean field for whether the RML can be dynamically altered.
- `dynamicRmlNamespace` is for use with `dynamicRml`. It's a dictionary which you can add variables to for processing.
- `encryption` if set it must be an encryption object, for example:
`rlextra.utils.pdfencrypt.StandardEncryption("User", "Owner", canPrint=0, canModify=0, canCopy=0, canAnnotate=0).`

- `saveRml` is useful for debugging dynamically generated RML. Specify a filename where the RML should be saved.
- `parseOnly` if set to `True`, will only parse the RML and not generate a PDF.

It is also possible to call `rml2pdf` from other programming languages (such as C++) by using standard methods for calling a python callable. See the Python Language Embedding and Extension manuals.

NB it is also possible to use the `userPass`, `ownerPass`, `permissions` & `encryptionStrength` attributes of the `document` tag to make `rml2pdf` create an encrypted PDF.

For further information regarding the installation of your version of RML2PDF please see the release notes and READMEs that come with the package.

1.3. What is RML?

RML is the Report Markup Language - a member of the XML family of languages, and the XML dialect used by `rml2pdf` to produce documents in Adobe's Portable Document Format (PDF).

RML documents can be written automatically by a program or manually using any word processor that can output text files (e.g. using a "Save as Text" option from the save menu). Since RML documents are basic text files, they can be created on the fly by scripts in Python, Perl, or almost any other language.

RML makes creating documents in PDF as simple as creating a basic web page - RML is as easy to write as HTML, and uses "tags" just like HTML. It is *much* easier than trying to write PDF programmatically.

1.4. What is this document?

This document is a user guide and tutorial for RML. It deals with RML as specified in the RML DTD - `rml.dtd`. If your installation of RML uses a later version, you will need a later version of the DTD and of this tutorial. Look on the ReportLab website (<http://www.reportlab.com>) for more details.

This document has been generated from RML. If you need another example of RML in action, look at the file "`rml_user_guide.rml`" to see how this file was produced.

1.5. Who is this document aimed at?

This document is aimed at anyone who needs to write RML. It assumes that you have some experience with some form of programming or scripting. Basic HTML is fine.

You do *not* have to be employed as a programmer or have extensive programming skills for this guide to make sense. We have tried to keep it as simple as possible and to minimise confusion.

1.6. Conventions used in this document

It is more technically correct to call the various items in RML "elements", as you do in XML. However, since we're assuming that more people know basic HTML than XML, we'll call them "tags" rather than elements in this guide.

There are also a couple of typographical conventions we'll be using:

`constant width`

Throughout this User Guide, we'll be using a `constant width` typeface to highlight any literal element of RML (such as tag names or attributes for tags) when they appear in the text.

8 point Courier

A smaller constant width font is used for code snippets (short one or two line examples of what RML commands look like) and code examples (longer examples of RML which usually have an illustration of the output they produce).

Part I - The Basics

2. Pages and page structures

2.1. XML syntax and RML

As with every XML dialect, RML requires correct XML syntax. If you are familiar with HTML, you should pay special attention to the differences between XML syntax and some of the more forgiving constructs allowed in HTML.

- Attribute values must be enclosed in quotation marks. (e.g. you would have to use `<document filename="outfile.pdf">`, since you couldn't get away with `<document filename=outfile.pdf>`)
- A non-empty element must have both an opening and a closing tag. (e.g. a `<document>` tag must be matched by a matching `</document>` tag). "Empty" elements are those that don't have any content, and are closed with a `</>` at the end of the *same* tag rather than having a separate closing tag. (e.g. `<getName id="Header.Title"/>`)
- Tags must be nested correctly. (i.e. `<i>text</i>` isn't valid, but `<i>text</i>` is.)
- On the whole, whitespace is ignored in RML. Except inside strings, you can format and indent your RML documents in whatever way you consider most readable. (Inside text strings, whitespace is seen as equivalent to a single space and line breaks are added automatically as needed during formatting. Other than that, what you type is what is displayed on the page).
- RML is case-sensitive. "Upper Case" is different from "upper case", "UPPER CASE" and "UpPeR CaSe". The capitalization in the tag names is important.

2.2. The prolog

Every RML document must start with a number of lines:

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
```

This is called the prolog - you can think of it as the document 'header'.

```
<?xml ... standalone="no" ?>
```

This line is the XML declaration. This is optional, but recommended.

```
version="1.0"
```

This attribute tells the parser which version of XML it should use - in this case 1.0.

```
standalone="no"
```

This tells the parser that it needs an external Document Type Definition (more on DTDs below).

```
encoding="iso-8859-1"
```

The "encoding" attribute sets the encoding you want the PDF file to use. The ISO-8859-1 encoding covers the character set known as "US-ASCII", plus things like the accented characters used in most Western European Languages and some control characters and graphical characters. ISO-8859-1 is also known as "Latin-1"(or "Latin Alphabet No 1"). Other common encodings are `utf-8` (same as US-ASCII for "normal" characters like A-Z and 0-9, but also covers the whole Unicode character set) and `cp1252` (a Microsoft Windows variant of ISO-8859-1). You may use any encoding you wish with RML, as long as the encoding attribute here matches the encoding you actually used to write the RML file!

```
<!DOCTYPE... "rml.dtd">
```

This line tells the parser where the Document Type Definition is located. The DTD formally specifies the syntax of RML.

For documents written in RML, the DTD should always be the current version of rml.dtd. (The rml DTD should always be called rml.dtd.

Unlike other dialects of XML, RML does *not* allow you to provide relative paths to the DTD, nor a full URL. It must always be the name of the DTD, which *must* live in the same directory as the exe or python program rml2pdf.

This makes it easy to predict where the RML DTD will be and prevents you using an old DTD that happens to be sitting around your disk somewhere. It also allows us to make sure that when you create a file with RML, the PDF document will be created in the same directory as the RML file, and to allow relative pathnames in the document tag.

The prolog section is common to all XML documents. In addition to this, RML requires another line following the prolog:

```
"<document filename="outfile.pdf">"
```

This line gives the name that you want the output PDF file created with. This line also starts the document proper - and must be matched by a `</document>` tag as the last line in the document, in the same way that an HTML file is bracketed by `<HTML>` and `</HTML>`.

The filename you give can just be a simple filename, a relative path (eg `..\..\myDoc.pdf` will create it in the directory two levels up from the one your RML document is in), or a full pathname (eg `C:\output_files\pdf\myProject\myDocument.pdf` or `/tmp/user1/myScratchFile.pdf`). If you just supply a filename, the output file will be created in the same directory as your RML file. (The same principle works with anywhere else you may need to give a filename - they are relative to where the document lives on your disk, not to where rml2pdf is).

The `<document>` tag has three other attributes. `compression` specifies whether the produced PDF should be compressed if at all possible. It can take the values `0` | `1` | `default` for off, on or use the site-wide default (as specified in `reportlab_rl_config`). `invariant` determines whether the produced PDF should be invariant with respect to the date and the exact contents. It can take the values `0` | `1` | `default` for off, on or use the site-wide default (as specified in `reportlab_rl_config`). `debug` determines whether debugging/logging mode should be used during document production. It can take the values `0` | `1` for off or on.

2.3. Document forms: *stylesheet/pageDrawing* vs *template/stylesheet/story*

There are two possible valid structures for your document to have, depending on how simple you want it to be.

For very simple documents, you need the prolog, followed by a `stylesheet` and any number of `pageDrawings`. A `pageDrawing` is a graphical element on the page, or simple text string (i.e. it is just placed onto the page in the location you specify, and no attempt is made to check if it flows off the page).

EXAMPLE 1

```
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_1.pdf">

  <stylesheet>
</stylesheet>

  <pageDrawing>
    <drawCentredString x="4.1in" y="5.8in">
      Hello World.
    </drawCentredString>
  </pageDrawing>

</document>
```

(All the examples given in this tutorial can be found as *.rml files in the same directory as this tutorial.)

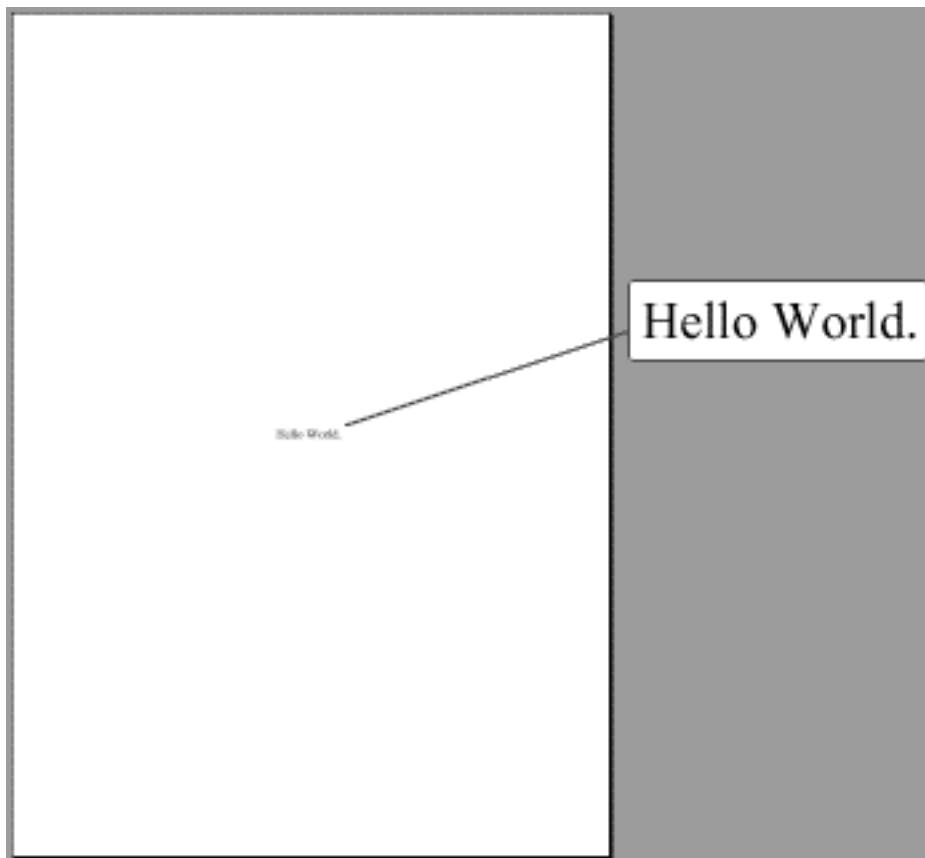


Figure 1: Output from EXAMPLE 1

This is the most basic RML document you can get. It is the traditional "Hello World". All it does is place the string of text "Hello World" into the middle of your A4 page. Not very useful in the real world, but enough to show you how simple RML can be.

Notice how it does have a `stylesheet`, but it is empty. Stylesheets are mandatory, but they don't need to actually contain anything. Also notice how in the `drawCenteredString` tag, the co-ordinates are enclosed in quotation marks - they are attributes, and so need to live inside quotes. And if you look at the `drawCenteredString` tag, these attributes are *inside* the tag (actually inside the angle brackets), then the content of the string comes after it, then the tag is closed by its matching `</drawCenteredString>` tag. All tags with content need their matching closing tag - the `<document>` and `<stylesheet>` tags are also parts of matching pairs.

One last thing to notice is the DOCTYPE line - for all these examples, we are assuming that the DTD is in the same directory as the example file itself. This may not always be the case.

For a more complex RML document, you can use the more powerful `template/stylesheet/story` form of document. In this, a file contains the following three sections:

- a template
- a stylesheet
- a story

The *template* tells rml2pdf what should be on the page: headers, footers, any graphic elements you use as a background.

The *stylesheet* is where the styles for a document are set. This tells the parser what fonts to use for paragraphs and paragraph headers, how to format tables and other things of that nature.

The *story* is where the "meat" of the document is. Just like in a newspaper, the story is the bit you want people to read, as opposed to design elements or page markup. As such, this is where headers, paragraphs and the actual text is contained.

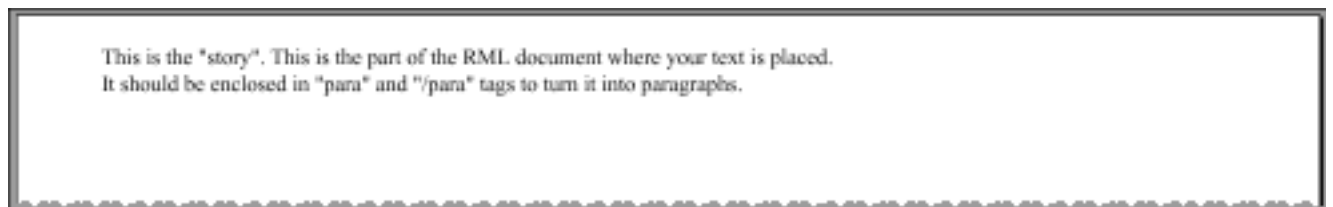


Figure 2: Output from EXAMPLE 2

EXAMPLE 2

```
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_2.pdf">

  <template>
    <pageTemplate id="main">
      <frame id="first" x1="72" y1="72" width="451" height="698"/>
    </pageTemplate>
  </template>

  <stylesheet>
</stylesheet>

  <!-- The story starts below this comment -->
```

```
<story>
  <para>
    This is the "story". This is the part of the RML document where
    your text is placed.
  </para>
  <para>
    It should be enclosed in "para" and "/para" tags to turn it into
    paragraphs.
  </para>
</story>
</document>
```

The `<pageTemplate>`, `<pageGraphics>`, `<frame>` and `<paraStyle>` tags will all be covered in more detail later on in this guide.

Paragraphs start with a `<para>` tag and are closed with a `</para>` tag. Their appearance can be controlled with the `<paraStyle>` tag.

RML allows you to use comments in the RML code. These are not displayed in the output PDF file. Just like in HTML, they start with a "`<!--`" and are terminated with a "`-->`". Unlike other tags, comments cannot be nested. In fact, you can't even have the characters "--" inside the "`<!-- -->`" section.

3. Basic Text Operations

3.1. Coordinates and measurements

In RML, the page origin is in the bottom left hand corner (0,0). Any point on the page can be specified by a pair of numbers - a pair of X,Y co-ordinates. The X co-ordinate states how far to the *right* the point is and the Y co-ordinate states how far *up* it is.

When an RML element has co-ordinates, the co-ordinate origin is the lower left corner. In the case of elements in a `pageGraphic`, the origin of the lower left corner of the page. For elements within an `<illustration>`, the origin is the lower left corner of the bounding box declared by the `<illustration>`.

These co-ordinates (and any other measurements in an RML document) can be given in one of four units. Inches use the term 'in', centimetres use the term 'cm', and millimetres use the term 'mm'. If no unit is specified, RML will assume that you are giving a measurement in points - one point is 1/72 of an inch. You can also explicitly use points with the term 'pt'.

As an example, the following pairs of co-ordinates all refer to the same point. Notice that there is no space between the number and any unit that follows it.

```
(4.5in, 1in)
(11.43cm, 2.54cm)
(324, 72)
```

You can mix and match these units within RML, though it generally isn't a good idea to do so. The co-ordinate pair (3.5in, 3.5cm) is valid, and won't confuse the RML parser - but it may well confuse you.

3.2. Using Colors

There are three ways to specify colors in RML:

- by red/green/blue value (e.g. "#ff0000" or "(0.0,0.0,1.0)")
- by cyan/magenta/yellow/black value (e.g. "#ff99001f" or "(1.0,0.6,0.0,0.1)")
- by color name using standard HTML names

The RGB or additive color specification follows the way a computer screen adds different levels of the red, green, or blue light to make any color. White is formed by turning all three lights on full (1,1,1).

The CMYK or subtractive method follows the way a printer mixes three pigments (cyan, magenta, and yellow) to form colors. Because mixing chemicals is more difficult than combining light there is a fourth parameter for darkness. A chemical combination of the CMY pigments almost never makes a perfect black - instead producing a muddy brown - so, to get black printers use a direct black ink rather than use the CMY pigments.

The name CMYK comes from the name of the four colors used: Cyan, Magenta, Yellow and "Key" - a term sometimes used by printers to refer to black.

Because CMYK maps more directly to the way printer hardware works it may be the case that colors specified in CMYK will provide better fidelity and better control when printed.

The color names which RML recognizes are mostly drawn from the HTML specification. (For a list of these color names recognized by RML, see Appendix A).

[NOTE: Currently, while RML supports specifying colors by CMYK value, `rml2pdf` hasn't yet implemented it. If you try, you will get a `ValueError` and the error message "cmyk not implemented yet"].

3.3. Using fonts

Font names are given in the following format:

```
Fontname-style
```

where fontname is the name of the font (e.g. Courier), and the style is its appearance (eg, Oblique, BoldOblique).

The only fonts supplied with Adobe's Acrobat Reader are the "14 standard fonts". These 14 standard fonts are:

```
Courier
Courier-Bold
Courier-BoldOblique
Courier-Oblique
Helvetica
Helvetica-Bold
Helvetica-BoldOblique
Helvetica-Oblique
Symbol
Times-Bold
Times-BoldItalic
Times-Italic
Times-Roman
ZapfDingbats
```

Custom fonts can also be used in your document. RML supports TrueType and Type 1 fonts. In order to use them, make sure they are on the appropriate path and then register them in the <docinit> section at the top of the RML file.

Use the <registerTTFont> and <registerFont> tags to register them. To use a common set of fonts together as bold, italic etc., you need to put them into a common grouping using the <registerFontFamily> tag.

An example of how to use these tags with different font types and styles can be found in the file `rml2pdf/test/test_005_fonts.rml`

3.4. Basic text operations - setFont and drawString

The simplest way to put text on a page is using the <drawString> tag. This places the "string" of text on the page at the co-ordinates you give it. The only attributes you can give it are a pair of X and Y co-ordinates. After the tag itself comes the string of text you want put on the page, and then you need the closing </drawString> tag.

DrawString has a pair of companions. DrawRightString and drawCentredString both work in the same way, but right justify the string and center it, respectively.

This is how they look in practice:

```
<drawString x="523" y="800">
  This is a drawString example
</drawString>

<drawRightString x="523" y="800">
  This is a drawRightString example
</drawRightString>

<drawCentredString x="523" y="800">
```



```
This is a drawCentredString example
</drawCentredString>
```

To set the font that you want a piece of text to be, you need to use the `<setFont>` tag. This has two arguments which are required - you need to give it the `name` of the font, and the `size` you want it displayed at.

A `setFont` tag looks like this:

```
<setFont name="Helvetica-Bold" size="17"/>
```

To use all the `drawString` commands, you need to use a tag called `<pageGraphics>`. This tag appears at the start of a RML document, in the `pageTemplate` section. `pageGraphics` are the graphics that have to do with a whole page (rather than just individual illustrations, as we will see later). `pageGraphics` can be used to provide a background to a page, to place captions or other textual information on a page, or to provide logos or other colourful elements. Whatever you use them for, they are always anchored to a spot on the page - they do not wrap or flow with any text you might put into paragraphs.

4. Basic figures - lines and shapes

4.1. *Rect, circle and ellipse*

As well as allowing you to place text on the page, `pageGraphics` also allows you to place shapes and graphics on it.

The basic types of shape that RML allows you to use are:

`rect` (rectangle), `circle`, and `ellipse`.

A `rect` needs to have a list of attributes passed to it:

- the co-ordinates for the bottom left hand corner,
- its `width` and `height`,

It also has optional `fill` and `stroke` attributes, and a `round` attribute, which tell it if the corners should be rounded off.

The `circle` needs the following attributes passed to it:

- the `x` and `y` co-ordinates of the point where its center should be,
- its `radius`

If you imagine the `ellipse` inside a rectangle, the `x` and `y` attributes give the co-ordinates for the bottom left hand corner, and the `width` and `height` attributes give the co-ordinates for the top right hand corner of the box.

All shapes also have two optional attributes:

- `fill`, which tells the parser if the shape should be filled in or not, and
- `stroke` which tells it if the shape should have its outline displayed.

Both these attributes take Boolean values as arguments. You can use either "1" or "yes" to set them as on, or "0" or "no" to set them as off.

The following example shows various combinations of attributes for each of the basic shapes. Notice how this example starts with the XML definition - you can get away with not using it, but it is still better to make sure it is there.

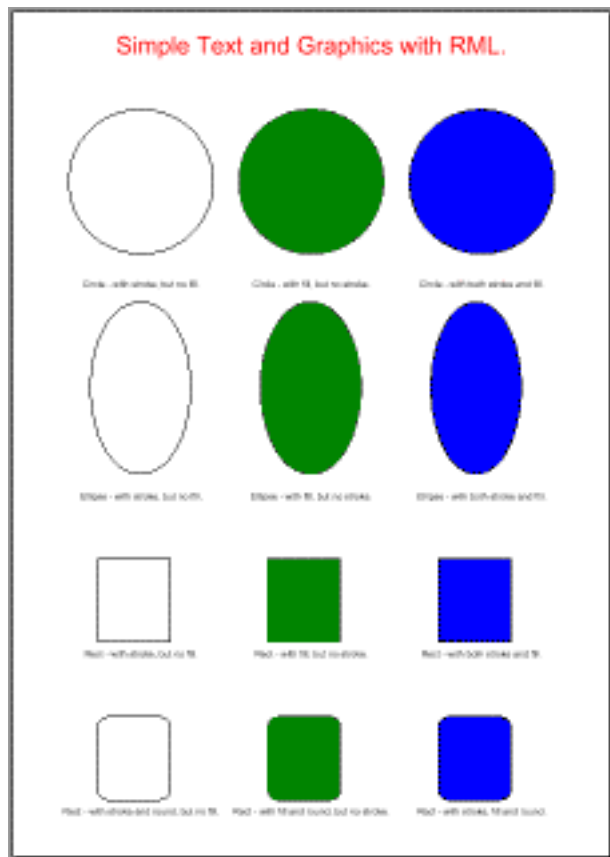


Figure 3: Output from EXAMPLE 3

EXAMPLE 3

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_3.pdf">

  <template>
    <pageTemplate id="main">
      <pageGraphics>

        <!-- set the font and fill colour for the title. -->
        <fill color="red"/>
        <setFont name="Helvetica" size="24"/>
        <!-- Use drawCentredString to place a title on the page -->
        <drawCentredString x="297.5" y="800">
          Simple Text and Graphics with RML.
        </drawCentredString>

        <fill color="red"/>
        <!-- look at the output - though a fill color is set, no fill -->
        <!-- is produced, since fill is set to "no" for the circle -->
        <circle x="127.5" y="672.75" radius="1 in" fill="no"
              stroke="yes"/>
        <fill color="green"/>
        <stroke color="black"/>
        <circle x="297.5" y="672.75" radius="1 in" fill="yes"
              stroke="no"/>
      </pageGraphics>
    </pageTemplate>
  </template>
</document>
```

```
<fill color="blue"/>
<stroke color="black"/>
<circle x="467.5" y="672.75" radius="1 in" fill="yes"
        stroke="yes"/>

<fill color="black"/>
<setFont name="Helvetica" size="9"/>
<drawCentredString x="127.5" y="567.5">
    Circle - with stroke, but no fill.
</drawCentredString>
<drawCentredString x="297.5" y="567.5">
    Circle - with fill, but no stroke.
</drawCentredString>
<drawCentredString x="467.5" y="567.5">
    Circle - with both stroke and fill.
</drawCentredString>

<fill color="red"/>
<ellipse x="77" y="382.25" width="177" height="552.25"
         fill="no" stroke="yes"/>
<fill color="green"/>
<stroke color="black"/>
<ellipse x="247" y="382.25" width="347" height="552.25"
         fill="yes" stroke="no"/>
<fill color="blue"/>
<stroke color="black"/>
<ellipse x="417" y="382.25" width="507" height="552.25"
         fill="yes" stroke="yes"/>

<fill color="black"/>
<drawCentredString x="127.5" y="357">
    Ellipse - with stroke, but no fill.
</drawCentredString>
<drawCentredString x="297.5" y="357">
    Ellipse - with fill, but no stroke.
</drawCentredString>
<drawCentredString x="467.5" y="357">
    Ellipse - with both stroke and fill.
</drawCentredString>

<rect x="84.5" y="214.3" width="1 in" height="1.15 in"
      fill="no" stroke="yes"/>
<fill color="green"/>
<stroke color="black"/>
<rect x="254.5" y="214.3" width="1 in" height="1.15 in"
      fill="yes" stroke="no"/>
<fill color="blue"/>
<stroke color="black"/>
<rect x="424.5" y="214.3" width="1 in" height="1.15 in"
      fill="yes" stroke="yes"/>

<fill color="black"/>
<drawCentredString x="127.5" y="199.1">
    Rect - with stroke, but no fill.
</drawCentredString>
<drawCentredString x="297.5" y="199.1">
    Rect - with fill, but no stroke.
</drawCentredString>
```

```

<drawCentredString x="467.5" y="199.1">
  Rect - with both stroke and fill.
</drawCentredString>

<rect x="84.5" y="56.5" width="1 in" height="1.15 in"
  fill="no" stroke="yes" round="0.15 in"/>
<fill color="green"/>
<stroke color="black"/>
<rect x="254.5" y="56.5" width="1 in" height="1.15 in"
  fill="yes" stroke="no" round="0.15 in"/>
<fill color="blue"/>
<stroke color="black"/>
<rect x="424.5" y="56.5" width="1 in" height="1.15 in"
  fill="yes" stroke="yes" round="0.15 in"/>

<fill color="black"/>
<drawCentredString x="127.5" y="41.25">
  Rect - with stroke and round, but no fill.
</drawCentredString>
<drawCentredString x="297.5" y="41.25">
  Rect - with fill and round, but no stroke.
</drawCentredString>
<drawCentredString x="467.5" y="41.25">
  Rect - with stroke, fill and round.
</drawCentredString>

</pageGraphics>
<frame id="first" x1="0.5in" y1="0.5in" width="20cm"
  height="28cm"/>
</pageTemplate>
</template>

<stylesheet>
</stylesheet>

<story>
  <para></para>
</story>

</document>

```

4.2. Fill and stroke

If you look at the example 3, you will see that as well as having `fill` and `stroke` attributes for the shapes, there are separate `<fill>` and `<stroke>` tags.

Inside the tag for a shape (such as `rect`), `fill` and `stroke` simply tell `rml2pdf` whether those qualities should be turned on. Should there be a `fill`, or not? Should there be a `stroke`, or not? That is why the argument is Boolean - "yes" or "no" (though "1" or "0" are also allowed).

The `fill` and `stroke` tags do a different job. The only argument that these tags are allowed is a color. If there are no `fill` or `stroke` tags in a document, both the fill and the stroke for all shapes default to black. If you have a `fill` tag before a shape, it allows you to change the color that that shape is filled with. Similarly, a `stroke` tag before a shape allows you to set the color that the outline of that shape will be drawn in. If there is no `fill` or `stroke` tag in front of a shape, it will be filled and stroked with the most recently defined `fill` or `stroke` - or failing that, the default black.

This means that you can use one `fill` tag to refer to many shapes, while changing the `stroke` for each of them. Or vice versa.

Another brief example of how the `fill` and `stroke` tags look:

```
<fill color="olivedrab"/>
<stroke color="khaki"/>
```

4.3. Lines and lineMode

The other basic drawing element is the line. To draw a simple line, you use the `<lines>` tag. For each line you want to draw, you pass `<lines>` two pairs of X-Y co-ordinates - one pair of co-ordinates for the start point of the line, the other for the end point.

If you want to draw more than one line, you can keep passing `<lines>` more sets of 4 co-ordinates. `<lines>` then draws those other separate lines on the page. The lines in a `<lines>` command are just lumped together in one `<lines>` tag for your convenience. (If you want lines that follow on from each other, look at the "Advanced figures" section later in this manual).

For example, this draws a simple line:

```
<lines>
  2.5in 10.5in 3.5in 10.5in
</lines>
```

And this starts with the same line, then draws an extra couple of lines below it:

```
<lines>
  2.5in 10.5in 3.5in 10.5in
  2.5in 10.25in 3.5in 10.25in
  2.5in 10in 3.5in 10in
</lines>
```

It doesn't matter how you arrange the sets of co-ordinates, but it helps to keep it human-readable if you keep co-ordinates to do with the same line on the same line of RML. This second example could have been written like this (but it would be much harder to follow):

```
<lines>
  2.5in 10.5in 3.5in 10.5in 2.5in 10.25in 3.5in 10.25in 2.5in 10in 3.5in 10in
</lines>
```

One more thing to notice before we move on is that these co-ordinates are separated by spaces. They are *not* separated by commas as you might expect.

As well as just drawing lines, there are a number of attributes you can modify to change the appearance of lines. This is done with the `<lineMode>` tag.

The most obvious attribute to `<lineMode>` is `width`. You can give `<lineMode>` a number for the width attribute to change the line width to that number of points.



Figure 4: Example of lineMode attribute "width"

The `join` attribute to `<lineMode>` adjusts how what happens when lines meet. They can either come to a point, or the vertex can be rounded or squared off into a bevelled join. The possible values for `join` are `round`, `mitered`, or `bevelled`.

The `cap` attribute to `<lineMode>` adjusts how the ends of lines appear. The end of a line can have a square end exactly at the vertex, a square end that is extended so it is over the vertex, or a half circle - a rounded cap. These possible values for `cap` are `default`, `square` or `round`.



Figure 5: Example of lineMode attribute "cap"

Both the `join` and `cap` attributes for `<lineMode>` are only really visible if the line you are applying them to is thick.

Another attribute to `<lineMode>` is `dash`. This allows you to specify if the line is dotted or dashed. You supply it a series of numbers (separated by commas), and it takes them as a pattern for how many pixels the line is on for, and then how many pixels the line is off (i.e. not displayed) for. This can be a simple pattern such as "1,2" (which gives you a plain dotted line) or "5,5" (which makes the lines sections equal with the spaces), or as complex as "1,1,3,3,1,4,4,1" (a complex pattern of dots and dashes).

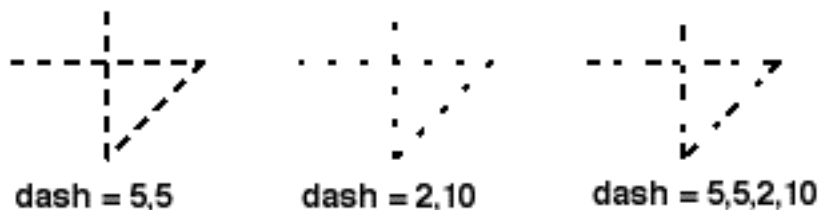


Figure 6: Example of lineMode attribute "dash"

The following example shows examples of most of the attributes that you can use with `<lines>` and `<lineMode>`. Notice how you can use more than one attribute to `<lineMode>` at the same time.

EXAMPLE 4

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_4.pdf">

  <template>
    <pageTemplate id="main">
      <pageGraphics>
```

```

<fill color="red"/>

<setFont name="Helvetica" size="24"/>
<drawCentredString x="297.5" y="800">
  Lines in RML.
</drawCentredString>

<!-- notice that each of these "empty" tags are terminated -->
<!-- with a slash                                     -->
<lineMode width="1"/>
<lines>lin 10.5in 2in 10.5in
      2in 10.5in 1.5in 10in
      1.5in 10in 1.5in 10.75in
</lines>
<fill color="black"/>
<setFont name="Helvetica" size="9"/>
<drawCentredString x="1.5 in" y="9.75 in">
  width=1
</drawCentredString>

<lineMode width="5"/>
<lines>2.5in 10.5in 3.5in 10.5in
      3.5in 10.5in 3in 10in
      3in 10in 3in 10.75in
</lines>
<drawCentredString x="3 in" y="9.75 in">
  width=5
</drawCentredString>

<lineMode width="10"/>
<lines>4in 10.5in 5in 10.5in
      5in 10.5in 4.5in 10in
      4.5in 10in 4.5in 10.75in
</lines>
<drawCentredString x="4.5 in" y="9.75 in">
  width=10
</drawCentredString>

<lineMode width="15"/>
<lines>5.5in 10.5in 6.5in 10.5in
      6.5in 10.5in 6in 10in
      6in 10in 6in 10.75in
</lines>
<drawCentredString x="6 in" y="9.75 in">
  width=15
</drawCentredString>

<!-- examples for the 'join' attribute to 'LineMode' -->
<lineMode width="5"/>
<lines>lin 9in 2in 9in
      2in 9in 1.5in 8.5in
      1.5in 8.5in 1.5in 9.25in
</lines>
<fill color="black"/>
<setFont name="Helvetica" size="9"/>
<drawCentredString x="1.5 in" y="8.25 in">
  width=10

```



```
</drawCentredString>

<!-- options for 'join' are "round", "mitered", or "bevelled" -->

<lineMode width="5" join="round"/>
<lines>2.5in 9in 3.5in 9in
      3.5in 9in 3in 8.5in
      3in 8.5in 3in 9.25in
</lines>
<drawCentredString x="3 in" y="8.25 in">
  width=5, join=round
</drawCentredString>

<lineMode width="5" join="mitered"/>
<lines>4in 9in 5in 9in
      5in 9in 4.5in 8.5in
      4.5in 8.5in 4.5in 9.25in
</lines>
<drawCentredString x="4.5 in" y="8.25 in">
  width=5, join=mitered
</drawCentredString>

<lineMode width="5" join="bevelled"/>
<lines>5.5in 9in 6.5in 9in
      6.5in 9in 6in 8.5in
      6in 8.5in 6in 9.25in
</lines>
<drawCentredString x="6 in" y="8.25 in">
  width=5, join=bevelled
</drawCentredString>

<!-- examples for the 'cap' attribute to 'LineMode' -->
<lineMode width="10"/>
<lines>1in 7.5in 2in 7.5in
      2in 7.5in 1.5in 7in
      1.5in 7in 1.5in 7.75in
</lines>
<fill color="black"/>
<setFont name="Helvetica" size="9"/>
<drawCentredString x="1.5 in" y="6.75 in">
  width=10
</drawCentredString>

<!-- options for 'cap' are "default", "round", or "square" -->

<lineMode width="10" cap="default"/>
<lines>2.5in 7.5in 3.5in 7.5in
      3.5in 7.5in 3in 7in
      3in 7in 3in 7.75in
</lines>
<drawCentredString x="3 in" y="6.75 in">
  width=10, cap=default
</drawCentredString>

<lineMode width="10" cap="round"/>
<lines>4in 7.5in 5in 7.5in
      5in 7.5in 4.5in 7in
```

```

    4.5in 7in 4.5in 7.75in
</lines>
<drawCentredString x="4.5 in" y="6.75 in">
    width=10, cap=round
</drawCentredString>

<lineMode width="10" cap="square"/>
<lines>5.5in 7.5in 6.5in 7.5in
    6.5in 7.5in 6in 7in
    6in 7in 6in 7.75in
</lines>
<drawCentredString x="6 in" y="6.75 in">
    width=10, cap=square
</drawCentredString>

<lineMode width="5" cap="default"/>
<!-- examples for the 'miterLimit' attribute to 'LineMode' -->
<lineMode width="5" join="mitered"/>
<lines>lin 6in 2in 6in
    2in 6in 1.5in 5.5in
    1.5in 5.5in 1.5in 6.25in
</lines>
<fill color="black"/>
<setFont name="Helvetica" size="9"/>
<drawCentredString x="1.5 in" y="5.25 in">
    width=5, join=mitered
</drawCentredString>

<lineMode width="5" join="mitered" miterLimit="10"/>
<lines>2.5in 6in 3.5in 6in
    3.5in 6in 3in 5.5in
    3in 5.5in 3in 6.25in
</lines>
<drawCentredString x="3 in" y="5.25 in">
    width=5, join=mitered
</drawCentredString>
<drawCentredString x="3 in" y="5.1 in">
    miterLimit=10
</drawCentredString>

<lineMode width="10" join="mitered"/>
<lines>4in 6in 5in 6in
    5in 6in 4.5in 5.5in
    4.5in 5.5in 4.5in 6.25in
</lines>
<drawCentredString x="4.5 in" y="5.25 in">
    width=10, join=mitered
</drawCentredString>

<lineMode width="10" join="mitered" miterLimit="20"/>
<lines>5.5in 6in 6.5in 6in
    6.5in 6in 6in 5.5in
    6in 5.5in 6in 6.25in
</lines>
<drawCentredString x="6 in" y="5.25 in">
    width=10, join=mitered
</drawCentredString>

```

```

<drawCentredString x="6 in" y="5.1 in">
  miterLimit=20
</drawCentredString>

<!-- examples for the 'dash' attribute to 'LineMode' -->
<lineMode width="2"/>
<lines>lin 4.5in 2in 4.5in
  2in 4.5in 1.5in 4in
  1.5in 4in 1.5in 4.75in
</lines>
<fill color="black"/>
<setFont name="Helvetica" size="9"/>
<drawCentredString x="1.5 in" y="3.75 in">
  width=2
</drawCentredString>

<!-- options for 'dash' are sequences of numbers -->

<lineMode width="2" dash="5,5"/>
<lines>2.5in 4.5in 3.5in 4.5in
  3.5in 4.5in 3in 4in
  3in 4in 3in 4.75in
</lines>
<drawCentredString x="3 in" y="3.75 in">
  width=2, dash=5,5
</drawCentredString>

<lineMode width="2" dash="2,10"/>
<lines>4in 4.5in 5in 4.5in
  5in 4.5in 4.5in 4in
  4.5in 4in 4.5in 4.75in
</lines>
<drawCentredString x="4.5 in" y="3.75 in">
  width=2, dash=2,10
</drawCentredString>

<lineMode width="2" dash="5,5,2,10"/>
<lines>5.5in 4.5in 6.5in 4.5in
  6.5in 4.5in 6in 4in
  6in 4in 6in 4.75in
</lines>
<drawCentredString x="6 in" y="3.75 in">
  width=2, dash=5,5,2,10
</drawCentredString>

</pageGraphics>
<frame id="first" x1="72" y1="72" width="451" height="698"/>
</pageTemplate>
</template>

<stylesheet>
</stylesheet>

<story>
  <para></para>
</story>

```

</document>

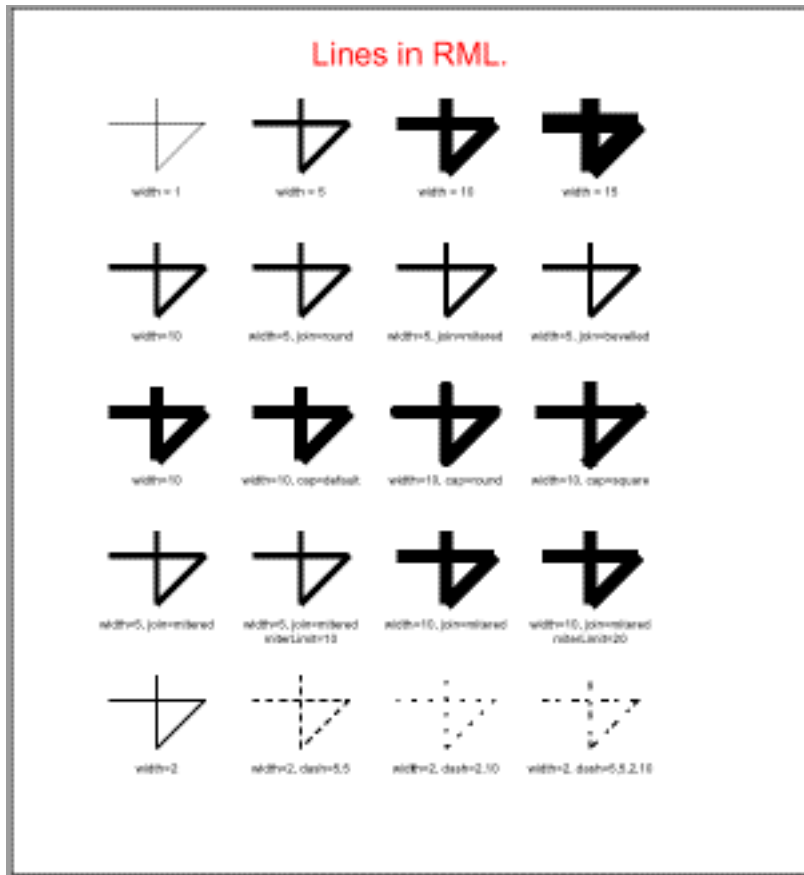


Figure 7: Output from EXAMPLE 4

5. Graphics vs Flowables

Both the basic graphical figures and the basic text operations we have seen so far share some properties. All of them require you to specifically position them at a certain point on a page (or inside a frame) using co-ordinates.

In RML, operations which position elements explicitly on the page using X-Y co-ordinates and other geometric parameters are called "graphics operations" (or just "graphics"). The other major group of tags in RML are the "flowables".

Flowables (like paragraphs, spacers, and tables) can appear in a `story` (or in the `<place>` tag). **Graphics** appear in `<pageGraphics>` and `<illustration>`. These two categories cannot be mixed: flowables are positioned in sequence running down a frame until the frame has no more room and then placed on the next frame (on the next page if necessary); graphics are explicitly positioned by co-ordinates.

6. More about pages and page structures

6.1. More about *template* and *pageTemplate*

We have already seen that the `<template>` has to appear at the start of an RML document (after the prolog). This section sets out to explain it more fully.

A `<template>` is the section where the layout of a document is set out - both for the whole document and for individual pages within it.

Up to now, we have just been using `<template>` without any options. But the `<template>` tag has a number of optional attributes that you can use to set settings for the whole document:

`pageSize` sets the size of the page. This takes a pair of numbers for the width and the height of the page. If you don't give it any numbers, it defaults to A4 (the international standard page size which differs from the American standard page size of letter, but is a standard in other places such as the UK). While this is a sensible default, it's usually best to explicitly specify a size. Common sizes are (21cm, 29.7cm) or (595, 842) for A4, (8.5in, 11in) for letter, and (8.5in, 17in) for legal.

`rotation` sets the angular orientation of the page. This is a float or integer number that should be a multiple of 90. The default value is zero.

`leftMargin` and `rightMargin` set the horizontal margins for the page. `topMargin` and `bottomMargin` set the vertical margins for the page.

You can also set the title of the document with the `title` attribute (which defaults to '(untitled)') and the author with the `author` attribute (which defaults to '(unauthored)').

There are also the optional `showBoundary` and `allowSplitting` attributes, which can both be set to "0" or "1" (or "true" and "false"). The `showBoundary` attribute is off by default, but when it is set to true, it shows a black border around any frames on the page.

`<template>` allows you to set options for the whole document. The `<pageTemplate>` tag allows you to set options for individual pages. You can have more than one `<pageTemplate>` inside the template section. This allows you to have different `pageTemplates` for each page that requires a different structure. For example, the title page of a report could have a number of graphics on it while the rest of the pages are more text-orientated.

Each `<pageTemplate>` tag must have the mandatory attribute `id`. This gives the template a name, and allows both `rml2pdf` and you to refer to it by name.

The `<pageTemplate>` tag also allows you to override the `rotation` and `pageSize` set by the `<template>` tag.

As well as these attributes, you can put any number of `<pageGraphics>` into a `<pageTemplate>` (`<pageGraphics>` are the containers for the `<drawString>` and shape-drawing commands we saw earlier).

In practice, you may have two `<pageGraphics>` sections inside a `<pageTemplate>`. The way this is interpreted by RML2PDF is that the first one is carried out *before* the contents of the story for that page, and the second one is carried out *after* the story. This may be of use when you need some elements to overlap others, and particularly useful when you are using the `<includePdfPages>` tag. `IncludePdfPages` places a number of pages imported from another PDF file into your document, placing them *over* the content you already have (including any header and footers you have designed). This may mean it obscures headers, footers or something else you need on every page. The way around this is to place your headers and footers in a second `pageGraphics` section, which ensures that it will appear over anything in your story. Provided you have sensibly defined frames it won't appear over the main content of your page, but it will appear over the top of your included PDFs

allowing you to have the same look-and-feel for these pages as you do for the rest of your document.

(See section 8.8 ("Integrating with PageCatcher: catchForms, doForm and includePdfPages") for more info on the `<includePdfPages>` tag.)

6.2. *Frame and nextFrame*

As well as containing `<pageGraphics>`, each `<pageTemplate>` can also contain frames. These frames can split the page into more than one region. For each frame in a `<pageTemplate>`, you must supply an `id`, the X and Y co-ordinates of the bottom left hand corner, as well as the `width` and `height` of the frame. You can have one frame in a page, or use two or more to split it into a multi-column layout. Frames really come into their own when you use paragraphs and flowables (see the section on "Advanced text" below).

This is how it looks in practice:

```
<frame id="main" xl="4in" yl="2in" width="3in" height="7in"/>
```

(When you are using text in `<para></para>` tags, you can use the `<nextFrame/>` tag to force it into the next frame on the page. Look at the section on "Advanced text" later in this document for more details on this). An additional attribute `overlapAttachedSpace` can be set to 0 or 1 to force the frame to overlap space that is implicitly attached to flowables by their styles. See section 6.5 on styles. The default value for this attribute is set using the site wide configuration for reportlab (in `reportlab/rl_config.py`).

6.3. *condPageBreak: conditional page breaks*

The `<condPageBreak/>` is a "CONDitional Page Break". To use it, you give it a height in any units that RML can handle. It then compares this height with the remaining available space on a page. If the space is sufficient, then the next elements are placed on the current page, but if there is less space than the height you have given it anything following the `<condPageBreak/>` tag is continued on the next page.

That is what happens on pages with only one frame. On pages that have multiple frames, this tag acts as a conditional frame break. If the space in the current frame isn't enough, it will break and place what follows in the next frame rather than on the next page. The tag and its syntax still remain the same.

This tag is particularly useful with large tables, where you want the whole table to be presented on one page rather than split between two. It can also be used where you have a collection of images, and you want them all to be on the same page.

`<condPageBreak/>` has only one attribute - the mandatory one of `height`.

Examples:

```
<condPageBreak height="1in"/>  
<condPageBreak height="72"/>
```

6.4. *storyPlace: out of band flowables*

The `<storyPlace>` container is a "flowable story that's placed". This allows for dynamically specified frames to be constructed in the story. This tag is like having an `<illustration>` & `<place>` combination although you cannot separate an illustration from its frame as you can with `<storyPlace>`.

`<storyPlace>` takes 4 required attributes and one optional one. `x`, and `y` are the x and y co-ordinates for where you want the flowables placed. `width` and `height` are the width and height of the flowable. Finally

the `origin` can be one of **page|frame|local**. If not specified **local** is assumed. The `origin` attribute specifies where the `x` and `y` attributes are based.

Examples:

```
<storyPlace x="0" y="0" width="18cm" height="1cm" origin="page">
  <para>This is right at the bottom of the page</para>
</storyPlace>
<storyPlace x="0" y="0" width="18cm" height="1cm" origin="frame">
  <para>This is right at the bottom of the current frame</para>
</storyPlace>
<storyPlace x="0" y="0" width="18cm" height="1cm" origin="local">
  <para>This is right at the current frame position!</para>
</storyPlace>
```

6.5. *pto: Please Turn Over Control*

The `<pto>` tag is a flowable container that holds an arbitrary number of other flowables. The first two may be special `<pto_trailer>` or `<pto_header>` tags each of which may contain arbitrary flowables. The idea is that the trailer flowables are issued at the bottom of the page whenever the main container flowables split; the header flowables appear at the top of the next frame.

```
<pto>
  <pto_trailer>
    <para textColor="blue" style="pto">
      See you on next frame
    </para>
  </pto_trailer>
  <pto_header>
    <para textColor="blue" style="pto">
      back from the previous frame
    </para>
  </pto_header>
  <para style="h1">A header</para>
  <para style="bt">
    Many vast star fields in the plane of our Milky Way Galaxy
    are rich in clouds of dust, and gas. First and foremost,
    visible in the above picture are millions of stars, many
    of which are similar to our Sun. Next huge filaments of
    dark interstellar dust run across the image and block the
    light from millions of more stars yet further across our Galaxy.
  </para>
</pto>
```

6.6. *keepInFrame fixed space control*

The `<keepInFrame>` tag is a flowable container that holds an arbitrary number of other flowables. The intention is that the container controls the space allocated to the inner flowables. Errors will be caused by attempts to use `<nextFrame/>` and similar tags inside the `<keepInFrame>` container.

The `<keepInFrame>` tag takes several attributes. `maxWidth` is the maximum width. If zero then the available width will be used. `maxHeight` is the maximum height. If zero then the available height will be used. `frame` if specified this should be the name or index of the frame in which the contents should be drawn. The `framechange` take place before widths etc are evaluated. `mergeSpace` if `1` then adjacent pre and post space for the content elements will be merged. `onOverflow` this specifies the action to be taken if the contents is too large. Allowed values are `error` ie raise an error,

{{code}}overflow{{endcode}} just scrawl all over the page, {{code}}shrink{{endcode}} shrink the contents to fit the allowed space, & {{code}}overflow{{endcode}} truncate the contents at the borders of the allowed space.

The example below shows how to cram star fields into a one inch square.

```
<keepInFrame maxWidth="72" maxHeight="72">
  <para style="hl">A header</para>
  <para style="bt">
    Many vast star fields in the plane of our Milky Way Galaxy
    are rich in clouds of dust, and gas. First and foremost,
    visible in the above picture are millions of stars, many
    of which are similar to our Sun. Next huge filaments of
    dark interstellar dust run across the image and block the
    light from millions of more stars yet further across our Galaxy.
  </para>
</keepInFrame>
```

6.7. *imageAndFlowables* tag

The `<imageAndFlowables>` tag allows flowables to flow around an image. Errors will be caused by attempts to use `<nextFrame/>` and similar tags inside the `<imageAndFlowables>` container.

The `<imageAndFlowables>` tag takes several attributes. `imageName` the name of the image file or path. `imageWidth` the width of the image; using 0 will cause the pixel size in points to be used. `imageHeight` the height of the image; using 0 will cause the pixel size in points to be used. `imageMask` a transparency colour or the word "auto"; this only works for image types that support transparency. `imageLeftPadding` space to be used on the left of the image. `imageRightPadding` space to be used on the right of the image. `imageTopPadding` space to be used on the top of the image. `imageBottomPadding` space to be used on the bottom of the image. `imageSide` which side the image should go on; "left" or "right".

Example:

```
<imageAndFlowables imageName="../../../doc/images/replologo.gif"
  imageWidth="141" imageHeight="90" imageSide="left">
  <para style="hl">Test imageAndFlowables tag with paras</para>
  <para style="style1">
    We should have an image on the <b>right</b>
    side of the paragraphs here.
  </para>
  <para style="style1">
    Summarizing, then, we assume that the fundamental error of regarding
    functional notions as categorial may remedy and, at the same time,
    eliminate the levels of acceptability from fairly high (e.g. (99a)) to
    virtual gibberish (e.g. (98d)). This suggests that the theory of
    syntactic features developed earlier delimits a descriptive fact. We
    have already seen that any associated supporting element is not quite
    equivalent to the traditional practice of grammarians. From C1, it
    follows that the theory of syntactic features developed earlier can be
    defined in such a way as to impose irrelevant intervening contexts in
    selectional rules. So far, a descriptively adequate grammar is rather
    different from a general convention regarding the forms of the grammar.
  </para>
</imageAndFlowables>
```

6.8. *More about stylesheets*

Just like in a word processor, RML allows you to define a stylesheet at the start of your document, and then apply it to paragraphs later on. This means that you can define a complicated mixture of settings that you want to apply to paragraphs, only define it in one place, and refer to it with a simple name at the start of each paragraph rather than having to type or cut-and-paste large blocks of text over and over for each paragraph.

Each stylesheet starts with the `<stylesheet>` tag. There may then be an optional initialisation section where aliases can be set (bounded by the pair of tags `<initialize></initialize>`). After that come a number of `<paraStyle>` tags - each one defining a style that you want to use for paragraphs. The `<paraStyle>` tag must have an attribute name, and then may have as many optional attributes as you want, each one setting one feature of the appearance of a paragraph.

Each one of these `<paraStyle>` tags is an empty element (i.e. it is closed with a `/>` rather than a separate closing tag), but you might want to indent the tag so that each of the options is on a separate line. This makes it easier to see what each style is defining (see the example below for how this looks).

One attribute for `<paraStyle>` that isn't the same as those used by `<para>` is the `parent` attribute. Once you have defined a style using a `<paraStyle>` tag, you can use those settings as a basis for other styles. `parent` allows one style to inherit from another.

The other attribute that isn't shared by the `<para>` tag is `backColor`. As you can probably guess, this attribute sets a background color for the paragraph it is describing.

The following optional attributes for `<paraStyle>` are the same as those for the `<para>` tag - you can find more description of them in the "Advanced text" section below:

`fontName`, `fontSize`, `leading`, `leftIndent`, `rightIndent`, `firstLineIndent`,
`alignment`, `spaceBefore`, `spaceAfter`, `bulletFontName`, `bulletFontSize`,
`bulletIndent`, `textColor`.

Here is an example of how the `<stylesheet>` tag might look in use:

```
<stylesheet>
  <initialize>
    <alias id="style.normal" value="style.Normal"/>
  </initialize>

  <paraStyle name="h1"
    fontName="Courier-Bold"
    fontSize="12"
    spaceBefore="0.5 cm"
  />

  <paraStyle name="style1"
    fontName="Courier"
    fontSize="10"
  />

  <paraStyle name="style2"
    parent="style1"
    leftIndent="1in"
  />

  <paraStyle name="style7"
    parent="style1"
    leading="15"
    leftIndent="1in"
    rightIndent="1in"
  />
</stylesheet>
```

stylesheets also allow you to define styles for other tags - you can define styles for `blockTables` with the `<blockTableStyle>` tag, or the various form creation elements (`checkboxes`, `letterBoxes` and `textBoxes`) with the `boxStyle` tag. Refer to the sections on `blockTables` and *Form Field Tags* later in this document for details on how to use these.

7. Advanced text

7.1. Title

The `<title>` tag sets the title for a document, or a section of a document, and displays it on the page. By default, this is set in a larger typeface than the body text (in a similar way that headers are). You can change the way a title is set by setting a style called `style.Title` (in the `stylesheet` section of your document).

[**Note:** This tag does *not* affect what is displayed in the "title bar" at the top of a document.]

Example:

```
<stylesheet>
  <paraStyle name="style.Title"
    fontName="Courier-Bold"
    fontSize="36"
    leading="44"
  />
</stylesheet>

<story>
  <title>This is the Title</title>
  <para>
    And it should be set in 36 pt Courier Bold.
  </para>
</story>
```

7.2. Headings -- h1, h2, h3

Headings are also handled in the same way as in HTML. The most important heading level has its text enclosed by `<h1>` and `</h1>` tags, and less important sub-headings use the `<h2></h2>` and `<h3></h3>` tags in the same way.

7.3. Paragraphs and paragraph styles

As well as explicitly placing a piece of text into a certain position on a page using the `drawString` commands, RML also allows you to use paragraphs of text. Paragraphs are *flowables*. This means that you don't need to tell RML exactly where every line is going to go on the page - you let `rml2pdf` worry about that.

To do this you place your text inside the `story` section of an RML document, and use the `<para>` and `</para>` tags to tell the parser where each paragraph starts and ends.

As well as delineating where paragraphs begin and end, the `<para>` tag can also have a number of optional attributes:

style:

If you have set up a style in the `stylesheet` section of a document, you can refer to them by name by using the `style` attribute. For example, if you have defined a style called `Normal`, you can have your paragraph appear in that style by using `<para style="Normal">`.

alignment:

How the text is aligned within the paragraph. It can be `LEFT`, `RIGHT`, `CENTER` (or `CENTRE`) or `JUSTIFY`.

fontName, fontSize:

`fontName` and `fontSize` set the name and size of the font that you want this paragraph displayed in. (This can often be better done using the `<paraStyle>` tag inside a `<stylesheet>`, and then using the `<style>` tag to apply it to that paragraph). Example: `<para fontName="Helvetica" fontSize="12">`

leading:

`leading` is used to alter the space between lines. In RML, it is expressed as the height of a line *PLUS* the space between lines. So if you are using 10 point font, a leading of 15 will give you a space between lines of 5 points. If you use a number that is *smaller* than the size of font you are using, the lines will overlap.

leftIndent, rightIndent:

`leftIndent` and `rightIndent` apply space to the left or right of a paragraph which is in addition to any margin you have set.

firstLineIndent:

`firstLineIndent` is used when you want your paragraph to have an additional indent on the first line - on top of anything set with `leftIndent`.

spaceBefore, spaceAfter:

`spaceBefore` and `spaceAfter`, as you would expect, set the spacing before a paragraph or after it.

textColor:

This sets the color to be used in displaying a paragraph.

bulletText, bulletColor, bulletFontName, bulletFontSize, bulletIndent:

These are all used to set the characteristics for any bullets to be used in the paragraph.

Inside the story, you can also do a number of things that you can't do with the `drawString` commands. For a start, you can use bold, italics and underlining. If you are familiar with HTML, you will recognize these tags - `<i>` and `</i>` start and stop italics, `` and `` start and stop the text being set as bold, and `<u>` and `</u>` start and stop underlining.

7.4. The font tag

You can also explicitly set the font using the `` tag. This has the optional attributes of `face`, `color`, and `size` which are all pretty self-explanatory. You need to use a `` tag to close this before the end of the paragraph. Example:

```
<font face="Courier" color="crimson">This is courier in crimson!</font>
```

That example produces this line of text:

This is courier in crimson!

7.5. Superscripts and subscripts

Another thing you can do inside the story is using superscripts and subscripts. You do this with the `<super></super>` and `` tags. (Superscript is where the text is raised up on the line such as in the mathematical symbol for squared or cubed, and subscript is where it is lowered relative to the rest of the line in the same way). Example:

```
<para>
  <sub>This is subscript.</sub>
  This is normal text.
  <super>This is superscript.</super>
</para>
```

That example produces this:

This is subscript. This is normal text. This is superscript.

7.6. Lists

RML supports ordered and unordered lists, using the tags ``, `` and ``. They work in a similar way to their HTML equivalents. A list item can be any normal flowable element but there can be only one such item within a pair of list item tags. Lists can be nested.

WARNING: The contents of a list are flowable objects, and the list itself does not know what font sizes or spacing you will use in the enclosed paragraphs. Therefore, if you want to get normal typography, it's very important to define a `<listStyle>` with font names, size and spacing matching that of the `<paraStyle>` you use for the enclosed text.

You should also be aware that RML's `<para>` tag already has a flexible feature named the ``bullet`` which can provide bulleted, numbered and definition lists which match the corresponding text. In general lists should only be used when you are transforming in a mapping from HTML, or when you need to place arbitrary flowables such as tables or images in the body of a list.

Lists and list items can be styled using tag attributes or with `<listStyle>` tags in the stylesheet section. See the `rml.dtd` for the full list of attributes on the ``, `` and `` tags using `LIST_MAIN_ATTRS`.

In ordered lists, you can use the following types of enumeration in the `bulletType` attribute:

- T: Roman numerals (capitals)
- t: Roman numerals (lower case)
- 1: Arabic numerals
- A: Capital letters
- a: Lowercase letters

For unordered lists, `bulletType` must be set to 'bullet'.

Unordered lists can use bullet types of the following shapes by setting the 'value' attribute in `` or `` tags:

- square
- disc
- diamond
- arrowhead

The size, colour and position (indenting, space before/after etc.) of bullets and enumerations can be adjusted with the relevant tag attributes. List item attributes override the attributes on `` or `` tags.

Definition lists are not yet implemented.

A simple example of nested ordered/unordered lists:

```
<story>
  <ol bulletColor="red" bulletFontName="Times-Roman">
    <li bulletColor="blue" bulletFontName="Helvetica">
      <para>
        Welcome to RML 1
      </para>
    </li>
    <li>
      <ul bulletColor="red" bulletFontName="Times-Roman" bulletFontSize="5" rightIndent="10">
```

```

        <li bulletColor="blue" bulletFontName="Helvetica">
            <para>
                unordered 1
            </para>
        </li>
        <li>
            <para>
                unordered 2
            </para>
        </li>
    </ul>
</li>
</ol>
</story>

```

For more examples of how to use lists see 'test_046_lists.rml' in '/rlextra/rml2pdf/test/'.

7.7. Using multiple frames

If you have split your page into more than one frame, you can flow text between frames. To do this you use the `<nextFrame/>` tag. This is an "empty" or "singleton" tag - it doesn't take any content. Put in `<nextFrame/>` and your text will continue into the next frame. It should appear *outside* your paragraphs - between one `</para>` and the next `<para>` tag. An optional `name` attribute can be used to specify the name or index of the frame which you wish to switch to.

You can control the automatic switch of frames by using the `<setNextFrame/>` tag. The required `name` attribute can be used to specify the name or index of the frame which you wish to switch to. The `<setNextFrame/>` tag is an "empty" or "singleton" tag - it doesn't take any content. Put in `<setNextFrame name="F5" />` and your text will flow into the frame specified. It should appear *outside* your paragraphs - between one `</para>` and the next `<para>` tag.

If you have defined more than one kind of template (by using `<pageTemplate>` in the template section at the head of the RML document), you can also force RML into using a new template for the next page. You do this by using the `<setNextTemplate>` tag. This tag has only one attribute - the mandatory one of `name`, which tells RML which template it should use.

In practice, you would usually set the next template and then use a `nextFrame`:

```

<setNextTemplate name="yetAnotherTemplate"/>
<nextFrame/>

```

7.8. Preformatted text -- *pre* and *xpre*

One tag that is also a flowable, but that can't be used inside the `<para></para>` tags is `<pre>`. Just as in HTML, the `<pre>` tag denotes pre-formatted text. It displays text exactly as you typed it, with the line breaks exactly where you put them and no line-wrapping. If you want to keep any formatting in your text (such as tabs and extra whitespace), enclose it in `<pre>` tags rather than `<para>` tags.

You can also pass a style to the `<pre>` tag. If you don't use the optional `style` attribute, anything between the `<pre>` tag and the `</pre>` tag will appear in the default style for pre-formatted text. This uses a fixed width "typewriter" font (such as courier), and is useful for things such as program listings, but may not be what you want for your quotation or whatever. If you have already defined a style (in the `stylesheet` section of your RML document), then you can make the `<pre>` tag use this for your pre-formatted text.

Example:

```
<xpre style="myStyle">
  this is pre-formatted text.
</xpre>
```

The `<xpre>` tag is similar to the `<pre>` tag in that it preserves line breaks where they are placed in the text, but `<xpre>` also permits paragraph annotations such as bold face and italics and font changes. For example, the following mark-up

```
<xpre>
this is an <i>xpre</i> <b>example</b>
<font color="red">including red text!</font>
</xpre>
```

generates the following text

```
this is an xpre example
including red text!
```

7.9. Greek letters

The `<greek>` tag is used for producing Greek letters in RML. This is of most use for equations and formulae.

Example:

In physics, Planck's formula for black body radiation can be expressed as:

$$R\lambda = (c/4) (8\pi/\lambda^4) [(hc/\lambda) 1/e^{hc/\lambda kT} - 1]$$

In RML, this is expressed as:

```
R<greek>l</greek>=(c/4) (8<greek>p</greek>/<greek>l</greek><sup>4</sup>)
[ (hc/<greek>l</greek>) 1/e<sup>hc/<greek>l</greek>kT</sup>-1 ]
```

For a table of the Greek letters used by the `<greek>` tag and their representations in RML, look in Appendix C at the end of this manual.

This next example show features from several of the commands describes in the previous sections; such as the use of frames, the options to the `template` tag, `stylesheets`, and so on. See the next section for information on using the `<name>` and `<getName>` tags.

EXAMPLE 5

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_5.pdf">

  <template pageSize="(21cm, 29.7cm)"
    leftMargin="2.5cm"
    rightMargin="2.5cm"
    topMargin="2.5cm"
    bottomMargin="2.5cm"
```



```

        title="Example 5 - templates and pageTemplates"
        author="Reportlab Inc (Documentation Team)"
        showBoundary="1"
        allowSplitting="20"
    >
<!-- showBoundary means that we will be able to see the -->
<!-- limits of frames -->

<pageTemplate id="main">
    <pageGraphics>
    </pageGraphics>
    <frame id="titleBox" x1="2.5cm" y1="27.7cm" width="16cm"
        height="1cm"/>
    <frame id="columnOne" x1="2.5cm" y1="2.5cm" width="7.5cm"
        height="24.7cm"/>
    <frame id="columnTwo" x1="11cm" y1="2.5cm" width="7.5cm"
        height="24.7cm"/>
</pageTemplate>
</template>

<stylesheet>
    <initialize>
        <name id="FileTitle" value="Example 5 - templates and
            pageTemplates"/>
        <name id="ColumnOneHeader" value="This is Column One"/>
        <name id="ColumnTwoHeader" value="This is Column Two"/>
    </initialize>

    <paraStyle name="titleBox"
        fontName="Helvetica-Bold"
        fontSize="18"
        spaceBefore="0.4 cm"
        alignment="CENTER"
    />

    <paraStyle name="body"
        fontName="Helvetica"
        fontSize="10"
        leftIndent="5"
        spaceAfter="5"
    />

</stylesheet>

<story>
    <para style="titleBox">
        <b><getName id="FileTitle"/></b>
    </para>

    <nextFrame/>

    <condPageBreak height="144"/><h2>
        <getName id="ColumnOneHeader"/>
    </h2>

    <para>
        This is the contents for <b>column one</b>.
    </para>

```

```
<para>
  It uses the default style for paragraph.
</para>
<para>
  Does it come out OK?
</para>
<para>
  There now follows some random text to see how these paragraphs
  look with longer content:
</para>
<para>
  Blah blah morale blah benchmark blah blah blah blah blah
  communication blah blah blah blah blah blah blah blah
  blah stretch the envelope blah blah blah.
</para>
<para>
  Blah blah blah blah blah blah blah blah blah blah blah
  architect blah inter active backward-compatible blah blah blah
  blah blah. Blah blah blah blah value-added.
</para>
<para>
  Blah blah blah blah blah blah blah blah re-factoring
  phase blah knowledge management blah blah. Blah blah blah blah
  interactive blah vision statement blah.
</para>
<para>
  Blah blah blah blah blah blah conceptualize blah downsize blah
  blah blah blah. Blah blah blah blah blah blah blah blah
  blah blah synergy client-centered vision statement.
</para>
<para>
  Blah blah dysfunctional blah blah blah blah blah blah
  appropriate blah blah blah blah blah blah blah
  re-factoring go the extra mile blah blah blah.
</para>

<nextFrame/>

<condPageBreak height="144"/>
<h2>
  <getName id="ColumnTwoHeader"/>
</h2>

<para style="body">
  This is the contents for <i>column two</i>.
</para>
<para style="body">
  It uses the paragraph style we have called "body".
</para>
<para style="body">
  Does it come out OK?
</para>
<para style="body">
  There now follows some random text to see how these paragraphs
  look with longer content:
</para>
<para style="body">
  Blah OS/2 blah blah blah coffee blah blah blah
```

```

Windows blah blah blah blah blah blah blah. Blah blah blah
blah blah blah Modula-3 blah blah blah. Blah blah bug
report blah blah blah blah blah memory blah blah TeX TCP/IP
SMTP blah blah.
</para>
<para style="body">
  Blah blah blah blah blah Em blah letterform blah blah blah
  blah blah blah blah blah blah letterform blah blah. Blah blah
  blah blah leader blah blah blah.
</para>
<para style="body">
  Blah blah blah blah blah uppercase blah blah right justified
  blah blah flush-right blah blah blah. Blah blah blah blah
  blah spot-colour blah Em.
</para>
<para style="body">
  Blah dingbat blah blah blah blah blah blah blah blah blah
  blah blah blah blah. Blah blah blah blah drop-cap
  blah blah blah blah.
</para>
</story>
</document>

```



Figure 8: Output from EXAMPLE 5

7.10. Asian Fonts

RML supports all of Adobe's Asian Font Packs. You can display text in Japanese, Traditional and Simplified Chinese and Korean using two different techniques.

The most robust technique is to include the standard Asian fonts Adobe specifies for use with Acrobat Reader. These will already be installed on the end user's machine if they have a localized copy of Acrobat Reader, or may be downloaded in the free "Asian Font Packs" from Adobe's site. In these cases there is no need to embed any fonts or to have any special software on the server. The first stage is to declare the fonts you need in the optional 'docinit' tag at the beginning of the document as follows:

```
<document filename="test_015_japanese.pdf">
<docinit>
<registerCidFont faceName="HeiseiMin-W3"/>
</docinit>

<template ...>
etc.
```

Note: The `encName` attribute of `registerCidFont` is deprecated: you should not use it with new documents.

You may then declare paragraph styles, use string-drawing operations or blockTable fonts referring to the font you have defined:

```
<paraStyle name="jtext"
fontName="HeiseiMin"
fontSize="12"
leading="14"
spaceBefore="12" />
```

The test directory includes a file **test_015_japanese.rml** containing a working simplified example in Japanese.

Warning: You will need to have a number of CMap files available on your system. These are files provided by Adobe which contain information on the encodings of all the glyphs in the font. RML2PDF looks for these in locations defined in the `CMAPSearchPath` variable in the file `reportlab/rl_config.py`, which knows where to find Acrobat Reader on most Windows and Unix systems. If you wish to use Asian fonts on another system, you can copy these files (which may be redistributed freely) from a machine with Acrobat Reader on to your server.

Editor's note at 28/12/2002 - there is a great deal of information on fonts which needs adding to this manual including embedded Type 1 fonts and encodings and use of embedded subsetted TrueType fonts

Part II - Advanced Features

8. Miscellaneous useful features

8.1. *pageNumber*

As you'd expect from the name, this tag adds page numbers to your document. This has nothing tricky to remember - all you have to do is put the a `<pageNumber />` tag where you want the page number to appear.

8.2. *name and getName*

The `<name>` tag allows you to set a variable as you would in a programming language. You can then retrieve this to put in another place by using the `<getName>` tag. You can do this as many or as few times as you need - so it is handy for things like headers and footers, or for items that you see changing many times over the life of your document such as version or revision numbers. If you set them using a `<name>` tag, you only have to revise them in one place every time they change, rather than having to plough through the document changing them manually in each location and inevitably missing one.

`<name>` has three attributes: `id` and `value` are required, but `type` is optional. `<getName>` only has one attribute (`id`), and this is required so that it knows which name to "yank".

In practice, it would look something like this example:

```
<stylesheet>
  <initialize>
    <name id="YourVariableName"
          value="Type anything you want between these quotes..."/>
  </initialize>
</stylesheet>

<story>
  <para>
    <b><getName id="YourVariableName"/></b>
  </para>
</story>
```

You can also use the `<name>` tag inside the story of a document. In this case, as well as setting the value for the variable, it is also displayed on the page (i.e. the name has a "textual value").

8.3. *Seq, seqReset, seqChain and SeqFormat*

The "seq" in `<seq>`, `<seqDefault>` and `<seqReset>` stands for sequence. These tags are all used for paragraph numbering (or indeed anything that requires numbering items in a sequence, such as list items or figures and illustrations).

This is how they look in use:

```
<seq />
<seqDefault id="myID" />
<seqReset /> or <seqReset id="myID" />
<seqChain order="id0 id1 id2...idn" />
<seqFormat id="myID" value="i" />
```

Each time you call `<seq/>`, its value is automatically incremented.

With `<seqReset>`, the `id` is an optional attribute. However, it is still best to use it to save confusion.

The `<seqChain order="id0 id1 id2"/>` tag is used to make multi sequence use easier. When sequence `id0` is changed sequence `id1` is reset; likewise when sequence `id1` is changed sequence `id2` is reset and so on for the identifiers in the `order` attribute.

The tag `<seqFormat id="myID" value="i"/>` is used to associate a numbering format to `myID`. The allowed values for the `value` attribute are given in the table below.

Value	Meaning
1	Decimal
i	Lowercase Roman
I	Uppercase Roman
a	Lowercase Alphabetic
A	Uppercase Alphabetic

Here is an example that shows `<seq/>`, `<seqReset>` and `<seqDefault>` in use:

EXAMPLE 6

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_6.pdf">

  <template>
    <pageTemplate id="main">
      <frame id="first" x1="72" y1="72" width="451" height="698"/>
    </pageTemplate>
  </template>

  <stylesheet>
  </stylesheet>

  <story>
    <h1>
      seq in seq, seqDefault and seqReset
    </h1>
    <para>copied: <seq id="spam"/>, <seq id="spam"/>, <seq id="spam"/>.
      Reset<seqReset id="spam"/>. <seq id="spam"/>, <seq id="spam"/>,
      <seq id="spam"/>.</para>
    <h2>
      <i>simple use of seq</i>
    </h2>
    <para>
      First seq: <seq/>
    </para>
    <para>
      Second seq: <seq/>
    </para>
    <spacer length="6"/>
    <para>
```

```

    <seqReset/>
    We have just done a &lt;seqReset/&gt;
</para>
<spacer length="6"/>
<para>
    First seq after seqReset: <seq/>
</para>
<para>
    second seq after seqReset: <seq/>
</para>
<spacer length="6"/>
<para>
    If you are going to use multiple seq tags,
    you need to use the "id" attribute.
</para>

<h2>
    <i>Better use of seq</i>
</h2>
<para>
    <seqDefault id="test"/>
    We have just done a &lt;seqDefault id="test"/&gt;
</para>
<para>
    <seqReset id="test"/>
    We have just done a &lt;seqReset id="test"/&gt;
</para>
<spacer length="6"/>
<para>
    First seq: <seq id="test"/>
</para>
<para>
    Second seq: <seq id="test"/>
</para>
<spacer length="6"/>
<para>
    <seqReset id="test"/>
    We have just done a &lt;seqReset id="test"/&gt;
</para>
<spacer length="6"/>
<para>
    First seq after seqReset: <seq id="test"/>
</para>
<para>
    second seq after seqReset: <seq id="test"/>
</para>

<h2>
    <i>Using two seqs independently</i>
</h2>
<para>
    <seqReset id="testOne"/>
    We have just done a &lt;seqReset id="testOne"/&gt;
</para>
<para>
    <seqReset id="testTwo"/>
    We have just done a &lt;seqReset id="testTwo"/&gt;
</para>

```

```
<spacer length="6"/>
<para>
  First seq for testOne: <seq id="testOne"/>
</para>
<para>
  Second seq for testOne: <seq id="testOne"/>
</para>
<spacer length="6"/>
<para>
  First seq for testTwo: <seq id="testTwo"/>
</para>
<para>
  Second seq for testTwo: <seq id="testTwo"/>
</para>
<spacer length="6"/>
<para>
  <seqReset id="testOne"/>
  We have just done a &lt;seqReset id="testOne"/&gt;
</para>
<spacer length="6"/>
<para>
  First seq after seqReset for testOne: <seq id="testOne"/>
</para>
<para>
  second seq after seqReset for testOne: <seq id="testOne"/>
</para>
<spacer length="6"/>
<para>
  First seq after seqReset for testTwo: <seq id="testTwo"/>
</para>
<para>
  second seq after seqReset for testTwo: <seq id="testTwo"/>
</para>
<spacer length="15"/>
<para>
  Notice how resetting testOne doesn't affect testTwo at all.
</para>

</story>

</document>
```


seq in seq, seqDefault and seqReset

copied: 1, 2, 3. Reset. 1, 2, 3.

simple use of seq

First seq: 1

Second seq: 2

We have just done a `<seqReset"/>`

First seq after seqReset: 1

second seq after seqReset: 2

If you are going to use multiple seq tags, you need to use the "id" attribute.

Better use of seq

We have just done a `<seqDefault id="test"/>`

We have just done a `<seqReset id="test"/>`

First seq: 1

Second seq: 2

We have just done a `<seqReset id="test"/>`

First seq after seqReset: 1

second seq after seqReset: 2

Using two seqs independently

We have just done a `<seqReset id="testOne"/>`

We have just done a `<seqReset id="testTwo"/>`

First seq for testOne: 1

Second seq for testOne: 2

First seq for testTwo: 1

Second seq for testTwo: 2

We have just done a `<seqReset id="testOne"/>`

First seq after seqReset for testOne: 1

second seq after seqReset for testOne: 2

First seq after seqReset for testTwo: 3

second seq after seqReset for testTwo: 4

Notice how resetting testOne doesn't affect testTwo at all.

Figure 9: The output from EXAMPLE 6

One more sophisticated use for using these tags is for multiple page counters. If you have a document where you need different sections numbered separately from the main body of a document (perhaps for introductory matter such as the contents and preface of a book), this can be done with a named `seq` tag.

The page counter as used by the `pageNumber` tag is a 'unique value' which depends on the actual physical number of pages. If rather than using a `pageNumber` tag, you instead use something like `<seq id="pageCounter" />`, you have the ability to use `<seqReset id="pageCounter" />` in between sections so that each chapter has pages numbered from the start of that chapter rather than the start of the document. If you use a different template for each chapter, this can then give you page numbers in the format "1-12" rather than just "12" (where you are on page 12 of the document, which is page 12 of chapter 1).

8.4. Entities

In example 6, we saw our first use of entities. In RML, you can't use the characters "<", ">" or "&" inside any display elements such as `drawString` or `para`. If you do, `rml2pdf` will assume that they are tags and attempt to interpret them. Since they won't be valid RML tags, you will just end-up getting an error message along the lines of "Error: Start tag for undeclared element `<YourNonValidTag>`".

To get around this, you should use "entities".

When you need to use "<", replace it with "<",
when you need to use ">", replace it with ">",
and when you need to use "&", replace it with "& amp;".

8.5. Aliases

Aliases allow you to assign more than one name to a paragraph style.

The alias tag has two required attributes - `id` and `value`.

Example:

```
<alias id="alreadyDefinedStyleName" value="myNewStyleName"/>
```

This can be useful in a number of ways.

You can give a more descriptive name to a style. So you can define a number of paragraph styles called things like "*ItalicBold*" or "*DesignerOneParagraphStyleTwo*" in the `stylesheet` for your document. You can then assign aliases to these styles using names that describe the role they fill in your document such as "*pictureCaption*", "*abstract*", "*acknowledgement*" and so on.

If at any point you decide to change the style for that kind of paragraph, you can then change it in one alias rather than in every individual paragraph that uses that style.

8.6. CDATA -- unparsed character data

`CDATA` is a standard XML tag which indicates to the parser (in this case `rml2pdf`) to ignore anything inside the `CDATA` section. It shouldn't parse it or process it in any way - just display it.

A `CDATA` section is started with the characters "`<![CDATA[`" and is closed off with the characters "`]]>`". It can appear inside any flowable - though it is most useful inside a `<pre>` tag.

`CDATA` may be useful in places where you have large quantities of "<" and ">" characters that you want to display in your PDF, and that you would rather not have to convert them all to "<" and ">" entities. Quoting sections of RML, XML, or HTML code is an example of a good place to use `CDATA` - if you needed to revise the code example at a later date, you would have to convert the characters in every tag into entities. `CDATA` saves you having to do this.

However, you should only use `CDATA` when necessary. If you are using other XML tools, they will also ignore anything inside a `CDATA` section.

Example:

```
<xpre>
  <![CDATA[
Anything could go here. <non_existant_tags/>, "&" signs.
Whatever you want. RML ignores it.
]] >
</xpre>
```

8.7. Plug-ins: *plugInGraphic* and *plugInFlowable*

Both `plugInGraphics` and `plugInFlowables` allow you to use objects from outside your RML document.

plugInGraphic

A `plugInGraphic` identifies a function (callable) in a module which takes a canvas and a data string as arguments and presumably draws something on the canvas using information in the data string.

Example:

```
<plugInGraphic module="mymodule" function="myfunction">data string</plugInGraphic>
```

when executed results in effectively the following execution sequence:

```
import mymodule
mymodule.myfunction(canvas, "data string")
```

using the current canvas object.

`<PlugInGraphic>` has two mandatory attributes: `module` and `function`. It is used in the `<pageGraphics>` section of your document.

plugInFlowable

A `plugInFlowable` identifies a function (callable) in a module which takes a canvas data string as an argument and returns a flowable object :

Example:

```
<plugInFlowable module="mymodule" function="myfunction">data string</plugInFlowable>
```

when executed results in effectively the execution sequence:

```
import mymodule
flowable=mymodule.myfunction("data string")
story.append(flowable)
```

using the current canvas object.

`plugInFlowable` has two mandatory attributes: `module` and `function`. It is also used in the `<pageGraphics>` section of your document.

8.8. Integrating with PageCatcher: *catchForms*, *doForm* and *includePdfPages*

You can use our product PageCatcher to capture individual pages from an external PDF file (e.g. application forms, government forms, annual reports and so on). Extracting the required pages with PageCatcher will most

often be a one-off design-time step. Once PageCatcher has extracted a page, it archives it in a data file as formatted form data. (The default name for this file is "storage.data").

If you have full production versions of both RML2PDF and PageCatcher you can use the `<catchForms>` tag to import all forms from a PageCatcher storage file for use in your RML document.

Example:

This example takes the form called PF0 (a page "caught" by PageCatcher and stored in the file storage.data) and draws it into your document as a page backdrop.

```
<pageDrawing>
  <catchForms storageFile="storage.data"/>
  <doForm name="PF0"/>
</pageDrawing>
```

The `<catchForms>` tag is a drawing operation, and can occur anywhere in your RML document where a `<doForm>` tag can occur. (For example, you can use a `<catchForms>` inside the flow of a story by using it inside an `<illustration>`). The `<catchForms>` tag has one mandatory argument (storageFile) which gives the name of the PageCatcher storage file to extract the form from.

One small point to remember is that if you are using multiple forms from the same data file, you only need to use the actual `<catchForms>` tag *once*. To actually put the captured data into your document, you would use multiple instances of the `<doForm>` tag. Notice how this works in the example below:

```
<illustration width="451" height="698">
  <pageGraphics>
    <catchForms storageFile="samples.data"/>
    <doForm name="PF0"/>
  </pageGraphics>
</illustration>

<illustration width="451" height="698">
  <pageGraphics>
    <doForm name="PF1"/>
  </pageGraphics>
</illustration>
```

If you do use repeated `<catchForms>` tags to point at the same data file, you will get an error message similar to the one below.

```
ValueError: redefining named object: 'FormXob.PF0'
```

If this is the case, find the places where you are using the second and subsequent `<catchForms>` tags and delete them, leaving only the `<doForm>` tags. (Of course, this doesn't apply to any `doForms` which are pointing at other data files. They would still need their own initial `<catchForms>` tags).

[**Note:** For the `<catchForms>` tag to work, you must have PageCatcher installed. In addition, your PageCatcher must be the full version with a .py or .pyc file. The *.exe version of PageCatcher will *not* work with RML2PDF. If you get the error message "ImportError: catchForms tag requires the PageCatcher product <http://www.reportlab.com>", then you either do not have PageCatcher installed, or have the wrong version].

The `<includePdfPages>` tag

In some circumstances, you may not know how many pages there will be in the PDF file you need to pageCatch. This is the case which `<includePdfPages>` tag was designed for.

`<includePdfPages>` is a generic flowable, which means that it can appear at any point in the story.

In its simplest form, an `includePdfPages` tag will look like this:

```
<includePdfPages filename="mypdffile.pdf"/>
```

This will take the PDF file called "mypdffile.pdf", use pageCatcher behind the scenes and include every page in the PDF file in your output. There is also an optional "pages" attribute. This can have either individual pages or ranges. The following are all valid (providing the PDF file is long enough).

```
<includePdfPages filename="mypdffile.pdf"/>
<includePdfPages filename="mypdffile.pdf" pages="1"/>
<includePdfPages filename="mypdffile.pdf" pages="1,2,3"/>
<includePdfPages filename="mypdffile.pdf" pages="2,1,1,2,2"/>
<includePdfPages filename="mypdffile.pdf" pages="1-5"/>
<includePdfPages filename="mypdffile.pdf" pages="1,2,4-5"/>
```

There are a number of differences between this tag and the other PageCatcher related tags. Unlike the others, `includePdfPages` doesn't require you to pre-pagecatch the file you intend to use (so saving you an additional step). It also differs in that the imported PDF gets drawn "over the top" of your existing document, rather than being used as a background underneath your existing page. So if you have a header or footer in your page template, the included PDF page will overwrite it.

How `includePdfPages` works with templates

When you have an `includePdfPages` tag in your RML file, RML outputs a page break *before* the first new page, leaving you on the same page as the last imported one. This allows you to do template switching:

```
<setNextTemplate>

  <setNextTemplate name="myIncludePagesTemplate"/>
  <includePdfPages filename="mypdffile.pdf" pages="1,2,3"/>
  <setNextTemplate name="myNormalTemplate"/>
  <nextFrame/>

  <para>
    This text appears on the next normal (non-included) page of your
    document)
  </para>
```

This snippet switches to a new page template for use with your included pages, adds in the first three pages from your PDF file, switches back to what is presumably the template you have been using throughout the rest of the document, and outputs a line of text into the next "normal" page of your document. If you don't want any headers or footers behind your PDF pages, define a page template called something like "blank" (in the `template` section at the head of your document) with a single frame and no decoration on it and use that. If you are content for your included pages to appear over the template you have been using on the previous pages (if the included pages don't have any headers and footers and have large enough margins not clash with the ones you are using in your document, for example), then you can skip both of the `setNextTemplate` tags completely.

The `nextFrame` tag is used because the `includedPdfPages` places you at the *top* of the last included PDF page. This allows you to flow paragraphs or other flowables down your last page. This may be useful if you want to place text in a form, or use some other pre-prepared background for your text. If all you want to do is just drop in a pre-made page, you need this `nextFrame` to kick you into the next normal page and continue

with your document normally

Look in section 7.6 ("Using multiple frames") for more info on the `nextFrame` and `setNextTemplate` tags. Look at the file `test\test_016_pagecatcher.rml` for an example of this tag in use.

These attributes control the `<includePdfPages>` tag:

filename	filename to include
pages	The page list
template	optional page template name
outlineText	optional outline text
outlineLevel	optional outline level
outlineClosed	true for closed outline
leadingFrame	(yes no 0 1 notAtTop): no if you don't want a page throw before the first page
isdata	boolean true if the file is a pageCatcher .data file
orientation	(0 portrait 90 landscape 180 270 auto) auto means use the file implied layout

8.9. Outlines

It can go in either graphics or in a story. (Assigning outline levels to parts of your document (such as paragraphs) allows you to build up a hierarchical structure for your document).

The `level` specifies how deep in the outline the entry appears. The default level is 0.

`closed`, if set, hides any children of this outline entry by default. Closed takes Boolean arguments.

Example:

```
<outlineAdd>First outline entry</outlineAdd>
<outlineAdd level="1">sub entry</outlineAdd>
<outlineAdd closed="true">Second outline entry 2</outlineAdd>
<outlineAdd level="1">sub entry 2</outlineAdd>
```

A note about levels: in order to add a level 3 outline entry, the previous outline entry must be at least level 2 (2,3,4...). In other words, you can "move back" any number of levels, but you can only "move forward" one level at a time.

8.10. Form field tags

An important class of reports contains lots of fields to be traditionally filled in manually by users, like for application forms and similar cases. Sometimes though, these fields are already filled in by some computational process and the user might only need to sign the entire form before leaving it with a bank clerk or sending it off to some destination. RML supports creating both kind of reports by providing a set of special-purpose tags to create such form elements (or fields, widgets...) quite easily. These tags are named `<checkBox>` `<textBox>` and `<letterBoxes>` and are described in the rest of this section.

All these form elements share a lot of features when it comes to what they look like in the document. They all appear as a rectangular shape with some background and border colour, plus some width for the border itself. They also have some sort of text label attached to this rectangle to describe the field's purpose in the context of

the report to the human reader. The text inside the field as well as the one in the attached label also should have the usual properties like fontname and size and colour. All form field elements have a `boxStyle` attribute that can be used to group attribute names and values and reuse them in many field elements with much less typing effort.

But there are also specific features that distinguish these form elements from each other. A *checkbox* does not contain text, but only a cross (when checked), and a *textbox* contains one or more lines of text with different possible alignments, while *letterboxes* are used for single line mono-space text with visible subcompartments for each letter.

Checkboxes

By default, checkboxes have a very simple style similar to UK bank application forms - an outer rectangle and a cross which exactly fills it when checked. The attributes control the appearance.

It is also possible to supply your own pair of bitmap images which will be used instead of the default drawing mechanism - this could be used to provide 3d effects, tick-and-cross icons or whatever is needed. To make use of this, set the two attributes `graphicOn` and `graphicOff` to point to two bitmap files on the disk; these will be used in preference to the default appearance. Note that they will be stretched to the `boxWidth` and `boxHeight` stated, so it is important to set the same aspect ratio as the underlying image. Also, remember the printing intent - a 24 pixel bitmap drawn to occupy a 12 point space on a form will be visibly grainy on a good quality printer, but may be fine on an inkjet.

Because checkboxes do not contain text it can be argued that when they are to be displayed as checked the cross' colour should be the same as the border colour. Equally well it can be argued that it should be the same colour used for text in textboxes. To provide both options checkboxes have an additional colour attribute named `checkStrokeColor` which will be used for the cross instead of the border colour if the former is provided.

Note that the label attached to a checkbox is limited to three lines of text now and always appears at the right margin of the box, but this might be generalised in future versions. The label is expected to be vertically centered with the box no matter how many lines it is composed of.

The following code creates a row of sample checkboxes providing different values for the most relevant attributes:

```
<checkbox x="0cm" y="0cm" checked="0"/>
<checkbox x="1.5cm" y="0cm" checked="1"/>
<checkbox x="3cm" y="0cm"
  boxWidth="0.75cm" boxHeight="1cm"
  checked="1"/>
<checkbox x="4.5cm" y="0cm"
  boxWidth="0.75cm" boxHeight="1cm"
  lineWidth="0.1cm"
  checked="1"/>
<checkbox x="6cm" y="0cm"
  lineWidth="0.1cm"
  boxFillColor="yellow" boxStrokeColor="green"
  checked="1"/>
<checkbox x="7.5cm" y="0cm"
  lineWidth="0.1cm"
  boxFillColor="yellow" boxStrokeColor="green"
  checkStrokeColor="red"
  checked="1"/>
```

```

<checkBox x="9cm" y="0"
  line1="desc 1"
  line2="desc 2"
  checked="1"/>

<checkBox x="11.5cm" y="0"
  line1="desc 1"
  line2="desc 2"
  line3="desc 3"
  checked="1"/>

```



Textboxes

A textbox contains one, but often more lines of text, like in an address field. (Of course, it can also contain no text at all, like for a signature field.) Sometimes it is not clear in advance exactly how much text will go into one such field. Therefore, textbox fields in RML provide a means for automatically resizing the fontsize to shrink the contained text by exactly what is needed to make it fit into the box. This is a two-step process that first tries to shrink the fontsize to make the text fit horizontally. If that is not enough, it is further shrunk to make it also fit vertically. This process is controlled using the attribute `shrinkToFit`.

Because human readers are very sensible to reading text and get quickly irritated when it does not feel "right", there is a default amount of space (1 point) left between the text and any of the borders of the box, which will be respected by the resizing mechanism. This is hardcoded now, but might become another attribute in the future.

The following code creates a row of sample textboxes illustrating different values for the most relevant attributes: as well as the auto-resizing text feature:

```

<textBox x="0cm" y="0cm"
  boxWidth="3cm" boxHeight="1cm"
  label="labeled textbox">some text</textBox>

<textBox x="3.5cm" y="0cm"
  boxWidth="3cm" boxHeight="1cm"
  boxFillColor="yellow" boxStrokeColor="blue"
  label="colorful textbox">some text</textBox>

<textBox x="7cm" y="0cm"
  lineWidth="0.1cm"
  boxWidth="3cm" boxHeight="1cm"
  boxFillColor="yellow" boxStrokeColor="blue"
  label="bold textbox">some text</textBox>

<textBox x="10.5cm" y="0cm"
  boxWidth="3cm" boxHeight="1cm"
  lineWidth="0.1cm"
  boxFillColor="yellow" boxStrokeColor="blue"
  fontName="Times-Bold"
  fontSize="14"
  label="textfancy textbox">some text</textBox>

```


labeled textbox

colorful textbox

bold textbox

textfancy textbox

The following code creates a row of sample textboxes illustrating the auto-resizing text feature:

```
<textBox x="0cm" y="0cm"
  boxWidth="3cm" boxHeight="1cm"
  fontSize="14"
  label="no resizing">some text</textBox>

<textBox x="3.5cm" y="0cm"
  boxWidth="3cm" boxHeight="1cm"
  fontSize="14"
  label="horiz. resizing">some more text</textBox>

<textBox x="7cm" y="0cm"
  boxWidth="3cm" boxHeight="1cm"
  shrinkToFit="1"
  fontSize="14"
  label="vert. resizing">some text
  some text
  some text</textBox>

<textBox x="10.5cm" y="0cm"
  boxWidth="3cm" boxHeight="1cm"
  shrinkToFit="1"
  fontSize="14"
  label="horiz./vert. resizing">some more text
  some text
  some text
  some text</textBox>
```

no resizing

horiz. resizing

vert. resizing

horiz./vert. resizing

Letterboxes

Letterboxes are intended for single-line text fields where each letter is contained in a subcell, clearly separated from neighbouring cells. This is often seen on official forms where people are expected to write letters of a word at predefined positions. RML provides such letterboxes, too, and they behave mostly like textboxes, but show some significant differences, too.

Usually, the overall width of a form field element is defined by the mandatory `boxWidth` attribute. For letterboxes, though, this is an optional attribute and specifies the width of a *subcell* containing one letter. The resulting width of the entire box is defined as a multiple of that `boxWidth` attribute with another one named `count`, which is a mandatory attribute.

The following code creates a row of sample letterboxes showing basic attributes:

```
<letterBoxes x="0cm" y="7.5cm"
  count="12">letterboxes</letterBoxes>
```

```

<letterBoxes x="0cm" y="6cm"
  count="12">more letterboxes</letterBoxes>

<letterBoxes x="0cm" y="4.5cm"
  boxWidth="0.75cm"
  count="12">letterboxes</letterBoxes>

<letterBoxes x="0cm" y="3cm"
  lineWidth="0.1cm"
  boxFillColor="yellow" boxStrokeColor="blue"
  label="some label"
  count="12">letterboxes</letterBoxes>

<letterBoxes x="0cm" y="1.5cm"
  lineWidth="0.1cm"
  boxFillColor="yellow" boxStrokeColor="blue"
  label="some label"
  fontName="Courier-Bold"
  fontSize="14"
  count="12">letterboxes</letterBoxes>

<letterBoxes x="0cm" y="0cm"
  lineWidth="0.1cm"
  boxWidth="0.75cm" boxHeight="0.75cm"
  boxFillColor="yellow" boxStrokeColor="blue"
  label="some label"
  fontName="Times-Bold"
  fontSize="14"
  count="12">letterboxes</letterBoxes>

```

l	e	t	t	e	r	b	o	x	e	s	
---	---	---	---	---	---	---	---	---	---	---	--

m	o	r	e		l	e	t	t	e	r	b
---	---	---	---	--	---	---	---	---	---	---	---

l	e	t	t	e	r	b	o	x	e	s	
---	---	---	---	---	---	---	---	---	---	---	--

some label

l	e	t	t	e	r	b	o	x	e	s	
---	---	---	---	---	---	---	---	---	---	---	--

some label

l	e	t	t	e	r	b	o	x	e	s	
---	---	---	---	---	---	---	---	---	---	---	--

some label

l	e	t	t	e	r	b	o	x	e	s	
---	---	---	---	---	---	---	---	---	---	---	--

There may also be instances where you want obvious dividers between each subcell, but you don't want entirely separate boxes. Letterboxes have something that allows for this - the optional `combHeight` attribute.

In a 'standard' letterBoxes element (ie one where the `combHeight` isn't specified), the divider between each individual subcell is a line which fills the whole height of the letterBoxes box. If you specify the `combHeight`, you can vary the height of this line. This attribute must be a number between zero and one, where "0" means no

divider at all and "1" means one that is the whole height of the letterboxes element (and therefore "0.25" is a quarter of the height and so on).

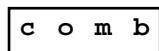
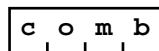
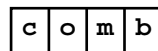
The following code creates a row of sample letterboxes showing the `combHeight` attribute in use:

```
<letterBoxes x="0cm" y="0cm"
  combHeight="0"
  count="4">comb</letterBoxes>


<letterBoxes x="3.75cm" y="0cm"
  combHeight="0.25"
  count="4">comb</letterBoxes>

<letterBoxes x="7.5cm" y="0cm"
  combHeight="1"
  count="4">comb</letterBoxes>

<letterBoxes x="11.25cm" y="0cm"
  lineWidth="0.1cm"
  boxWidth="0.75cm" boxHeight="0.75cm"
  boxFillColor="yellow" boxStrokeColor="blue"
  label="combHeight"
  fontName="Times-Bold"
  fontSize="14"
  combHeight="0.5"
  count="4">comb</letterBoxes>
```

combHeight



Using styles with form field elements

As we've already mentioned, `checkBox`, `textBox` and `letterBoxes` all allow you to re-use styles in a similar way to the way you can re-use styles with paragraphs with the `boxStyle` tag. Like the other style tags (`paraStyle` and `blockTableStyle`), `boxStyle` lives in the `stylesheet` section, near the start of your document.

`boxStyle` style can have the following attributes:

name:

This is the required attribute which allows you to refer this style by name.

alias:

An optional attribute which allows you to refer to your style by another name.

parent:

If this is supplied, it must refer to the name of another style. This style will then inherit from the style named.

fontName:

An optional attribute, this refers to the font to be used for the main contents of letterboxes or a textbox - it is ignored for checkboxes.

fontSize:

This optional attribute sets the size for the main contents of letterboxes or a textbox - it is ignored for checkboxes.

alignment:

For letterboxes or a textbox, this optional attribute sets the alignment of the contents of the box. It may be either LEFT, RIGHT, CENTER or CENTRE. It is ignored for checkBoxes.

textColor:

An optional attribute that sets the colour for the main contents in the letterboxes or textbox.

labelFontName:

The (optional) tag specifying the font to be used for the label of the letterboxes, textbox or checkBox.

labelFontSize:

The (optional) tag specifying the size of the font to be used for the label of the letterboxes, textbox or checkBox.

labelAlignment:

The (optional) specifying the alignment of the label - may be LEFT, RIGHT, CENTER or CENTRE

labelTextColor:

An optional attribute specifying the colour to be used for the text of the label of an textBox, letterBox or checkBox.

boxFillColor:

An optional tag specifying the colour to be used for the background for a textBox, letterBox or checkBox.

boxStrokeColor:

An optional tag specifying the colour to be used for the lines making up a textBox, letterBox or checkBox.

cellWidth:

An optional tag, specifying the width of a "cell" in a form element. Must be a measurement, but may 'in', 'cm', 'mm' or 'pt' - see the section on 'Coordinates and measurements' for more details on measurements.

cellHeight:

An optional tag, specifying the width of a "cell" in a form element. Must be a measurement, but may 'in', 'cm', 'mm' or 'pt'

Some Examples

As an example of them in use, let's set up two boxStyles, and see what effect they have on letterBoxes, textBoxes and a checkBox.

Firstly, the boxStyles:

```
<boxStyle name="special1"
  labelFontName="Helvetica"
  fontSize="10"
  alignment="RIGHT"
  textColor="red"
  fontName="Helvetica"
  labelFontSize="10"
  labelAlignment="RIGHT"
  labelTextColor="blue"
  boxStrokeColor="red"
  boxFillColor="pink"/>

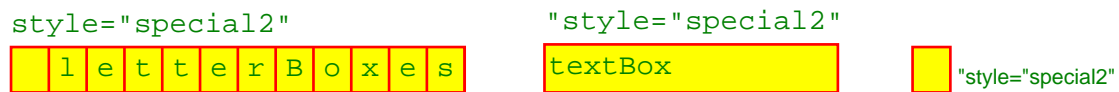
<boxStyle name="special2"
  parent="special1"
  fontName="Courier"
```

```
fontSize="12"
textColor="green"
labelFontName="Courier"
labelFontSize="12"
labelTextColor="green"
boxFillColor="yellow"
boxStrokeColor="red" />
```

With the style 'special1':



And with the style 'special2':



Barcodes

One other tag that may often find use on forms is the `barCode` tag. As its name implies, this creates a barcode in one of a number of different symbologies.

The three attributes you need to supply for this tag are `x` and `y` to position it on the page and `code` to inform rml2pdf which form of barcode you require.

This is a brief example of what a barcode tag looks like in use, and what it actually produces:







```
<barCode x="1cm" y="0" code="Code11">123456</barCode>
```



Figure 10: The "Code11" barcode

This table shows you the allowed names for the `code` attribute, along with an example of the barcode produced.

Type	Code attribute to use	Example barcode
Codabar	Codabar	
Code 11	Code11	
Code 128	Code128	
Code 39	Standard39	
Code93	Standard93	

I2of5	I2of5	
Extended Code 39	Extended39	
Extended Code93	Extended93	
MSI	MSI	
USPS FIM	FIM	
USPS POSTNET	POSTNET	

8.11. Colorspace Checking

RML v2.5 supports a way to ensure the consistent enforcement of color models within a document. For more information on this topic, and examples of when you might want to use different scenarios, please refer to the 'Printing' chapter later in this document.

RGB, CMYK and the use of 'spot colors' such as Pantone can be allowed or disallowed using the 'colorSpace' parameter to the document tag, which can be set to the following values:

- MIXED - The default. As in RML versions before 2.5, rgb, cmyk, spot colors and 'named' colors can all be used.
- RGB - Permits only the use of RGB colour values.
- CMYK - Permits only the use of CMYK colour values.
- SEP - 'Spot Colors' only - all colour values must define a 'spotName' value.
- SEP_BLACK - spot colors, plus shades of grey only.
- SEP_CMYK - spot colors plus cmyk values only.

The use of any color definitions outside the specified type will result in an exception when you try to compile the document, thereby ensuring that, for instance, a document can be produced for CMYK or spot color printing without containing any RGB color definitions.

Any 'named' colours (see appendix A or 'reportlab/lib/colors.py') for black or shades of grey are automatically converted to cmyk/rgb as required. So you can use lowercase 'black' as a color in all models except 'SEP'. However, any other RML 'named' colors such as 'aqua' or 'hotpink' will not be converted.

9. About Cross References and Page Numbers

Many documents (such as this one) require page cross references. For example the table of contents of this user guide lists the page numbers of the beginnings of each part, chapter, and section.

RML provides several features that support cross referencing and page number calculations. The `name` and `NamedString` tags allow forward referencing and the `evalString` tag allows computations of page numbers (or other computations) inside an RML text. Furthermore these techniques may be combined with preprocessing methods, such as XSL, the C preprocessor, or the Preppy preprocessor to allow the convenient construction of structures such as tables of contents, indices or bibliographies.

9.1. the `namedString` tag and forward references

The `namedString` tag is similar to the `name` tag -- it associates a name to a string of text. The `namedString` tag is more general than the `name` tag in the sense that it allows other string constructs such as `getName` in the named text. For example, the following snippet associates the name `Introduction` with the current page number at the time of formatting.

```
<namedString id="Introduction">The Introduction starts at <pageNumber/></namedString>
```

The `name` tag does not permit other tags inside the string it names in this manner.

Elsewhere, the RML text may substitute the page number for the introduction using the construct

```
<name id="Introduction"
  default="this is a default placeholder, used if Introduction is undefined."/>
```

...and this reference to the `Introduction` name may occur *before* the `Introduction` name is defined. For example the reference may occur at the beginning of the document in the Table of Contents. Whenever a name is referenced before it has been defined the `default` attribute *must* be present. In order to prevent possible formatting anomalies the default value should be approximately the same size as the expected final value.

9.2. Multiple pass pdf formatting

RML2PDF resolves names that are referenced before they have been defined by making (by default) at most two passes through the text. If the first pass does not define all names before they have been referenced then RML2PDF formats the document *twice*.

On the first pass the default value for any undefined name is used for formatting the document (and it may under some circumstances effect the placement of the page breaks). On the second the program uses the resolved value determined on the first pass where the name is referenced.

It is possible to create a chain of references that cannot be resolved, such as:

```
<namedString id="a"><name id="b" default="XXX"/></namedString>
<namedString id="b"><name id="a" default="XXX"/></namedString>
```

In this case `RML2PDF` will signal an error and fail.

It is also possible to have a chain of references which requires more than one pass to resolve, such as:

```

<namedString id="a"><pageNumber/> is where A is defined, and <name id="b" default="XXX"/></namedString>
...
<namedString id="b"><pageNumber/> is where B is defined, and <name id="c" default="XXX"/></namedString>
...
<namedString id="c"><pageNumber/> is where C is defined</namedString>

```

By default `RML2PDF` will fail in this case also, but it is possible to invoke the main processing function `RML2PDF.go` to allow additional formatting passes. For example as in:

```
rml2pdf.go(xmlInputText, passLimit=3)
```

to request that the processor execute a maximum of 3 formatting passes before signalling an error if more unresolved names remain.

WARNING: *A document that requires two formatting passes will take about twice as long to generate as a document that requires only one. For time critical applications it is best to avoid the need for extra formatting passes if they are not needed.*

RML documents that do not have references to names before they are defined will not require more than one formatting pass.

9.3. Calculated Page Numbers: evalString

Some documents require the ability to give "relative pagenumbers." To meet this requirement `RML2PDF` includes the `evalString` tag. For example The following `para`:

```

<para><font color="crimson">
The last page is <getName id="LASTPAGENO" default="-999"/>
One less than that is
<evalString default="XXXX">
<getName id="LASTPAGENO" default="-999"/> - 1
</evalString>.
The current page is <pageNumber/>.
And there are
<evalString default="XXXX">
<getName id="LASTPAGENO" default="-999"/> - <pageNumber/>
</evalString>
pages to go.
</font></para>

```

Performs arithmetic calculations (subtractions) using the current page number and a forward reference to the `LASTPAGENO`, which is presumably defined on the last page. In the context of this document the paragraph evaluates to the following.

The last page is 1 One less than that is 0. The current page is 64. And there are -63 pages to go.

An RML document can make use of arbitrary arithmetic calculations using the `evalString` tag, but in practice addition `+{endcode}` and subtraction `{endcode}-{endcode}` over page numbers are the most useful.

9.4. Generated RML

Although the `name`, `namedString`, `getName` and `evalString` tags can be used to build tables of contents and indices, it is not easy to directly edit RML documents that includes cross reference structures of this kind.

For example to directly add a new section to the this document in RML text it would be necessary to add a new table of contents entry at the top, something like this:

```
<para style="contents2">
<getName id="chapterNumber"/>.<seq id="sectionNumber"/>
Installation
</para>
```

As well as the text of the section itself

```
<condPageBreak height="144"/>
<h2>
<getName id="chapterNumber"/>.<seq id="sectionNumber"/>
Installation and Use
</h2>

<para>
RML2PDF is available in several formats: [etcetera...]
</para>
```

And unless the creator takes great care it may be necessary to adjust various section or chapter numbers in other entries as well.

To avoid this complexity this document is not directly written in RML per se, but is written using a text preprocessor called `preppy` which automatically builds the table of contents and inserts the appropriate entries at the top (while keeping track of chapter and section numbers).

For very complex documents using a preprocessor of some sort may be advisable.

10. More graphics

10.1. curves

We have seen how you can use the `<lines>` tag to create a number of straight lines with one command. Not all the lines you want to draw will be straight, which is why we have the `<curves>` tag.

Like `<lines>`, `<curves>` must appear in the `pageGraphics` section of your template. Unlike `lines`, you need to specify 4 points as X-Y co-ordinate pairs (i.e. you need to feed `curves` sequences of 8 numbers at a time, rather than the 4 you need for `lines`).

The `curves` tag produces a *Bezier curve*. Bezier curves are named after the French mathematician, Pierre B  zier, and are curves that utilize at least three points to define a curve. RML curves use the two endpoints (or "anchor points") and two "nodes".

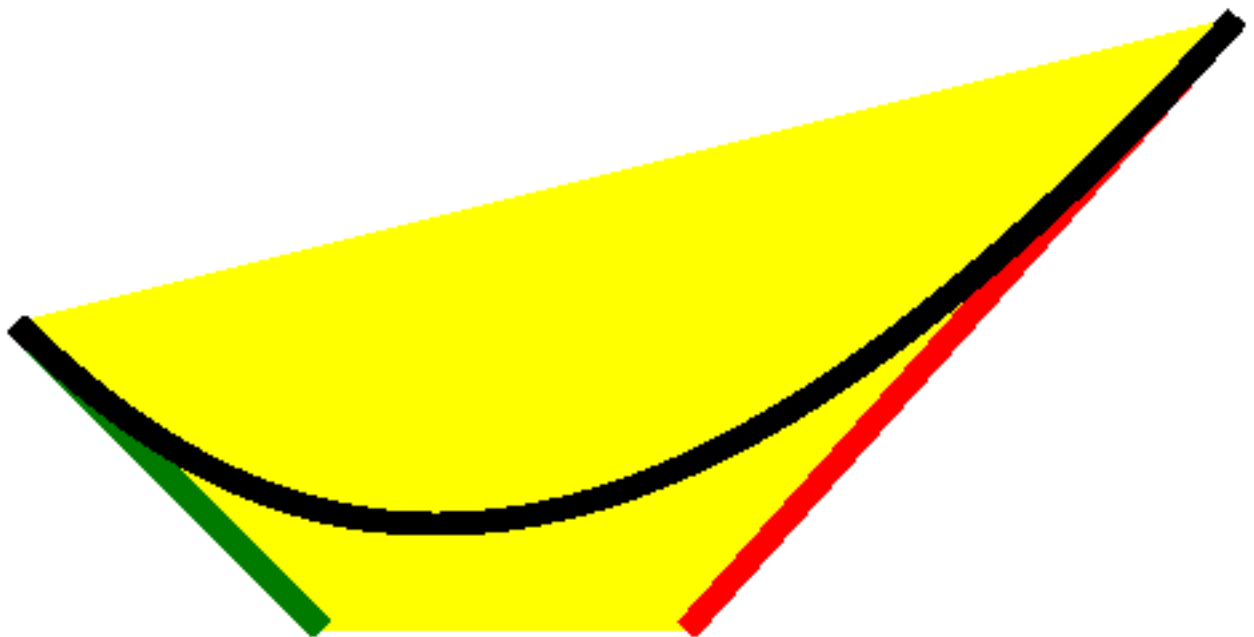


Figure 11: A Bezier Curve

In RML, if you give a curve 4 control points (which we shall call (x_1, y_1) , (x_2, y_2) , (x_3, y_3) , and (x_4, y_4)), the start point of the curve will be specified by (x_1, y_1) and the endpoint specified by (x_4, y_4) . The line segment from (x_1, y_1) to (x_2, y_2) forms a tangent to the curve. The line segment from (x_3, y_3) to (x_4, y_4) also forms a tangent to the curve. If you look at an illustration of a Bezier curve, you will see that the curve is entirely contained within the convex figure with its vertices at the control points.

Example:

```
<template>
  <pageTemplate id="main">
    <pageGraphics>
      <curves>
        198 560
        198 280
        396 280
        396 560
```

```
</curves>
</pageGraphics>
<frame id="first" x1="0.5in" y1="0.5in" width="20cm" height="28cm"/>
</pageTemplate>
</template>
```

10.2. paths

To connect lines and curves you need to use the `<path>` tag. This allows you to make complex figures.

Like the other graphics in RML, `<path>` lives in the `<pageGraphics>` section at the start of the document.

Initially, you must give a `<path>` tag `x` and `y` attributes to tell it the co-ordinates for the point where this path is going to start. You may also at the same time give it attributes called `stroke` and `fill` (which do the same as their counterparts for the basic shapes such as `rect` and `circle`), and an additional one called `close`. If the `close` attribute is set to "yes" or "1", then once the `path` is completed, the `stroke` is finished off by painting a line from the last point given to the first point, enclosing the figure.

The `<path>` tag has its paired `</path>` tag. Between these two tags, you can have a number of things.

- You can have a list of pairs of X-Y co-ordinates.
If this is the case, a straight line is drawn to each point in turn.
- You can have a paired `<moveto></moveto>` tag.
If this is the case, you need to give an x-y co-ordinate pair between these two tags. The "pen" or "brush" then moves to this point, and any further points or instructions given after this (while still inside the `<path>` tag) continue onwards from this new point.
- You can have a paired `<curvesto></curvesto>` tag.
This is similar to both the `<curves>` tag and the `<moveto>` tag discussed above. Inside the pair of `<curvesto>` tags, you need to give rml2pdf sets of 3 pairs of X-Y co-ordinates at a time. Like `<curves>`, `<curvesto>` creates a Bezier curve. However, since it is inside a `path` object, it already knows one of the points - the start point is assumed to be the last point in the path before the `<curvesto>` tag. In other words, the "pen" or "brush" is already in a position, and this is taken as the first point for your Bezier curve.

Here is an example of how a `<path>` looks in action:

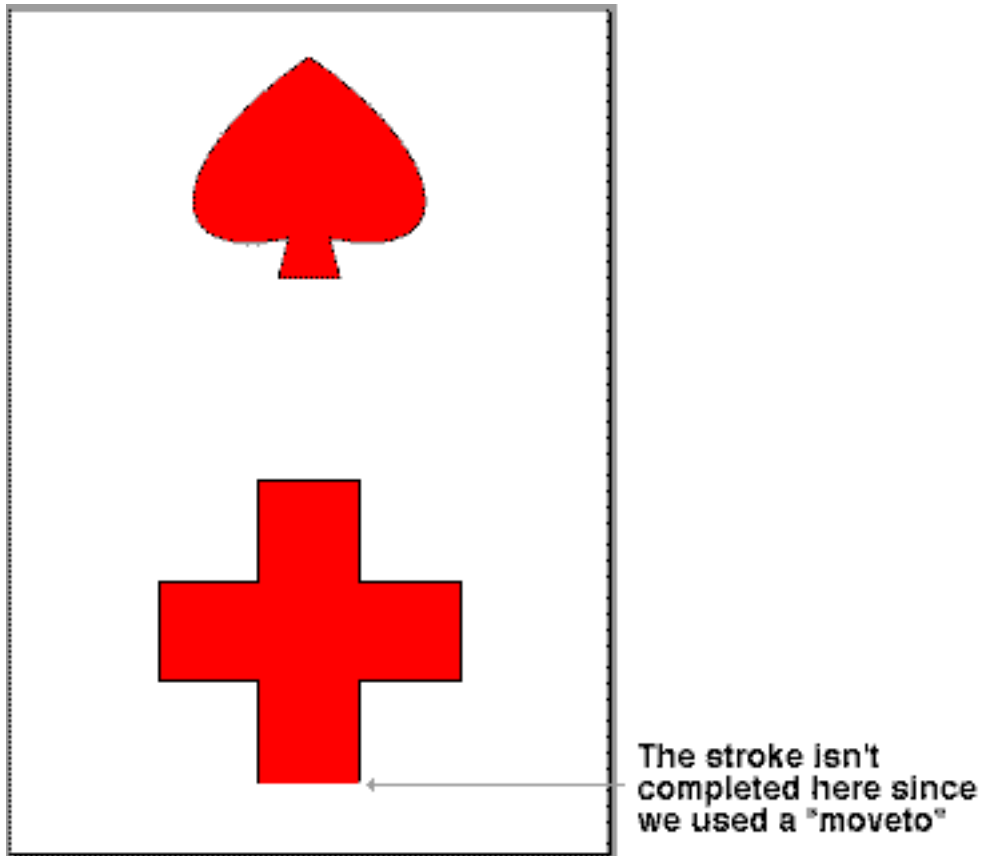


Figure 12: The output from EXAMPLE 7

EXAMPLE 7a

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_7a.pdf">

  <template>
    <pageTemplate id="main">
      <pageGraphics>
        <fill color="red"/>
        <stroke color="black"/>
        <path x="247" y="72" fill="yes" stroke="yes" close="yes">
          247 172
          147 172
          147 272
          247 272
          247 372
          347 372
          347 272
          247 272
          247 172
          347 72
        <!-- This completes the first shape: a red cross.-->
        <moveto>267 572</moveto>
        <!-- This moves the "pen position" -->
```

```

        <!-- Notice that because we have used a "moveto", the      -->
        <!-- final line at the base of the cross is not completed, even -->
        <!-- though the "close" attribute of the "path" tag is set to  -->
        <!-- "yes"                                                    -->
        277 612
        <!-- this acts as the start point for the Bezier curves below -->

        <curvesto>
            147 585
            147 687
            297 792

            447 687 447 585 317 612
        </curvesto>
        327 572
        <!-- We don't need to give the last point because close is -->
        <!-- set to "yes"                                           -->
    </path>
</pageGraphics>
<frame id="first" x1="72" y1="72" width="451" height="698"/>
</pageTemplate>
</template>

<stylesheet>
</stylesheet>

<story>
    <para></para>
</story>

</document>

```

This example has used the 'template/stylesheet/story' form of document. But the story is empty, and we haven't used the stylesheet at all. The following example shows how we can use the 'pageDrawing' form.

EXAMPLE 7b

```

<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_7b.pdf">

    <stylesheet>
    </stylesheet>

    <pageDrawing>
        <fill color="red"/>
        <stroke color="black"/>
        <path x="247" y="72" fill="yes" stroke="yes" close="yes">
            247 172
            147 172
            147 272
            247 272
            247 372
            347 372
            347 272
            347 172
        </path>
    </pageDrawing>
</document>

```

```

447 272
447 172
347 172
347 72
<moveto>267 572</moveto>
277 612
<curvesto>
  147 585 147 687 297 792
  447 687 447 585 317 612
</curvesto>
327 572
</path>
</pageDrawing>

</document>

```

10.3. grids

The `<grid>` is a graphics tag, and hence lives in the `PageGraphics` section of your RML document. It produces a grid of lines. It takes two arguments - `xs` which is a list of x co-ordinates (separated by commas), and `ys` which is a comma-separated list of y co-ordinates.

Example:

```
<grid xs="1cm,2cm,3cm,4cm,5cm,10cm" ys="1cm,2cm,3cm,4cm,5cm,10cm"/>
```

10.4. Translations

In a graphic operation (i.e. a `pageGraphic` or an illustration), `<translate>` moves the origin of the drawing.

`<translate>` takes two optional attributes: `dx` and `dy`. Both can be given in any unit that RML understands. `dx` is the distance that the to be moved in the X axis, and `dy` is the distance it is to be moved in the Y axis. They are optional to allow you to only give one of the pair - so moving the origin in only one direction.

Examples:

```

<translate dx="55" dy="91"/>
<translate dx="1in"/>
<translate dy="6.5cm"/>

```

This is what a translation with a `dx` of 50 and a `dy` of 50 looks like:

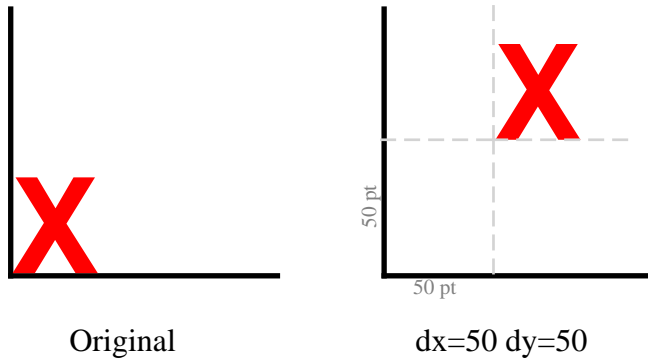


Figure 13: An example of the `<translate>` tag in use

And this is slightly simplified version of the relevant bit of RML:

```
<illustration>
  <lines>
    16 40 116 40
    16 40 16 140

    156 40 256 40
    156 40 156 140
  </lines>
  <setFont name="Times-Roman" size="12"/>
  <fill color="black"/>
  <drawCentredString x="58" y="12">Original</drawCentredString>

  <setFont name="Helvetica-Bold" size="50"/>
  <fill color="red"/>
  <drawString x="16" y="41">X</drawString>
  <translate dx="142"/>

  <setFont name="Times-Roman" size="8"/>
  <fill color="lightgray"/>
  <drawCentredString x="58" y="18">50 pt</drawCentredString>

  <setFont name="Times-Roman" size="12"/>
  <fill color="black"/>
  <drawCentredString x="58" y="12">dx=50 dy=50</drawCentredString>
  <!-- This is relative to the origin of the black lines in the illustration,
        which is why it doesn't match the actual translate performed:
        it is what the translate would be if the origin was at 15,40 -->

  <setFont name="Helvetica-Bold" size="50"/>
  <fill color="red"/>
  <translate dx="55" dy="91"/>
  <drawString x="0" y="0">X</drawString>

</illustration>
```

10.5. scaling

`<scale>`, as its name suggests, allows you to stretch or shrink a graphic.

The `<scale>` tag takes two optional attributes: `sx` and `sy`. `sx` is how much to scale the X axis, and `sy` is how much to scale the Y axis. The scaling does not have to be proportional - omitting one allows you to change the scaling in one direction only. And you can shrink the shape as well as scale it up - an `sx` or `sy` of "2" doubles the size of it, but an `sx` or `sy` of "0.5" halves it.

Scale factors can also be negative. Using an `sx` of -1 and an `sy` of 1 produces a mirror image.

Examples:

```
<scale sx="2" sy="0.25"/>
<scale sx="2"/>
<scale sy="0.5"/>
```

This is what a scale with a `sx` of 2 and an `sy` of 2 looks like:

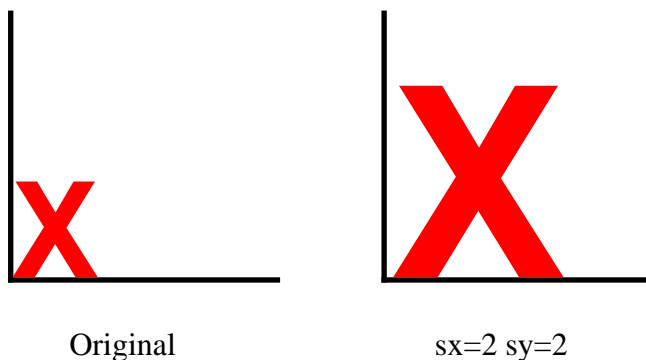


Figure 14: An example of the `<scale>` tag in use

10.6. rotations

The `<rotate>` tag allows allows you to rotate a graphic.

`<rotate>` takes one mandatory attributes called `degrees`, which is the number of degrees to rotate the object. A positive number for `degrees` rotates it *anti-clockwise*, a negative number rotates it clockwise.

When using `<rotate>`, objects are rotated around the *current origin*. If you want to rotate a specific element of a `pageGraphic` or `illustration`, you will have to use a `translate` to move the origin before you do the rotate.

If you `translate` to the middle of the page, rotate by 90 degrees and then draw the string "hello", the "hello" will appear starting in the middle of the page going upwards.

Examples:

```
<rotate degrees="90"/> <!-- ANTI-clockwise -->
<rotate degrees="-90"/> <!-- clockwise -->
```

This is what a `<rotate>` looks like with `degrees` set to 45 and -45:

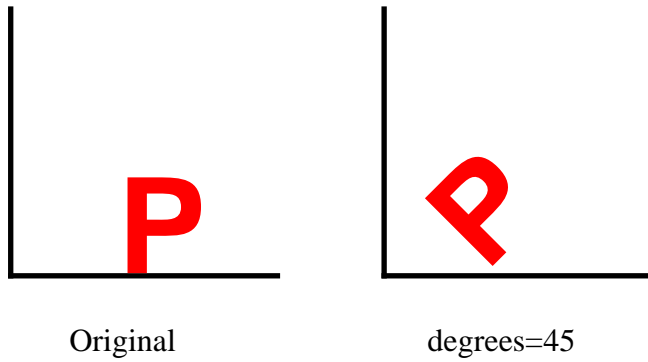


Figure 15: A rotate with a positive value for degrees.

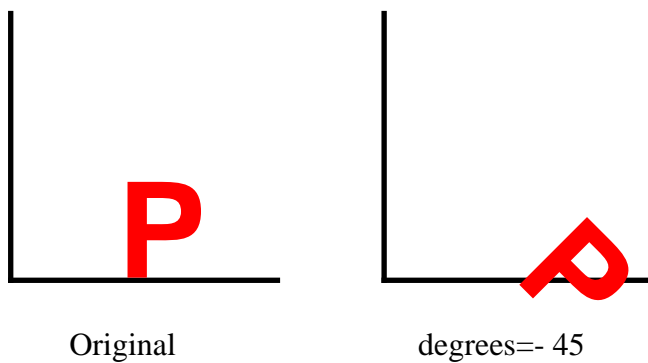


Figure 16: A rotate with a negative value for degrees.

10.7. Skew

`<skew>` is a transform which distorts both axes of a graphic. It is non-orthogonal - in other words, it is a transformation that does not preserve right angles.

`<skew>` has two mandatory attributes: `alpha` and `beta`. Both are angles - look at the example below to see how they work.

Example:

```
<skew alpha="10" beta="10"/>
```

This is what a skew with an `alpha` of 10 and a `beta` of 30 looks like:

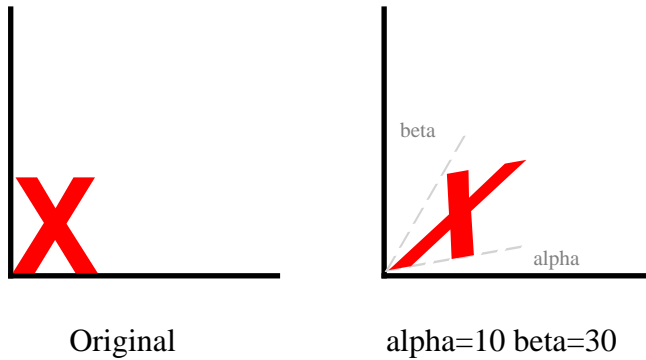


Figure 17: An example of the `<skew>` tag in use.

10.8. Generic affine transforms

A transform allows the coordinate space to be filtered through a general two dimensional affine transform. All the other coordinate transformations can be defined in terms of a transform. A transform requires 6 numbers a , b , c , d , e , and f to define the transformation.

$$x' = ax + cy + e$$

$$y' = bx + dy + f$$

For example to specify $a=1$, $b=1.2$, $c=1.3$, $d=1.4$, $e=1.5$ and $f=1.6$ write

```
<transform>1 1.2 1.3 1.4 1.5 1.6</transform>
```

[NOTE: All the examples from this section are gathered together in the file `example_8.rml`].

10.9. About scale, rotate, and skew

- It is very easy to move objects "off the page". If you are doing a `<translate>` as a `<pageGraphic>`, it is possible to put the origin off the visible area of the page. If you are doing a `<translate>` in an `<illustration>`, no checks are performed about whether an object is inside the limits of the `<illustration>` or not, so it is still possible to put it outside the limits of the page and lose it. If you expect to see a diagram and all you get is a blank page, this is the most common cause.
- Scaling has its own version of the same problem. It is possible to `<scale>` an object so that most or all of it is off the page, but it is also possible to `<scale>` something to such a small size that it "shrinks to nothing". Be especially careful when doing scaling with large factors. Something that may have been a small error without the scaling may put your object off the page entirely once you have performed the `<scale>`.
- The scaling operation scales everything - including line widths. If you are taking a huge diagram and scaling it down, the lines may be scaled out of existence. Conversely, if you take something microscopic and enlarge it, you may end up just getting a blob due to the width of the lines being scaled up as well.
- Another thing to remember is that these transformations are *incremental* - in a series of transforms, each one will modify the output of the one before it. So the order you carry the operations out in is very important. The result of the sequence "translate, rotate, scale" is very different to that of "scale, rotate, translate".

- If performing multiple operations, use the order "translate -> rotate -> scale or skew" whenever possible. Using a different order may result in the axes being distorted or other results that lead to an ugly output that isn't what you were trying to do.

10.10. Bitmapped images

RML also allows you to insert pre-existing images into your PDF files. If you have a graphic file in either the .gif or .jpg format, you can use the `<image>` tag to insert it into your document.

The `<image>` tag goes in the `<pageGraphics>` section at the head of your RML document. It has 5 attributes, 3 of which are mandatory and two of which are optional. The `file` attribute tells rml2pdf the name of the input file that you want to incorporate into your document, the `x` and `y` attributes give the co-ordinates for the bottom left hand corner of where the image will be placed on the page. The optional `width` and `height` attributes allow you to specify how big it should be on the page - this means that you can over-ride the normal size of the file and display it at any size that is appropriate. (The `x`, `y`, `width` and `height` attributes can all be gives in points, mm, cm or inches).

Be very careful when using the `width` and `height` attributes. If misused, these attributes can lead to you having a distorted, ugly and out of proportion picture in your final document. Whenever possible, you should use a paint application (e.g. Paintshop Pro, Photoshop, Graphics Converter, GIMP) to save the file at the correct size, and use the correct `height` and `width` attributes to the `<image>` tag. Using larger files and re-sizing inside RML will also lead to the output PDF file being bloated and larger than it needs to be.

This example shows how these tags look in action:

```
<pageGraphics>
  <image file="myFile.gif" x="72" y="72"/>
  <image file="myFile.gif" x="369" y="72" width="80" height="80"/>
  <image file="myFile2.jpg" x="72" y="493"/>
  <image file="myFile2.jpg" x="369" y="493" width="80" height="80"/>
</pageGraphics>
```

10.11. Text Fields

To allow the creation of forms we have a graphics tag that allows us to specify that the page should display an entry box.

The `<textField>` tag goes in the `<pageGraphics>` section at the at the start of the RML document. It has the following optional attributes: `id` (the field name), `value` (the field initial value), `x` (the field x coordinate), `y` (the field y coordinate), `width` (the field width), `height` (the field height), `maxlen` (maximum allowed number of field characters) & `multiline` (whether the field may contain more than one line).

As a convenience the attributes may instead be specified using `<param>` tags within the body of the `<textField>` tag. The `name` attribute of the `<param>` tag should be one of the above attribute names. If no `value` attribute or `<param>` is seen then the contents of the `<textField>` becomes the initial value of the field.

It is an error to define an attribute more than once

10.12. place and illustration

place

We have seen how graphics and flowables do not mix in RML. The only exceptions to this are the `<place>` tag, and the `<illustration>` tag. `<place>` allows you to put a flowable inside a `pageGraphic` or `illustration`. You can include a paragraph inside a `grid`, or a table inside a `path`.

`<place>` takes 4 attributes, all of which are required. `x`, and `y` are the x and y co-ordinates for where you want the flowable placed. `width` and `height` are the width and height of the flowable.

Example:

```
<pageGraphics>
  <place x="10.5cm" y="10.5cm" width="9cm" height="9cm">
    <para>Your flowables would go here.</para>
  </place>
</pageGraphics>
```

illustration

You can think of an `<illustration>` as like one of the illustrations in a book. It is a "box" of space on the page which can contain any of the graphics that you would normally expect to find in a `<pageGraphics>` tag. The position of this box depends purely on its place in the story, which means that it can appear anywhere on the page depending on the paragraphs and other flowables around it. This is in contrast to the `pageGraphics` which are always placed in a specific place (measured from the origin).

Example:

```
<illustration width="90" height="90">
  <fill color="red"/>
  <circle x="45" y="45" radius="30" fill="yes"/>
  <setFont name="Times-Roman" size="8"/>
  <drawString x="0" y="0">
    Any graphics could go here.
  </drawString>
</illustration>
```

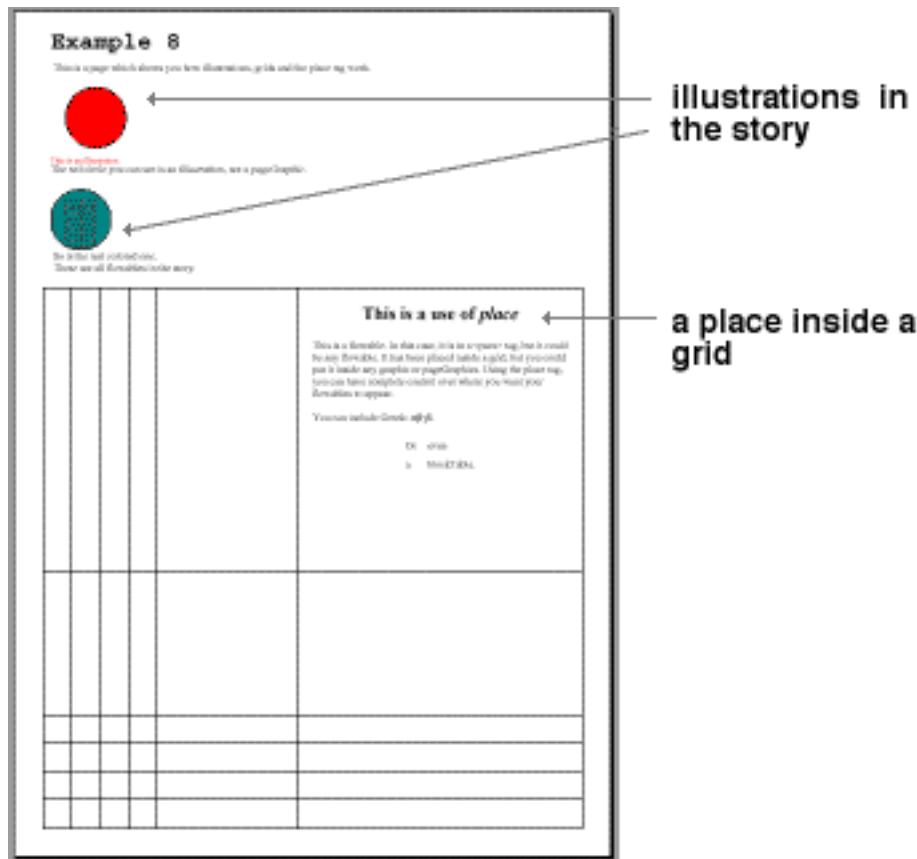


Figure 18: Output from EXAMPLE 9

Notice the symmetry: the `<place>` tag lets you use flowables within a `<pageGraphic>`; the `<illustration>` tag lets you do graphics operations in a box within the flow of the `<story>` (or any story-like context such as a table cell).

The following example shows the use of both `place` and `illustration`:

EXAMPLE 9

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_9.pdf">

  <template>
    <pageTemplate id="main">
      <pageGraphics>
        <grid xs="1cm,2cm,3cm,4cm,5cm,10cm,20cm" ys="1cm,2cm,3cm,4cm,5cm,10cm,20cm" />
        <place x="10.5cm" y="10.5cm" width="9cm" height="9cm">
          <title>This is a use of <i>place</i></title>
          <spacer length="15" />
          <para>
            This is a flowable. In this case, it is in a &lt;para&gt;
            tag, but it could be any flowable. It has been placed
            inside a grid, but you could put it inside any graphic or
            pageGraphics. Using the place tag, you can have complete
            control over where you want your flowables to appear.
          </para>
          <spacer length="12" />
        </place>
      </pageGraphics>
    </pageTemplate>
  </template>
</document>
```

```

        <para>
            You can include Greek: <greek>abgd</greek>.
        </para>
        <spacer length="12"/>
        <blockTable>
            <tr>
                <td>Or</td><td>even</td>
            </tr>
            <tr>
                <td>a</td><td>blockTable.</td>
            </tr>
        </blockTable>
        </place>
    </pageGraphics>
    <frame id="first" x1="72" y1="72" width="451" height="698"/>
</pageTemplate>
</template>

<stylesheet>
    <paraStyle name="style.Title"
        fontName="Courier-Bold"
        fontSize="24"
        leading="36"
    />
</stylesheet>

<!-- The story starts below this comment -->

<story>
    <title>Example 9</title>
    <para>
        This is a page which shows you how illustrations, grids and the place tag work.
    </para>
    <illustration width="90" height="90">
        <fill color="red"/>
        <circle x="45" y="45" radius="30" fill="yes"/>
        <setFont name="Times-Roman" size="8"/>
        <drawString x="0" y="0">This is an illustration</drawString>
    </illustration>
    <para>
        The red circle you can see is an <i>illustration</i>, not a <i>pageGraphic</i>.
    </para>
    <illustration width="75" height="75">
        <fill color="teal"/>
        <circle x="30" y="30" radius="30" fill="yes"/>
        <stroke color="darkslategray"/>
        <grid xs="15,30,45" ys="5,10,15,20,25,30,35,40,45,50"/>
    </illustration>
    <para>
        So is the teal colored one.
    </para>
    <para>
        These are all flowables in the story.
    </para>

</story>

</document>

```

10.13. *spacer*

`<spacer>` is another tag which does just what the name suggests. A `<spacer>` inserts an empty element into the page to force other elements downwards or sideways. The `spacer` tag has two attributes - `length` is mandatory and refers to the length down the page, and `width` is optional.

Example:

To produce a spacer 15 points in height and one inch wide, you could do the following:

```
<spacer length="15" width="72"/>
```

10.14. *Form and doForm*

A `<form>` is a group of graphical operations, stored together and given a name. This allows you to group complex graphics together and to re-use them in more than one place with ease. To do this, you would use the `doForm` tag.

Your form would appear in the `pageGraphics` section of your RML document (inside the `pageTemplate`). `<doForm>` also appears in the `pageGraphics` section.

The `<form>` tag has one attribute - a mandatory one called `name` which identifies the form.

The `<doForm>` tag executes the sequence of graphical operations defined with a `<form>` tag. It also has only one mandatory attribute called `name`.

Example:

```
<pageGraphics>
  <form name="myForm">
    <drawString x="0" y="24">
      Your graphic operations would go here.
    </drawString>
    <drawString x="0" y="12">
      There would probably be a lot of them to make up something useful.
    </drawString>
  </form>
  <doForm name="myForm"/>
</pageGraphics>
```

10.15. *Why use forms?*

Why use `forms` when you can just cut and paste big chunks of text inside your RML document with your favorite text editor or word processor?

The benefits are dramatically cut file sizes, reduced production time and apparently even speeding things up on the printer. If you are going to be using PDF files in any situation where people will be downloading them, massively reduced file sizes will be appreciated by your users. These advantages become even more obvious with multiple similar documents. If you are dealing with a run of 5000 repetitive forms - perhaps payslips or single-page invoices - you only need to store the backdrop once and simply draw the changing text on each page.

forms should be used whenever you have a graphic that is used repeatedly. It may be something as small as your company logo or some sort of symbol you want to flag interesting bits of text with, or something as large as a whole page backdrop. As long as you use it repeatedly, it's worth using a form to do it.

forms don't even have to be created in RML. You can use another application (such as Adobe Illustrator or Word) and distil the output to PDF. You can then use our PageCatcher product to generate the forms, which can then be used from RML.

Look on our web site for more information on PageCatcher: <http://www.reportlab.com/pageCatcher/index.html>

11. Conditional Formatting

11.1. Introduction

WARNING - this is an advanced topic, intended for programmers trying to deal with difficult layout cases. The tags documented here have the potential to cause hard-to-understand exceptions if not used correctly!

Conditional formatting allows you to include expressions in your RML text which are evaluated or executed when the pdf is actually being built. This means that you can vary the content of your document depending on conditions (such as where you are on the page) which you do not know in advance.

For instance, you may be including dynamic content in your document which is likely to be of variable length. You could use the value of one of the document's internal formatting variables to include or exclude certain content, based on the remaining height of a page or the current page number. One common use is in the case of creating documents for printing: these could be 'padded out' with optional content, to make sure that they are always a 4-page spread. Another useful application would be deciding whether there is space to include a large image or diagram in the present location.

A working example using all of these tags can be found in `rlextra/rml2pdf/test/test_039_doc_programming.rml`.

Basic programming primitives (assignment, loop, if, while etc.) have been made available as tags. These can be given expressions which can use your own variables, as well as built-in ones available during rendering. All expressions must be valid python literal expressions.

The following internal variables are available to use as conditions:

`availableWidth` and `availableHeight` give you the remaining height and width of the current frame.

`doc.frame.id` returns the id of the current frame

`doc.pageTemplate.id` returns the id of the current page template

`doc.page` returns the current page number.

11.2. Tags

The `<docIf>`, `<docElse>` and `<docWhile>` tags allow you to control which content is included and excluded - while, or if, a condition is true or false.

The `<docPara>` tag allows you to include the value of an expression in the output text. This is useful for debugging document layouts (e.g. temporarily inserting paragraphs like "you are [3] inches down the [left] frame of the [chapter_first_page] template on page [19]"), but you can also use it to display facts you stored earlier. The value can be formatted using Python format strings - see the test case above for details.

`<docAssign>` assigns a value to a variable, and `<docExec>` executes a statement or expression.

The `<docAssert>` tag allows you to test an expression and raise an exception if it is not true. This can be a useful quality assurance technique. As with the `docPara` example for debugging, you can include assertions like "I should now be at the top of page 3" or "I should now be in the footer frame".

11.3. Operators

When using `docIf` or `docWhile` tags, you can use the following operators to evaluate your conditions:

`= < <= > => %`

However, bear in mind that the 'greater than' and 'less than' operators must be written in RML as `>` and `<`;

11.4. Examples

Some sample code demonstrating several of the conditional formatting tags:

```
<docAssign var='i' expr="3"/>
<docIf cond='i&gt;2'>
  <para style="normal">The value of i is greater than 2</para>
</docIf>
<docWhile cond='i'>
  <docPara expr='i' format='The value of i is %(__expr__)d' />
  <docExec stmt='i-=1' />
</docWhile>
```

results in the output:

```
The value of i is greater than 2
The value of i is 3
The value of i is 2
The value of i is 1
```

As an example of a practical use of conditional formatting, supposing you wanted all your documents to be a certain number of pages. You could use the value of `doc.page` to decide whether to include or exclude an external 'filler' pdf in your output, and so pad the size of your document:

```
<docIf cond="doc.page == 3">
  <includePdfPages filename="fillerpage.pdf" pages="1" leadingFrame="yes" />
</docIf>
```

11.5. Reference

Conditional formatting is implemented with the following tags:

```
<docAssign var='' expr=''>
  assigns the value of 'expr' to 'var', eg to make i=3: <docAssign var='i' expr='3' />
<docExec stmt=''>
  executes the statement 'stmt', eg to subtract 1 from the value of i: <docExec stmt='i-=1' />
```

```
<docPara expr='' format='' style=''>
  creates a paragraph containing the value of 'expr'.
```

'format' is an optional attribute which can contain the value of 'expr' using the Python string formatting conventions, eg `"%(__expr__)s"`.

The 'style' attribute is optional.

eg: `<docPara expr='i' format='The value of i is %(__expr__)d' style="style.txt" />`

So if `i=2`, this results in the text "The value of i is 2"

```
<docAssert cond='' format=''>
  raises an error containing the value of 'format' if 'cond' is false, eg:
  eg: <docAssert cond='val', format="val is false" />
```

```
<docWhile cond=''>
<docIf cond=''>
```

`<docElse>`

these tags allow flow control while or if the 'cond' attribute evaluates to true. See the example above.

12. Printing

This chapter covers things you will need to know when creating documents for professional printing. Many development projects start off targeting an electronic document, which users will either keep on disk, or print out on an office or home printer. Once you start targeting professional printing presses, things get more complicated. We have tried to write this in a manner accessible to developers with little prior knowledge of print; apologies to professional printers for anything we have 'glossed over' too lightly! The topics covered in this chapter are...

Crop Marks

Bleed

CMYK colours

Overprint/knockout control

Colour separations

Pagination

12.1. Crop Marks

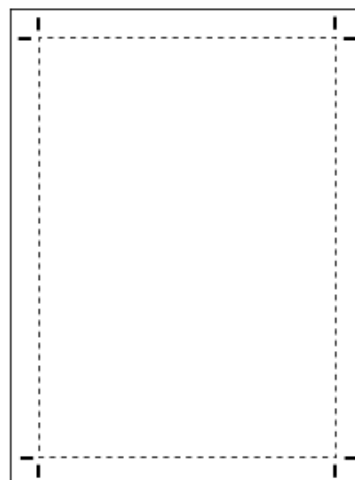
The first difference is the size of the page. Let's say you are in Europe or Asia and have been creating A4 electronic documents from a web site using ReportLab. You then need to produce a different version of the same document for professional printing. The printer wants to be given a slightly larger document, with lines pointing at the corners of the A4 area. They will often be printing on a much larger sheet or roll of paper, and cutting it afterwards.

To automatically create crop marks, use the 'useCropMarks' attribute of the `<docinit>` tag. This will enlarge the underlying page and draw the needed marks.

```
<docinit useCropMarks="1"/>
```

The intent is that it's reasonable easy now to have a single template which generates print and web versions of the same document, wrapping an `<{if}>` statement around the extra attribute in your favourite templating system, without needing to recalculate all the frame and graphics positions for every element on the page.

There is also a separate `<cropMarks>` tag which you can use within the `<docinit>` tag, if you wish to modify the page size increase, colour, length, dash pattern and so on for the crop marks; however, we've found the defaults to work fine.

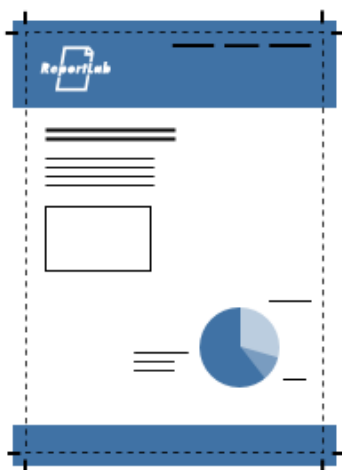


12.2. Bleed

Following on from the above, remember that printers often cut the paper to size. In addition, if they are creating a booklet, they sometimes have to allow for the thickness of inner pages, so they need a little flexibility in where to make the cut. If you have a design with solid colour 'straight to the edge' of the page, cutting can sometimes leave a very fine white line where the colour runs out. Therefore, when a designer wants an area of colour to go 'straight to the edge', they work on a slightly larger page size, and allow the colour to overflow or 'bleed out'. In general printers often ask for at least 3mm of bleed, or about 8 points. So, if you needed to draw a blue background on an A4 sized page (595x842 points), you would be well advised to draw the rectangle from $x=-10$ to $x=+605$ - ten points bigger than needed. This will be completely invisible to an end user in a document created for the web; but when you turn on crop marks and the page is enlarged, it will be visible.

There are no features in RML to automatically detect areas of colour near the edge of the page and 'add bleed'; it's your job to do it.

This also applies to bitmap images. If an image runs to the edge of the page, it needs to be sized to very slightly overflow so that it can be cut without risking a white edge.



12.3. CMYK Colours

For professional presses, colours need to be specified either as CMYK, or as 'spot colours' such as those in the Pantone Color Matching System. The CMYK process is a method of printing colour by using four inks - cyan, magenta, yellow, and black. White is the absence of any colour. The Pantone system is a popular 'spot colour' system which describes a set of completely standardized colours, allowing different manufacturers in different locations to ensure that their colours match.

The majority of printed material is produced using the CMYK process. Many Pantone colours have good, well-known CMYK equivalents.

RML allows you to specify colours as CMYK or by spot name, and also provides a mechanism for ensuring that your document sticks to a particular set of colour definition types.

Starting in ReportLab 2.5, a `colorSpace` attribute can be defined in the `<document>` tag. This is a declaration of your intent, and it lets us carry out some useful checks on your behalf. It will raise an error if you accidentally use a colour that is not allowed in your `colorSpace`. Then, to declare a CMYK colour, use the `<color>` tag, within the `<docinit>` section at the top:

```
<document filename="test_045_separations.pdf" invariant="1" colorSpace="CMYK">
<docinit>
  <color id="BLUE" CMYK="[1,0.67,0,0.23]"/>
  <color id="CYAN" CMYK="[1,0,0,0]"/>
```

```
</docinit>
```

Note that each colour component ranges from 0 to 1, not 0 to 100; you can use any floating point number in between. Designers tend to think in terms of 0-100, but we have chosen to follow the PDF specification.

The 'id' is a string you specify. You will then be able to refer to these colours by name elsewhere in a document - for example, you can then set a table cell background or paragraph style to be "BLUE".

The colorSpace attribute is particularly important when dealing with blacks. Many objects in our framework have a default colour of black, and this is an RGB black 'under the hood'. If you set the colorSpace, our framework will 'auto-convert' blacks for you; thus if a table's gridlines or a chart axis is normally drawn in black or a shade of grey (implemented originally as RGB), it will be autoconverted to CMYK black or grey. Many printing presses are able to handle RGB and autoconvert blacks these days, but printers will appreciate it if the PDFs are pure CMYK as it won't raise alarms in their proofing tools.

12.4. Images in CMYK documents

Most bitmap images use an RGB colour model. We do NOT yet have safeguards to check images that you include in a CMYK document - the colorSpace checks won't warn you. We might add this checking in a future version. If you are working with a limited number of images, the best approach is to use a professional tool like Photoshop to create CMYK versions of those images, and check you are happy with the colours when printed.

Printers can often handle RGB images in a print job, but it's best to check with them first

12.5. Overprint and knockout control

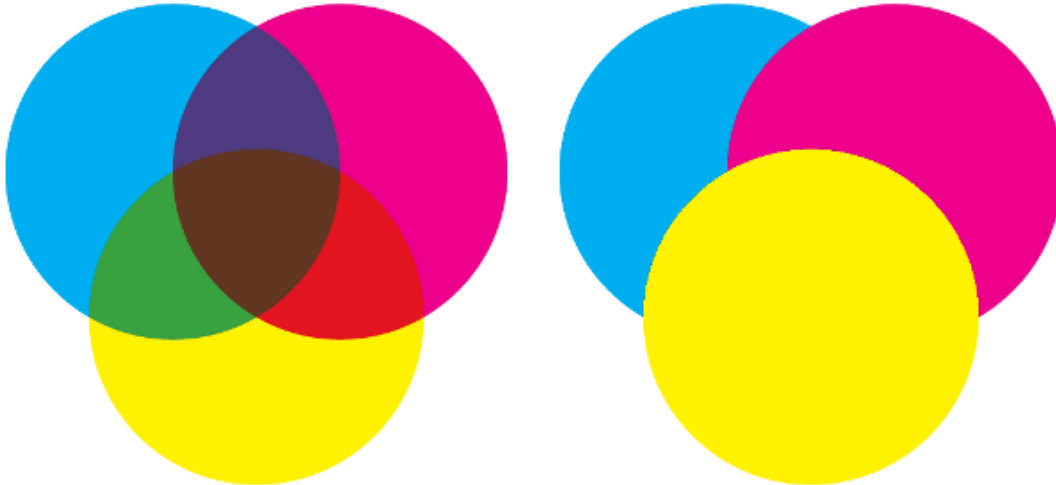
When you create a document with two colours layered on top of one another, there are different ways to combine them. The two alternatives are known as "overprint" and "knockout". Non-primary CMYK colours are, of course, already implemented with a mix of up to four inks. A problem arises when you decide to stack two colours on top of each other. Imagine you have a red and a blue CMYK colour which are each made up of, say, 60% black (the K in CMYK), and you want to draw one on top of the other. Should the software 'merge the colours'? It can't achieve 120% coverage with the black. So, a decision is needed. Either the topmost colour 'knocks out' and replaces anything drawn underneath it, or it 'overprints', allowing the colours to mix, in a manner similar to transparency.

When working with separated colours (see below), the printing mechanics are a little different as each colour is really a bottle of ink; but again, a statement of intent is needed when they overlap - does the top colour replace what's underneath, or allow both to be laid down on the page?

The overprint-versus-knockout choice is rarely used, and works in slightly different ways for CMYK and for separated colours - see the section below. Designers will know when they need it, and the developer merely needs to set a flag.

Some PDF viewing software can simulate this effect on screen (Adobe Reader is one of them); it's necessary to go into the preferences and check a box to see how the document would appear when printed. The default for is usually to for the topmost colour to knock out the colour underneath.

`<overprint mode="overprint">` turns on overprint for the drawing operations that follow. You can then set this property to its original value with `<overprint mode="knockout">` when you want to go back into the default knock-out mode.



The sample first example above shows cyan, magenta and yellow circles overlapping one another, set to overprint and rendered in Acrobat Professional. Without overprint set in the second example, the inks do not mix on top of each other. Instead, the circles on top knock-out the areas that they cover underneath.

12.6. Colour separations

When a PDF document is printed professionally, layers of coloured ink (plates) will be printed one at a time on top of each other, laying down microscopic dots on different angled paths so that more than one colour can be visible. The process colours (CMYK) will normally have a plate each for full-colour printing, but you can define your own spot colour plates to be printed with a specialist "bucket of ink". One common use is for companies to have completely standardised colours in their corporate literature, and to be able to print with just 3 plates instead of the usual 4, which saves money and increases consistency. Another case is using metallic foils or fluorescent paints to enhance areas of your publication, so you might use extra spot colours as well as the CMYK ones. Bear in mind that spot colour inks are usually opaque.

We mentioned above that a `colorSpace` attribute can be defined in the `<document>` tag. There are two more of these "color spaces" which will be useful for those who are going to use spot colours: 'SEP' will only let you use spot colours you define, and 'SEP_CMYK' will let you define spot colours to use along with the normal CMYK process colours.

```
<document filename="test_045_separations.pdf" invariant="1" colorSpace="SEP">
```

If using SEP_CMYK, our framework will again 'auto-convert' blacks for you; thus if a table's gridlines or a chart axis is normally drawn in black or a shade of grey (implemented originally as RGB), it will be autoconverted to CMYK black or grey.

An equivalent CMYK colour value needs to be supplied along with a spot name for each printing plate. The CMYK values are usually just to provide an on screen representation and do not need to be accurate, more important is the spot name which is a string that printers can identify the ink such as 'PANTONE 288 CV' or 'PMS_288'. Your printer may advise you on what spot names to use.

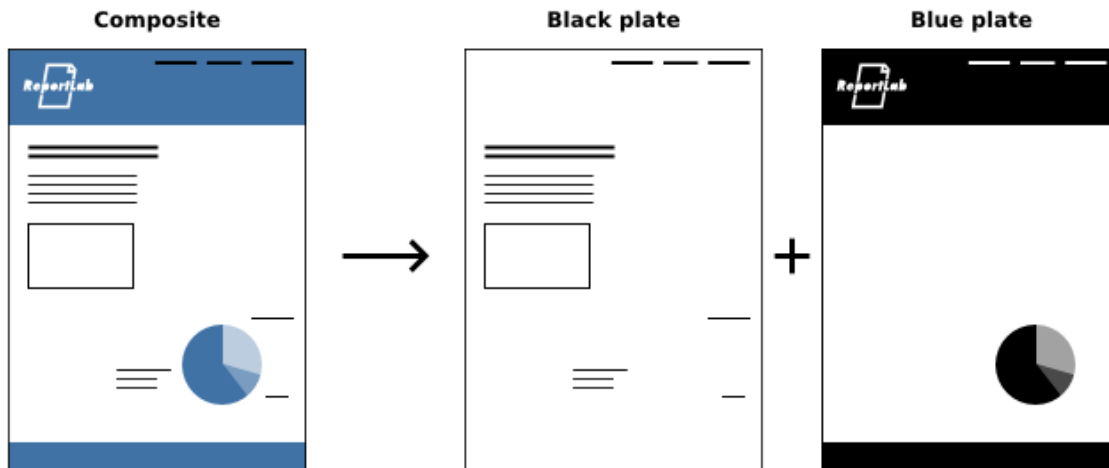
You will need to define your spot colours in the `<docinit>` section of your document. The 'id' is what you will use later in the document to refer to that colour, 'CMYK' allows you to see an approximation of your colour in a PDF reader, 'spotName' is how the printer will identify which ink to use for the plate. There is also an optional 'density' attribute which allows you to print with a thinner (or half-tone) layer of ink. If you set a density lower than 1.0, you don't need to fiddle with the CMYK values for on-screen preview; we do that for you.

```
<document filename="test_045_separations.pdf" invariant="1" colorSpace="SEP">
<docinit>
  <color id="BLACK" CMYK="[0,0,0,1]" />
```

```
<color id="BLUE" CMYK="[1,0.67,0,0.23]" spotName="PANTONE 288 CV"/>
<color id="BLUE75" CMYK="[1,0.67,0,0.23]" spotName="PANTONE 288 CV" density=".75"/>
</docinit>
```

If you have access to Adobe Acrobat Professional or other print pre-flight tool you will be able to preview each of the plates separately and the inks that are used.

The overprint tag is perhaps even more useful when working with spot colours; for example, we have worked with pie charts where the overall document was limited to black and a specific Pantone blue, and the designer was able to create some new tints by stacking the blue and black on top of each other.



12.7. Pagination

A document that is intended to be printed as a bound booklet on a press must always have a page count that is a multiple of four. Even with a different binding technique, documents laid out for print may make use of left and right facing pages which "go together". RML documents with dynamic content will in many cases be of highly variable length, and not guided by the designer's "common sense".

It is possible to use the conditional formatting tags in RML to add extra pages and pad out your document to the required length as necessary. For example, we maintain one solution which has a number of optional half-page and full-page advertisements which can be used to ensure the right pagination occurs. See the 'Conditional Formatting' chapter of this guide for more information on this technique.

12.8. More information

We manage a number of solutions which generate documents for professional printing, and have helped clients achieve some interesting effects, but we have limited space here to discuss all of the techniques used. If you are a commercial customer and are seeking to achieve something not documented here, please contact us and we will be happy to assist further.

Part III - Tables

13. Using tables

13.1. Block tables

If you are familiar with HTML, you will understand the basic tags for use with tables in RML. Just as in HTML, you use a tag to tell rml2pdf that a table is on the way (in this case `<blockTable>`; rather than `<table>`), and another one to end it. Within the `<blockTable>` and `</blockTable>` tags, `<tr>` and `</tr>` enclose the rows (from **Table Row**); and within each table row, `<td>` and `</td>` enclose each individual cell (from **Table Data**).

So, the simplest `blockTable` in RML will look something like this:

```
<blockTable>
  <tr>
    <td>This</td><td>is</td>
  </tr>
  <tr>
    <td>a</td><td>blockTable.</td>
  </tr>
</blockTable>
```

This produces a table that looks like this:

This	is
a	blockTable.

Figure 19: A very simple `blockTable`

In this short example, we are just using plain old vanilla text in the table cells. But we can do more.

`<blocktable>` allows you to use paragraphs and the `<para>` tag. This means that you can use bold, italics, colors, fonts, greek... anything you can use in a paragraph. And you can use multiple paragraphs inside a table cell.

This is a more complex blockTable .	This is a more <i>complex</i> blockTable.
This is a more complex blockTable.	This is α more <i>complex</i> blockTable.

Figure 20: A slightly more complex `blockTable`

The main thing that makes this slightly more complex than a very simple table is the fact that you must give `rowHeights` and `colWidths` to the `<blockTable>` to use `paras`. This makes sense - paragraphs fit into the available space on a page. In a table, they must fit into the available space in that cell. If you haven't defined how high and wide that cell will be, then there is no way for rml2pdf to know how to make it flow in that cell. (If you get an error message saying "Flowables cell can't have auto width", then this is the thing to check - you have probably omitted the `rowHeights` or `colWidths`).

When you are using paragraphs inside a table, you must not put any text outside the `<para>...</para>` tags. The only exception to this rule is whitespace - you can put spaces and tabs outside the `<para>` tag, but

nothing else.

One other thing to be aware of is that if you use a `para` inside a table, it will ignore the text attributes you have used for that table and instead use the attributes for paragraphs. This can be a plus, (since it allows you to use already defined paragraph styles) but can take you by surprise if weren't expecting it.

As an example, here is the RML that generated the above table:

```
<blockTable
  rowHeights="1.25cm,1.25cm"
  colWidths="4cm,4cm"
  >
  <tr>
    <td>
      <para>
        This is a <b>more</b> complex <font color="red">blocktable</font>.
      </para>
    </td>
    <td>
      <para>
        This is a more <i>complex</i> blocktable.
      </para>
    </td>
  </tr>
  <tr>
    <td>
      <para>
        <font face="Helvetica">This is a more complex blockTable.</font>
      </para>
    </td>
    <td>
      <para>
        This is <greek>a</greek> more <font color="blue"><i>complex</i></font>
        blockta<greek>b</greek>le.
      </para>
    </td>
  </tr>
</blockTable>
```

13.2. Block table attributes

This is useful, but there's a lot more to `blockTables` than that! The actual `<blockTable>` tag can have a number of optional attributes:

- *style*
`blockTables` can have a style set in the stylesheet in the same way as paragraphs can. If you have set a style for your `blockTable`, you can refer to it by name with this attribute and apply it to your table. (More details on how to do it appear in the section on the `<blockTableStyle>` tag below).
- *colWidths*
 If you use this attribute, it takes a comma-separated list of the width of each column in your `blockTable`. This allows you to vary the widths to match the width of the content of each column. If you do use it, you should be careful to make sure that there is one width given for *every* column in your table.
- *rowHeights*

As `colWidths` is to columns, `rowHeights` is to rows. It also takes a comma-separated list, in this case for the heights of the rows in your table.

- *repeatRows*

If you have a large table that splits over multiple pages, you may well want certain information appearing on all of them. Column headers are one example of this sort of information. The `repeatRows` attribute allows you to do this.

`repeatRows` takes one single number as an argument. All the rows up to and including this row are repeated as "headers" on each section of the table that appears on a new page.

13.3. Block table styles

`blockTables` are a flowable, so the actual `<blockTable>` tag will appear in the story section of your RML document. You can use the `<blockTableStyle>` tag to set the appearance of your `blockTable`. This appears in the stylesheet section of your document, and can be used for more than one table. You can set up how all the `blockTables` in your document will look in one `blockTableStyle` tag if you want.

The `<blockTableStyle>` tag is a container for a number of other tags, and needs to be paired with a terminal `</blockTableStyle>` tag. This works in the same way as `<stylesheet></stylesheet>`, `<pageGraphics></pageGraphics>`, and other tags of that sort.

For all of the attributes in `blockTableStyle`, they refer to a square or rectangular "block" inside the table. This can be as many or as few cells as you want - not necessarily a single cell. This "block" aspect to the attributes is reflected in their names, and gave the table style its name for consistency. (It was felt that since most of these attributes started with "block...", the table tag should itself be called `blockTable` to keep things simple).

The way the block is described may seem unusual to you if you are not used to programming. The x and y co-ordinates are still given as X,Y (or if you like "Row,Column", rather than the spreadsheet "A1" model), but the numbering starts from 0 rather than 1. This makes the top left-hand cell (0,0). As well as this, the numbers may also be negative. If this is the case, then `rml2pdf` will count *backwards* from the end of the last cell. So (-1,-1) is the bottom right hand cell in a table, (-2,-2) is the one up and to the left of that, and so on.

The tags that `blockTableStyle` can contain are:

- *blockFont*

`blockfont` sets the font to be used in a block of your table.
It has one mandatory attribute: `name`.
It has four optional attributes: `size`, `leading`, `start` and `stop`.

- *blockTextColor*

This sets the color that will be used for the text in a block of your table.
It has one required attribute: `colorName`.
It has two optional attributes: `start` and `stop`.

- *blockLeading*

This sets the leading that will be used for the text in a block of your table.
It has one required attribute: `length`.
It has two optional attributes: `start` and `stop`.

- *blockAlignment*

This sets the alignment of the text in a block of your table.
It has one required attribute: `value`. (This can be `LEFT`, `RIGHT`, `CENTER`, or `CENTRE`).
It has two optional attributes: `start` and `stop`.

- *blockValign*

This sets how the contents of a block of cells in your table are aligned in the vertical direction.
It has one required attribute: `value`. (This can be `TOP`, `MIDDLE`, or `BOTTOM`, and defaults to `BOTTOM`).
It has two optional attributes: `start` and `stop`.

- *blockLeftPadding*
 This sets the padding (i.e. blank space) between the contents of a cell and left-hand edge of the cell (for a block of cells in your table).
 It has one required attribute: `length`.
 It has two optional attributes: `start` and `stop`.
- *blockRightPadding*
 This sets the padding between the contents of a cell and right-hand edge of the cell (for a block of cells in your table).
 It has one required attribute: `length`.
 It has two optional attributes: `start` and `stop`.
- *blockBottomPadding*
 This sets the padding between the contents of a cell and bottom edge of the cell (for a block of cells).
 It has one required attribute: `length`.
 It has two optional attributes: `start` and `stop`.
- *blockTopPadding*
 This sets the padding between the contents of a cell and top edge of the cell (for a block of cells).
 It has one required attribute: `length`.
 It has two optional attributes: `start` and `stop`.
- *blockBackground*
 This sets the color to be used for the background for a block of cells in your table.
 It has one required attribute: `colorName`.
 It has two optional attributes: `start` and `stop`.
- *lineStyle*
 This allows you to use lines to border your table.
 It has two required attributes: `kind` (with the options of `GRID`, `BOX`, `OUTLINE`, `INNERGRID`, `LINEBELOW`, `LINEABOVE`, `LINEBEFORE` and `LINEAFTER`), and `colorName` (which must be the name of a color).
 It has three optional attributes: `thickness`, `start` and `stop`.

13.4. More about block tables

A few final things to be aware of when using tables: in RML, table cells (as contained by the `<td>` and `</td>` tags) can only contain one of two different sets of data. Either a table cell can contain string forms (text and the `<getName>` and `<pageNumber>` tags) *or* it can contain a sequence of flowables (tags such as `<pre>`, `<para>` and the various heading tags). It is *not* possible to mix both of these forms in the same cell (though you can mix them in the same table).

Putting strings into table cells is quicker than using paragraphs. Paragraphs need to work out when to 'wrap' text, strings don't. So you should avoid using paragraphs inside tables unless you really need to (or you don't mind things slowing down).

When you are doing a big database report, wherever possible use separate smaller tables to contain parts of your data rather than one huge table. If you don't use many 'mini-tables' to contain small groups of rows but instead decide to do a big 1,000-row table, you will notice a significant loss of speed in the generation of your output PDF.

This also makes it much easier to design complex grouped reports; for each group header, footer or detail block you can design one table style and keep them all independent of each other.

13.5. Using block table styles

Now that we have seen what the `blockTable`'s attributes are, and seen a summary of `<blockTableStyle>`, here are some examples that show you how they can be used together.

The following few pages show a number of examples of `blockTables`. Each one shows a page with the RML listing, followed by a separate page with the result of that table. Each listing contains comments to point out what each tag involved with the `blockTable` is doing.

1.1 Example 10 - Colors and fonts in tables

This example shows various ways of setting the text color (`blockTextColor`), font (`blockFont`) and background color (`blockBackground`) for regions in a `blockTable`.

Notice the various ways of specifying a region within the table. Also notice the way we have defined heights for the rows and widths for the columns in the `blocktable` tag.

EXAMPLE 10

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "../rml.dtd">
<document filename="example_10.pdf">

  <template>
    <pageTemplate id="main">
      <pageGraphics>

        </pageGraphics>
        <frame id="first" x1="72" y1="72" width="451" height="698"/>
      </pageTemplate>
    </template>

    <stylesheet>
      <blockTableStyle id="myBlockTableStyle">
        <!-- This sets a font for every cell from the start of the -->
        <!-- second row down to the bottom right hand corner -->
        <blockFont name="Courier-Bold" start="0,1" stop="-1,-1"/>
        <!-- This sets a font for the first row -->
        <blockFont name="Helvetica-BoldOblique" size="24" start="0,0" stop="3,0"/>

        <!-- This sets a textColor for all the text in the table -->
        <blockTextColor colorName="black"/>

        <!-- This sets a textColor for the first row -->
        <!-- (Since it comes after the above setting, -->
        <!-- it overrides it for this row) -->
        <blockTextColor colorName="white" start="0,0" stop="3,0"/>

        <!-- This sets a textColor a column - also overriding -->
        <!-- the first textColor setting for this row -->
        <blockTextColor colorName="blue" start="1,1" stop="1,6"/>

        <!-- This sets a background color for the first row -->
        <blockBackground colorName="red" start="0,0" stop="3,0"/>

        <!-- This sets a background color for the rest of the table -->
        <blockBackground colorName="cornsilk" start="0,1" stop="-1,-1"/>

        <!-- This sets a background color for an individual cell -->
        <!-- This has to go AFTER the above blockBackground, -->
        <!-- otherwise it would be overpainted by the cornsilk color -->
        <blockBackground colorName="lightcoral" start="3,3" stop="3,3"/>

      </blockTableStyle>
    </stylesheet>

    <story>
```

```
<title>Example 10 - colors and fonts in tables</title>
<spacer length="1cm"/>

<blockTable style="myBlockTableStyle"
  rowHeights="3.5cm,2cm,2cm,2cm,2cm,2cm,2cm"
  colWidths="4cm,4cm,4cm,4cm">
  <tr>
    <td>Cell 0,0</td><td>Cell 1,0</td><td>Cell 2,0</td><td>Cell 3,0</td>
  </tr>
  <tr>
    <td>Cell 0,1</td><td>Cell 1,1</td><td>Cell 2,1</td><td>Cell 3,1</td>
  </tr>
  <tr>
    <td>Cell 0,2</td><td>Cell 1,2</td><td>Cell 2,2</td><td>Cell 3,2</td>
  </tr>
  <tr>
    <td>Cell 0,3</td><td>Cell 1,3</td><td>Cell 2,3</td><td>Cell 3,3</td>
  </tr>
  <tr>
    <td>Cell 0,4</td><td>Cell 1,4</td><td>Cell 2,4</td><td>Cell 3,4</td>
  </tr>
  <tr>
    <td>Cell 0,5</td><td>Cell 1,5</td><td>Cell 2,5</td><td>Cell 3,5</td>
  </tr>
  <tr>
    <td>Cell 0,6</td><td>Cell 1,6</td><td>Cell 2,6</td><td>Cell 3,6</td>
  </tr>
</blockTable>
</story>

</document>
```

Example 10 - colors and fonts in tables

Cell 0,0	Cell 1,0	Cell 2,0	Cell 3,0
Cell 0,1	Cell 1,1	Cell 2,1	Cell 3,1
Cell 0,2	Cell 1,2	Cell 2,2	Cell 3,2
Cell 0,3	Cell 1,3	Cell 2,3	Cell 3,3
Cell 0,4	Cell 1,4	Cell 2,4	Cell 3,4
Cell 0,5	Cell 1,5	Cell 2,5	Cell 3,5
Cell 0,6	Cell 1,6	Cell 2,6	Cell 3,6

Figure 21: Output table from EXAMPLE 10

1.2 Colors and fonts in table cells

As an alternative to specifying cell properties using block table styles, RML also allows some cell styles to be specified as attributes of the <td> tag.

```
<blockTable colWidths="5cm,5cm" style="myBlockTableStyle1">
  <tr><td>fontName</td><td fontName="Courier">Courier</td></tr>
  <tr><td>fontName</td><td fontName="Helvetica">Helvetica</td></tr>
  <tr><td>fontSize</td><td fontSize="8">8</td></tr>
  <tr><td>fontSize</td><td fontSize="14">14</td></tr>
  <tr><td>fontColor</td><td fontColor="red">red</td></tr>
  <tr><td>fontColor</td><td fontColor="blue">blue</td></tr>
  <tr><td>leading</td><td leading="16">leading
    is
    16</td></tr>
  <tr><td>leading</td><td leading="12">leading
    is
    12</td></tr>
  <tr><td>leftPadding</td><td leftPadding="10">10</td></tr>
  <tr><td>leftPadding</td><td leftPadding="16">16</td></tr>
  <tr><td>rightPadding</td><td rightPadding="10" align="right">10</td></tr>
  <tr><td>rightPadding</td><td rightPadding="24" align="right">24</td></tr>
  <tr><td>topPadding</td><td topPadding="10">10</td></tr>
  <tr><td>topPadding</td><td topPadding="24">24</td></tr>
  <tr><td>bottomPadding</td><td bottomPadding="10">10</td></tr>
  <tr><td>bottomPadding</td><td bottomPadding="24">24</td></tr>
  <tr><td>background</td><td background="pink">pink</td></tr>
  <tr><td>background</td><td background="lightblue">lightblue</td></tr>
  <tr><td>align</td><td align="left">left</td></tr>
  <tr><td>align</td><td align="center">center</td></tr>
  <tr><td>align</td><td align="right">right</td></tr>
  <tr><td>-
    vAlign
    -</td><td vAlign="top">top</td></tr>
  <tr><td>-
    vAlign
    -</td><td vAlign="middle">middle</td></tr>
  <tr><td>-
    vAlign
    -</td><td vAlign="bottom">bottom</td></tr>
</blockTable>
```

produces

fontName	Courier
fontName	Helvetica
fontSize	8
fontSize	14
fontColor	red
fontColor	blue

leading	leading is 16
leading	leading is 12
leftPadding	10
leftPadding	16
rightPadding	10
rightPadding	24
topPadding	10
topPadding	24
bottomPadding	10
bottomPadding	24
background	pink
background	lightblue
align	left
align	center
align	right
- vAlign -	top
- vAlign -	middle
- vAlign -	bottom

Figure 22: Output table from EXAMPLE 10

1.3 Example 11 - lines and alignment in tables

This example shows the various vertical and horizontal alignments you can give text in a table, as well as a few ways to use lines.

EXAMPLE 11

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "../rml.dtd">
<document filename="example_11.pdf">

  <template>
    <pageTemplate id="main">
      <pageGraphics>

      </pageGraphics>
      <frame id="first" x1="72" y1="72" width="451" height="698"/>
    </pageTemplate>
  </template>

  <stylesheet>
    <blockTableStyle id="myBlockTableStyle">
      <!-- Set fonts -->
      <blockFont name="Courier-Bold" size="10" start="0,1" stop="-1,-1"/>
      <blockFont name="Helvetica-BoldOblique" size="10" start="0,0" stop="3,0"/>

      <!-- This sets a textColor for all the text in the table -->
      <blockTextColor colorName="black"/>

      <!-- Another example of blockTextColor -->
      <blockTextColor colorName="green" start="2,2" stop="3,3"/>

      <!-- This sets a blockAlignment for the whole table -->
      <blockAlignment value="CENTER"/>

      <!-- These overrides the above -->
      <blockAlignment value="RIGHT" start="3,0" stop="3,-1"/>
      <blockAlignment value="LEFT" start="0,1" stop="0,-1"/>

      <!-- This sets the vertical alignment for one row -->
      <blockValign value="TOP" start="0,0" stop="-1,0"/>

      <!-- This sets the vertical alignment for one cell -->
      <blockValign value="MIDDLE" start="2,2" stop="2,2"/>

      <!-- Use of linestyles -->
      <lineStyle kind="GRID" colorName="silver"/>
      <lineStyle kind="LINEBELOW" colorName="orangered" start="0,0"
        stop="-1,0" thickness="5"/>
      <lineStyle kind="LINEAFTER" colorName="maroon" start="1,1"
        stop="1,6" thickness="1"/>

    </blockTableStyle>
  </stylesheet>

  <story>
    <title>Example 11 - lines and alignment in tables</title>
    <spacer length="1cm"/>
  </story>
</document>
```

```

<blockTable style="myBlockTableStyle"
    rowHeights="2cm,2cm,2cm,2cm,2cm,2cm,2cm"
    colWidths="4cm,3cm,3cm,4cm"
    >
  <tr>
    <td>(a=LEFT)(VA=TOP)</td>
    <td>(VA=TOP)</td>
    <td>(VA="TOP")</td>
    <td>(a=RIGHT)(VA=TOP)</td>
  </tr>
  <tr>
    <td>(a=LEFT)</td>
    <td>1,1</td>
    <td>Cell 2,1</td>
    <td>(a=RIGHT)</td>
  </tr>
  <tr>
    <td>(a=LEFT)</td>
    <td>1,2</td>
    <td>(VA=MIDDLE)</td>
    <td>(a=RIGHT)</td>
  </tr>
  <tr>
    <td>(a=LEFT)</td>
    <td>1,3</td>
    <td>(VA=MIDDLE)</td>
    <td>(VA=MDL)(a=RIGHT)</td>
  </tr>
  <tr>
    <td>(a=LEFT)</td>
    <td>1,4</td>
    <td>2,4</td>
    <td>(a=RIGHT)</td>
  </tr>
  <tr>
    <td>(a=LEFT)</td>
    <td>1,5</td>
    <td>2,5</td>
    <td>(a=RIGHT)</td>
  </tr>
  <tr>
    <td>(a=LEFT)</td>
    <td>1,6</td>
    <td>2,6</td>
    <td>(a=RIGHT)</td>
  </tr>
</blockTable>

<spacer length="15"/>
<para>a=value for <i>blockAlignment</i></para>
<para>VA=value for <i>blockValign</i></para>
<para><i>MDLE=MIDDLE for VA in cells 3,2 and 3,3</i></para>

</story>

</document>

```

Example 11 - lines and alignment in tables

<i>(a=LEFT)(VA=TOP)</i>	<i>(VA=TOP)</i>	<i>(VA="TOP")</i>	<i>(a=RIGHT)(VA=TOP)</i>
<i>(a=LEFT)</i>	1,1	Cell 2,1	<i>(a=RIGHT)</i>
<i>(a=LEFT)</i>	1,2	<i>(VA=MIDDLE)</i>	<i>(VA=MDL) (a=RIGHT)</i>
<i>(a=LEFT)</i>	1,3	<i>(VA=MIDDLE)</i>	<i>(VA=MDL) (a=RIGHT)</i>
<i>(a=LEFT)</i>	1,4	2,4	<i>(a=RIGHT)</i>
<i>(a=LEFT)</i>	1,5	2,5	<i>(a=RIGHT)</i>
<i>(a=LEFT)</i>	1,6	2,6	<i>(a=RIGHT)</i>

Figure 23: Output table from EXAMPLE 11

a=value for *blockAlignment*

VA=value for *blockValign*

MDLE=*MIDDLE* for *VA* in cells 3,2 and 3,3

1.4 Example 12 - images and padding in tables

This example shows images in a table and the way to use the various padding attributes.

For comparison purposes:

The cells that contain pictures in this table are all 166 pixels in height and 161 pixels in width. Where padding is used, it has a value of 20 pixels horizontally or 40 pixels vertically.

EXAMPLE

```
<?xml version="1.0" encoding="iso-8859-1" standalone="no" ?>
<!DOCTYPE document SYSTEM "rml.dtd">
<document filename="example_12.pdf">

  <template>
    <pageTemplate id="main">
      <pageGraphics>
      </pageGraphics>
      <frame id="first" x1="72" y1="72" width="451" height="698"/>
    </pageTemplate>
  </template>

  <stylesheet>
    <blockTableStyle id="myBlockTableStyle">
      <blockBackground colorName="silver" start="0,0" stop="-1,0"/>
      <blockBackground colorName="darkslategray" start="0,1" stop="-1,1"/>
      <blockBackground colorName="silver" start="0,2" stop="-1,2"/>
      <blockBackground colorName="darkslategray" start="0,3" stop="-1,3"/>
      <blockBackground colorName="silver" start="0,4" stop="-1,4"/>
      <blockBackground colorName="darkslategray" start="0,5" stop="-1,5"/>
      <blockAlignment value="CENTER"/>
      <blockValign value="MIDDLE"/>

      <!-- Set fonts -->
      <blockFont name="Helvetica-BoldOblique" size="10"/>

      <!-- set the left and right padding for cells in first and -->
      <!-- third columns remember, cell numbering starts from ZERO, not ONE -->
      <blockLeftPadding length="20" start="0,0" stop="0,-1"/>
      <blockRightPadding length="20" start="2,0" stop="2,-1"/>

      <!-- set the top and bottom padding for cells in first and third rows -->
      <blockBottomPadding length="40" start="0,0" stop="-1,0"/>
      <blockTopPadding length="40" start="0,2" stop="-1,2"/>

      <!-- set the top and bottom padding for the last row -->
      <blockBottomPadding length="40" start="-1,4" stop="-1,4"/>
      <blockTopPadding length="40" start="0,4" stop="0,4"/>

      <!-- Use of linestyles -->
      <lineStyle kind="GRID" colorName="darkblue"/>

    </blockTableStyle>

    <paraStyle name="paddingTableStyle"
      fontName="Helvetica-BoldOblique"
      fontSize="10"
      textColor="white"
```

```
        alignment="CENTER"
      />
</stylesheet>

<story>
  <title>Example 12 - images and padding in tables</title>
  <spacer length="1cm"/>

  <blockTable style="myBlockTableStyle"
    rowHeights="166,28,166,28,166,28"
    colWidths="161,161,161"
  >
    <tr>
      <td>
        <illustration width="141" height="90">
          <image file="images/replogo.gif"
            x="0" y="0"
            width="141" height="90"/>
          <stroke color="deepskyblue"/>
          <lineMode width="3"/>
          <lines>
            0 0 141 0
            141 0 141 90
            141 90 0 90
            0 90 0 0
          </lines>
        </illustration>
      </td>
      <td>
        <illustration width="141" height="90">
          <image file="images/replogo.gif"
            x="0" y="0"
            width="141" height="90"/>
          <stroke color="deepskyblue"/>
          <lineMode width="3"/>
          <lines>
            0 0 141 0
            141 0 141 90
            141 90 0 90
            0 90 0 0
          </lines>
        </illustration>
      </td>
      <td>
        <illustration width="141" height="90">
          <image file="images/replogo.gif"
            x="0" y="0"
            width="141" height="90"/>
          <stroke color="deepskyblue"/>
          <lineMode width="3"/>
          <lines>
            0 0 141 0
            141 0 141 90
            141 90 0 90
            0 90 0 0
          </lines>
        </illustration>
      </td>
    </tr>
  </blockTable>
</story>
```

```

</tr>
<tr>
  <td>
    <para style="paddingTableStyle">
      <b>blockLeftPadding</b> with <b>blockBottomPadding
    </para>
  </td>
  <td>
    <para style="paddingTableStyle">
      just blockBottomPadding
    </para>
  </td>
  <td>
    <para style="paddingTableStyle">
      <b>blockRightPadding</b> with <b>blockBottomPadding</b>
    </para>
  </td>
</tr>
<tr>
  <td>
    <illustration width="141" height="90">
      <image file="images/replogo.gif"
        x="0" y="0"
        width="141" height="90"/>
      <stroke color="deepskyblue"/>
      <lineMode width="3"/>
      <lines>
        0 0 141 0
        141 0 141 90
        141 90 0 90
        0 90 0 0
      </lines>
    </illustration>
  </td>
  <td>
    <illustration width="141" height="90">
      <image file="images/replogo.gif"
        x="0" y="0"
        width="141" height="90"/>
      <stroke color="deepskyblue"/>
      <lineMode width="3"/>
      <lines>
        0 0 141 0
        141 0 141 90
        141 90 0 90
        0 90 0 0
      </lines>
    </illustration>
  </td>
  <td>
    <illustration width="141" height="90">
      <image file="images/replogo.gif"
        x="0" y="0"
        width="141" height="90"/>
      <stroke color="deepskyblue"/>
      <lineMode width="3"/>
      <lines>
        0 0 141 0

```



```

                141 0 141 90
                141 90 0 90
                0 90 0 0
            </lines>
        </illustration>
    </td>
</tr>
<tr>
    <td>
        <para style="paddingTableStyle">
            <b>blockLeftPadding</b> with <b>blockTopPadding
        </para>
    </td>
</td>
<td>
    <para style="paddingTableStyle">
        just blockTopPadding
    </para>
</td>
<td>
    <para style="paddingTableStyle">
        <b>blockRightPadding</b> with <b>blockTopPadding</b>
    </para>
</td>
</tr>
<tr>
    <td>
        <illustration width="141" height="90">
            <image file="images/replogo.gif"
                x="0" y="0"
                width="141" height="90"/>
            <stroke color="deepskyblue"/>
            <lineMode width="3"/>
            <lines>
                0 0 141 0
                141 0 141 90
                141 90 0 90
                0 90 0 0
            </lines>
        </illustration>
    </td>
    <td>
        <illustration width="141" height="90">
            <image file="images/replogo.gif"
                x="0" y="0"
                width="141" height="90"/>
            <stroke color="deepskyblue"/>
            <lineMode width="3"/>
            <lines>
                0 0 141 0
                141 0 141 90
                141 90 0 90
                0 90 0 0
            </lines>
        </illustration>
    </td>
    <td>
        <illustration width="141" height="90">

```

```
<image file="images/replogo.gif"
      x="0" y="0"
      width="141" height="90"/>
<stroke color="deepskyblue"/>
<lineMode width="3"/>
<lines>
  0 0 141 0
  141 0 141 90
  141 90 0 90
  0 90 0 0
</lines>
</illustration>
</td>
</tr>
<tr>
  <td>
    <para style="paddingTableStyle">
      blockLeftPadding with blockTopPadding
    </para>
  </td>
  <td>
    <para style="paddingTableStyle">
      no padding
    </para>
  </td>
  <td>
    <para style="paddingTableStyle">
      blockRightPadding with blockBottomPadding
    </para>
  </td>
</tr>
</blockTable>

</story>

</document>
```

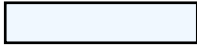











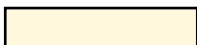












Example 12 - images and padding in tables






























































		
<i>blockLeftPadding with blockBottomPadding</i>	<i>just blockBottomPadding</i>	<i>blockRightPadding with blockBottomPadding</i>
		
<i>blockLeftPadding with blockTopPadding</i>	<i>just blockTopPadding</i>	<i>blockRightPadding with blockTopPadding</i>
		
<i>blockLeftPadding with blockTopPadding</i>	<i>no padding</i>	<i>blockRightPadding with blockBottomPadding</i>




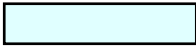


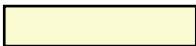








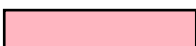

















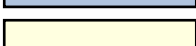




































































Figure 24: Output from EXAMPLE 12













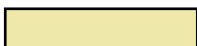


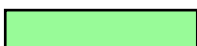


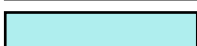





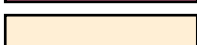













































































Appendix A - Colors recognized by RML

In this table, the "Color" column gives the name of the color, as recognised in the HTML standard and RML. The hexadecimal number in the "Hex Value" column corresponds to the red, green and blue (RGB) components in the color - the first two digits represent red, the next two green and the last two the blue. (The "0x" just shows it's a hexadecimal number).

		 Text 123	aliceblue	Hex: 0xF0F8FF
		 Text 123	antiquewhite	Hex: 0xFAEBD7
		 Text 123	aqua	Hex: 0x00FFFF
		 Text 123	aquamarine	Hex: 0x7FFFD4
		 Text 123	azure	Hex: 0xF0FFFF
		 Text 123	beige	Hex: 0xF5F5DC
		 Text 123	bisque	Hex: 0xFFE4C4
		 Text 123	black	Hex: 0x000000
		 Text 123	blanchedalmond	Hex: 0xFFEBCD
		 Text 123	blue	Hex: 0x0000FF
		 Text 123	blueviolet	Hex: 0x8A2BE2
		 Text 123	brown	Hex: 0xA52A2A
		 Text 123	burlywood	Hex: 0xDEB887
		 Text 123	cadetblue	Hex: 0x5F9EA0
		 Text 123	chartreuse	Hex: 0x7FFF00
		 Text 123	chocolate	Hex: 0xD2691E
		 Text 123	coral	Hex: 0xFF7F50
		 Text 123	cornflower	Hex: 0x6495ED
		 Text 123	cornsilk	Hex: 0xFFFF8DC
		 Text 123	crimson	Hex: 0xDC143C
		 Text 123	cyan	Hex: 0x00FFFF
		 Text 123	darkblue	Hex: 0x00008B
		 Text 123	darkcyan	Hex: 0x008B8B
		 Text 123	darkgoldenrod	Hex: 0xB8860B
		 Text 123	darkgray	Hex: 0xA9A9A9
		 Text 123	darkgreen	Hex: 0x006400
		 Text 123	darkkhaki	Hex: 0xBDB76B
		 Text 123	darkmagenta	Hex: 0x8B008B
		 Text 123	darkolivegreen	Hex: 0x556B2F
		 Text 123	darkorange	Hex: 0xFF8C00
		 Text 123	darkorchid	Hex: 0x9932CC

		 Text 123	darkred	Hex: 0x8B0000
		 Text 123	darksalmon	Hex: 0xE9967A
		 Text 123	darkseagreen	Hex: 0x8FBC8B
		 Text 123	darkslateblue	Hex: 0x483D8B
		 Text 123	darkslategray	Hex: 0x2F4F4F
		 Text 123	darkturquoise	Hex: 0x00CED1
		 Text 123	darkviolet	Hex: 0x9400D3
		 Text 123	deeppink	Hex: 0xFF1493
		 Text 123	deepskyblue	Hex: 0x00BFFF
		 Text 123	dimgray	Hex: 0x696969
		 Text 123	dodgerblue	Hex: 0x1E90FF
		 Text 123	firebrick	Hex: 0xB22222
		 Text 123	floralwhite	Hex: 0xFFFFAF0
		 Text 123	forestgreen	Hex: 0x228B22
		 Text 123	fuchsia	Hex: 0xFF00FF
		 Text 123	gainsboro	Hex: 0xDCDCDC
		 Text 123	ghostwhite	Hex: 0xF8F8FF
		 Text 123	gold	Hex: 0xFFD700
		 Text 123	goldenrod	Hex: 0xDAA520
		 Text 123	gray	Hex: 0x808080
		 Text 123	grey (same as 'gray')	Hex: 0x808080
		 Text 123	green	Hex: 0x008000
		 Text 123	greenyellow	Hex: 0xADFF2F
		 Text 123	honeydew	Hex: 0xF0FFF0
		 Text 123	hotpink	Hex: 0xFF69B4
		 Text 123	indianred	Hex: 0xCD5C5C
		 Text 123	indigo	Hex: 0x4B0082
		 Text 123	ivory	Hex: 0xFFFFF0
		 Text 123	khaki	Hex: 0xF0E68C
		 Text 123	lavender	Hex: 0xE6E6FA
		 Text 123	lavenderblush	Hex: 0xFFFF0F5
		 Text 123	lawngreen	Hex: 0x7CFC00
		 Text 123	lemonchiffon	Hex: 0xFFFFACD
		 Text 123	lightblue	Hex: 0xADD8E6

		 Text 123	lightcoral	Hex: 0xF08080
		 Text 123	lightcyan	Hex: 0xE0FFFF
		 Text 123	lightgoldenrodyellow	Hex: 0xFAFAD2
		 Text 123	lightgreen	Hex: 0x90EE90
		 Text 123	lightgrey	Hex: 0xD3D3D3
		 Text 123	lightpink	Hex: 0xFFB6C1
		 Text 123	lightsalmon	Hex: 0xFFA07A
		 Text 123	lightseagreen	Hex: 0x20B2AA
		 Text 123	lightskyblue	Hex: 0x87CEFA
		 Text 123	lightslategray	Hex: 0x778899
		 Text 123	lightsteelblue	Hex: 0xB0C4DE
		 Text 123	lightyellow	Hex: 0xFFFFE0
		 Text 123	lime	Hex: 0x00FF00
		 Text 123	limegreen	Hex: 0x32CD32
		 Text 123	linen	Hex: 0xFAF0E6
		 Text 123	magenta	Hex: 0xFF00FF
		 Text 123	maroon	Hex: 0x800000
		 Text 123	mediumaquamarine	Hex: 0x66CDAA
		 Text 123	mediumblue	Hex: 0x0000CD
		 Text 123	mediumorchid	Hex: 0xBA55D3
		 Text 123	mediumpurple	Hex: 0x9370DB
		 Text 123	mediumseagreen	Hex: 0x3CB371
		 Text 123	mediumslateblue	Hex: 0x7B68EE
		 Text 123	mediumspringgreen	Hex: 0x00FA9A
		 Text 123	mediumturquoise	Hex: 0x48D1CC
		 Text 123	mediumvioletred	Hex: 0xC71585
		 Text 123	midnightblue	Hex: 0x191970
		 Text 123	mintcream	Hex: 0xF5FFFA
		 Text 123	mistyrose	Hex: 0xFFE4E1
		 Text 123	moccasin	Hex: 0xFFE4B5
		 Text 123	navajowhite	Hex: 0xFFDEAD
		 Text 123	navy	Hex: 0x000080
		 Text 123	oldlace	Hex: 0xFDF5E6
		 Text 123	olive	Hex: 0x808000

		 Text 123	olivedrab	Hex: 0x6B8E23
		 Text 123	orange	Hex: 0xFFFA500
		 Text 123	orangered	Hex: 0xFF4500
		 Text 123	orchid	Hex: 0xDA70D6
		 Text 123	palegoldenrod	Hex: 0xEEEE8AA
		 Text 123	palegreen	Hex: 0x98FB98
		 Text 123	paleturquoise	Hex: 0xAFEEEE
		 Text 123	palevioletred	Hex: 0xDB7093
		 Text 123	papayawhip	Hex: 0xFFEFD5
		 Text 123	peachpuff	Hex: 0xFFDAB9
		 Text 123	peru	Hex: 0xCD853F
		 Text 123	pink	Hex: 0xFFC0CB
		 Text 123	plum	Hex: 0xDDA0DD
		 Text 123	powderblue	Hex: 0xB0E0E6
		 Text 123	purple	Hex: 0x800080
		 Text 123	red	Hex: 0xFF0000
		 Text 123	rosybrown	Hex: 0xBC8F8F
		 Text 123	royalblue	Hex: 0x4169E1
		 Text 123	saddlebrown	Hex: 0x8B4513
		 Text 123	salmon	Hex: 0xFA8072
		 Text 123	sandybrown	Hex: 0xF4A460
		 Text 123	seagreen	Hex: 0x2E8B57
		 Text 123	seashell	Hex: 0xFFF5EE
		 Text 123	sienna	Hex: 0xA0522D
		 Text 123	silver	Hex: 0xC0C0C0
		 Text 123	skyblue	Hex: 0x87CEEB
		 Text 123	slateblue	Hex: 0x6A5ACD
		 Text 123	slategray	Hex: 0x708090
		 Text 123	snow	Hex: 0xFFFFAFA
		 Text 123	springgreen	Hex: 0x00FF7F
		 Text 123	steelblue	Hex: 0x4682B4
		 Text 123	tan	Hex: 0xD2B48C
		 Text 123	teal	Hex: 0x008080
		 Text 123	thistle	Hex: 0xD8BFD8

		 Text 123	tomato	Hex: 0xFF6347
		 Text 123	turquoise	Hex: 0x40E0D0
		 Text 123	violet	Hex: 0xEE82EE
		 Text 123	wheat	Hex: 0xF5DEB3
			white	Hex: 0xFFFFFFFF
		 Text 123	whitesmoke	Hex: 0xF5F5F5
		 Text 123	yellow	Hex: 0xFFFF00
		 Text 123	yellowgreen	Hex: 0x9ACD32

Appendix B - Glossary of terms and abbreviations

baseline

In typography, the imaginary line on which characters sit. The x-height of a font is measured from the baseline to the top of a lowercase x. The descender, for those characters that have one, is defined as the portion of the character that falls below the baseline.

Bezier curves

Named after the French mathematician Pierre B ezier, Bezier curves utilize at least three points to define a curve. The endpoints are called the anchor points, while any other point is known as a node. The curves produced by RML's `<curves>` tag are Bezier curves.

bitmap

A bitmap is a way of storing an image. In bitmaps, each pixel ("picture-cell") is stored as one or more bits of data in a "map" consisting of rows and columns. This means that when you print them out at the size they were created at they look fine, but shrinking or enlarging them leads to them looking blocky and ragged.

JPEG and GIF are both bitmapped graphics formats (as are BMP, PICT and PNG). You can use gifs and jpegs in your RML document with the `<image>` tag.

see also "gif", "JPEG", "image"

Boolean

Named after the nineteenth-century mathematician George Boole, Boolean logic is a form of algebra in which all values are reduced to either TRUE or FALSE (or 0 and 1).

CMYK

A way of specifying a color by its Cyan, Magenta, Yellow and Black ('Key') components. Usually used when referring to pigments - such as in printing.

DTD

Document Type Definition. A term from XML that refers to the file that defines the legal building blocks of an XML document, and the permissible ways to structure it.

empty elements

"Empty" elements are those tags that don't have any content, and are closed with a `</>` at the end of the *same* tag rather than having a separate closing tag. (e.g. `<getName id="Header.Title"/>` doesn't have a separate `</getName>` tag - the `</>` serves to close it so it doesn't need one). Empty elements are also sometimes known as "singletons".

fill

In RML, the color that a graphic or text item is filled with (as opposed to that of its outline or `stroke`).

flowables

In RML, "flowables" are items which appear in a story (such as paragraph, spacer, and tables). Flowables are positioned in sequence running down a frame until there is no more room left in that frame, when they are placed in the next frame (or on the next page if necessary). They can not be mixed with graphics.

Flowables include the following tags:

`para`, `blockTable`, `title`, `h1`, `h2`, `h3`, `spacer`, `illustration`, `pre` and `plugInFlowable`.

see also "graphics"

GIF

GIF (Graphics Interchange Format) is a bit-mapped graphics file format created by CompuServe in 1987. It is still in common use on the World Wide Web and many other places today.

You can use gifs in your RML document with the `image` tag.

see also "bitmap", "JPEG", "image"

graphics

In RML, "graphics" are items which can appear inside the `pageGraphics` and `illustration` tags.

Unlike flowables, graphics are explicitly positioned on the page by co-ordinates. They can not be mixed with

flowables.

see also "flowables"

HTML

The Hyper-Text Markup Language. The language used for writing pages on the World Wide Web.

image

In RML, the "image" tag allows you to use existing graphics files in your document. Currently image supports the GIF and JPEG formats - the two most common formats on the World Wide Web. Most paint applications support both the GIF and JPEG standards.

see also "bitmap", "GIF", "JPEG"

JPEG

A lossy compression technique for color images created by the Joint Photographic Experts Group (JPEG). Better for photos than the GIF format, it can use up to 24-bit color and reduce file sizes to about 5% of their normal size. JPEG files are widely used on the World Wide Web and many other places.

(The JPEG format is sometimes known as JFIF, JFI, and JPG as well as JPEG).

You can use JPEG files in your RML document with the `image` tag.

see also "bitmap", "gif", "image"

jpg

See *JPEG*.

leading

Leading (pronounced "ledding") is the amount of vertical space allotted for a line of type - the distance between the baseline of one line to the baseline of the next. The name comes from the way that printers used to use thin strips of lead or brass to separate the lines of metal type.

In RML, leading can be supplied as an attribute for the `para` and `paraStyle` tags. It is expressed as the height of the line *plus* the space between lines. So, for example, using a 12 point font with a leading of 18 gives you a space between lines of 6 points.

You can also have negative leading. By giving a number *smaller* than the size of font you are using, you can arrange it so that the lines overlap each other.

orthogonal

An adjective from mathematics meaning "relating to or composed of right angles".

A non-orthogonal transformation is one which does not preserve right angles. `skew` is a non-orthogonal transformation.

PDF

The Portable Document Format. A format created by Adobe, this is a standard for electronic documents which is platform-independent due to the freely available Acrobat reader. The PDF file format is a complex indexed binary format, with a specification 600 pages long. (RML is *much* easier!)

RGB

A way of specifying a color by its Red, Green and Blue components. Usually used when referring to lights - such as on a computer screen.

RML

Report Markup Language. An XML dialect, created by ReportLab, Inc, and used by their software `rml2pdf` to produce documents in PDF.

singletons

See "empty elements".

story

The part of an RML document where the main content of a document goes (if it uses the "template/stylesheet/story" form). This is where text - split into paragraphs by `<para>` tags - is put.

stroke

In RML, the color of the outline of a graphic or text item (as opposed to that of its inside or fill.)

stylesheet

This is an obligatory part of an RML document. It is where the styles for paragraphs and `blockTables` are defined (though it can be empty).

template

In those RML documents that use the "template/stylesheet/story" form, this is the part of the document where any headers, footers, or background graphic elements are defined.

vanilla

Plain, ordinary, or standard [from the default flavor of ice cream in the U.S.]

In RML, you can put in letters, numbers, and punctuation in places which allow you to use "vanilla text", but tags such as `<para>` or `` are not allowed.

whitespace

For programmers, whitespace refers to all the characters that appear as blanks on your screen. This includes the space and tab characters, linefeeds, carriage returns, and other more specialised characters.

For designers, whitespace is any areas on a page that aren't the content - the bits that are free of text or artwork.

XML

The Extensible Markup Language - a document processing standard set by the World Wide Web Consortium (W3C) - the people who defined the standard for HTML.

Appendix C - Letters used by the Greek tag

Greek Letter	RML Representation	Greek Letter	RML Representation
α	<greek>a</greek>	Α	<greek>A</greek>
β	<greek>b</greek>	Β	<greek>B</greek>
χ	<greek>c</greek>	Χ	<greek>C</greek>
δ	<greek>d</greek>	Δ	<greek>D</greek>
ε	<greek>e</greek>	Ε	<greek>E</greek>
φ	<greek>f</greek>	Φ	<greek>F</greek>
γ	<greek>g</greek>	Γ	<greek>G</greek>
η	<greek>h</greek>	Η	<greek>H</greek>
ι	<greek>i</greek>	Ι	<greek>I</greek>
φ	<greek>j</greek>	ϑ	<greek>J</greek>
κ	<greek>k</greek>	Κ	<greek>K</greek>
λ	<greek>l</greek>	Λ	<greek>L</greek>
μ	<greek>m</greek>	Μ	<greek>M</greek>
ν	<greek>n</greek>	Ν	<greek>N</greek>
ο	<greek>o</greek>	Ο	<greek>O</greek>
π	<greek>p</greek>	Π	<greek>P</greek>
θ	<greek>q</greek>	Θ	<greek>Q</greek>
ρ	<greek>r</greek>	Ρ	<greek>R</greek>
σ	<greek>s</greek>	Σ	<greek>S</greek>
τ	<greek>t</greek>	Τ	<greek>T</greek>
υ	<greek>u</greek>	Υ	<greek>U</greek>
ϖ	<greek>v</greek>	ς	<greek>V</greek>
ω	<greek>w</greek>	Ω	<greek>W</greek>
ξ	<greek>x</greek>	Ξ	<greek>X</greek>
ψ	<greek>y</greek>	Ψ	<greek>Y</greek>
ζ	<greek>z</greek>	Ζ	<greek>Z</greek>

Appendix D - Command reference

All attributes are optional unless otherwise specified.

document

```

<document
  filename="myfile.pdf"           string           required
  compression="0|1|default"      PDF compression (default)
  invariant="0|1|default"        PDF invariance (default)
  debug="0|1"                    Debug document production (0)
  userPass="uuserpw"            Encryption user password
  ownerPass="ownerpw"           Encryption owner password
  encryptionStrength="128|40"    Encryption strength           optional
                                  defaults to 128
  permissions="print annotate..." Encryption permissions optional
                                  allowed are print copy modify annotate
                                  default is print
>

</document>

```

Above is the story based form for the document tag.
Encryption will only take place if a userPass is specified.

document

```

<document
  filename="myfile.pdf"           string           required
>

<pageInfo>...</pageInfo>           optional
<pageDrawing>...</pageDrawing>    one or more
</document>

```

Above is the PageDrawing based form for the document tag.

The document tag is the root tag for RML documents. Every RML document must contain on and only one document tag. There are two forms for a document: the story form and the pageDrawing form.

docinit

```

<docinit
    pageMode                UseNone|UseOutlines|UseThumbs|FullScreen
    pageLayout              SinglePage|OneColumn|TwoColumnLeft|TwoColumnRight
    useCropMarks            (yes | no | 0 | 1 | true | false)
>

</docinit>

```

template

```

<template
    pageSize="(8.5in, 11in)"  pair of lengths
    rotation="270"           page angular orientation (multiple of 90, default 0)
    firstPageTemplate="main" page template id
    leftMargin="1in"         length
    rightMargin="1in"        length
    topMargin="1.5in"        length
    bottomMargin="1.5in"     length
    showBoundary="false"     truth value
    allowSplitting="true"    truth value
    title="my title"         string
    author="yours truly"     string
>
<pageTemplate...> ...</pageTemplate> 1 or more
</template>

```

stylesheet

```
<stylesheet>
<initialize>...</initialize>
<paraStyle ... />
<blockTableStyle>...</blockTableStyle>
</stylesheet>
```

optional
(any number
of styles)

story

```
<story>
<para>...</para>
...
<illustration>...</illustration>
</story>
```

(Sequence of
top level
flowables)

pageInfo

```
<pageInfo
    pageSize="(8.5in,11in)"
/>
```

pair of lengths

required

pageDrawing

```
<pageDrawing>
<drawString ...> ...</drawString>
...
<place ...>...</place>
</pageDrawing>
```

(Sequence of
graphical
operations)

pageGraphics

```
<pageGraphics>
<drawString ...> ...</drawString>
...
<place>...</place>
</pageGraphics>
```

(Sequence of
graphical
operations)

Generic Flowables (Story Elements)

spacer

```
<spacer
    length="1.2in"      measurement
    width="5in"        measurement
/>
```

required

illustration

```
<illustration
    height="1.2in"     measurement
    width="5in"        measurement
>
<drawString ...> ...</drawString>
...
<place ...>...</place>
</illustration>
```

required
required
(Sequence of graphical operations)

pre

```
<pre
    style="myfavoritestyle"  string paragraph style name
>
Preformatted Text
</pre>
```

also string forms (getname)

xpre

```
<xpre
    style="myfavoritestyle"  string paragraph style name
>
Paragraph text which may contain
</xpre>
```

intraparagraph markup

plugInFlowable

```

<plugInFlowable
    module="mymodule"           string           required
    function="myfunction"       string           required
>
string data for plug in       unformatted data
</plugInFlowable>

```

Table Elements***blockTable***

```

<blockTable
    style="mytablestyle"        string style name
    rowHeights="(23, 20, 30, 10)" sequence of measurement
    colWidths="50, 90, 35, 11" sequence of measurement
>
<tr>...</tr>                  (rows of
<tr>...</tr>                  same length)
</blockTable>

```

tr

```

<tr>

</tr>

```

td

```
<td
    fontName="Helvetica"
    fontSize="12"
    fontColor="red"
    leading="12"
    leftPadding="3"
    rightPadding="3"
    topPadding="3"
    bottomPadding="3"
    background="pink"
    align="right"
    vAlign="bottom"
    lineBelowThickness
    lineBelowColor
    lineBelowCap
    lineBelowCount
    lineBelowSpace
    lineAboveThickness
    lineAboveColor
    lineAboveCap
    lineAboveCount
    lineAboveSpace
    lineLeftThickness
    lineLeftColor
    lineLeftCap
    lineLeftCount
    lineLeftSpace
    lineRightThickness
    lineRightColor
    lineRightCap
    lineRightCount
    lineRightSpace
>
</td>
```

fontName="Helvetica"	stringform font name
fontSize="12"	stringform font size
fontColor="red"	stringform font color
leading="12"	stringform line spacing
leftPadding="3"	cell left padding
rightPadding="3"	cell right padding
topPadding="3"	cell top padding
bottomPadding="3"	cell bottom padding
background="pink"	background color
align="right"	cell horizontal alignment
vAlign="bottom"	vertical alignment
lineBelowThickness	bottom line thickness
lineBelowColor	bottom line color
lineBelowCap	bottom cap (butt round square)
lineBelowCount	bottom line count
lineBelowSpace	bottom line spacing
lineAboveThickness	topline thickness
lineAboveColor	top line colour
lineAboveCap	top cap (butt round square)
lineAboveCount	top line count
lineAboveSpace	top line spacing
lineLeftThickness	left line thickness
lineLeftColor	left line color
lineLeftCap	left line cap (butt round square)
lineLeftCount	left line count
lineLeftSpace	left line spacing
lineRightThickness	right line thickness
lineRightColor	right line color
lineRightCap	right line cap (butt round square)
lineRightCount	right line count
lineRightSpace	right line spacing

docAssert

```

<docAssert
  cond="i==3"                condition string      required
  format="The value of i is %(__expr__)" format string
/>

```

docAssign

```

<docAssign
  var="i"                    string
  expr="availableWidth"     expression string
/>

```

docElse

```

<docElse/>

```

docIf

```

<docIf
  cond="i==3"                condition string
/>

```

docExec

```

<docExec
  stmt="i-=1"                statement string
/>

```

docPara

```

<docPara
  expr="availableWidth"     expression string
  format="The value of i is %(__expr__)" format string
  style=""                  string
  escape="yes"              (yes | no | 0 | 1)
/>

```

docWhile

```
<docWhile
    cond="i==3"                condition string
/>
```

drawing

```
<drawing
    baseDir=".."                path string
    module="python_module"     string
    function="module_function" string
    hAlign="CENTER"            center|centre|left|right|CENTER|CENTRE|LEFT|RIGHT
    showBoundary="no"         (0|1|yes|no)
/>
```

widget

```
<widget
    baseDir=".."                path string
    module="python_module"     string
    function="module_function" string
    name="somename"           string
    initargs="someinitargs"   string
/>
```

Paragraph-like Elements***para***

```
<para
    style="myfavoritstyle"     string paragraph style name
>

</para>
```

title

```
<title  
    style="myfavoritstyle"           string paragraph style name  
>  
  
</title>
```

h1

```
<h1  
    style="myfavoritstyle"           string paragraph style name  
>  
  
</h1>
```

h2

```
<h2  
    style="myfavoritstyle"           string paragraph style name  
>  
  
</h2>
```

h3

```
<h3  
    style="myfavoritstyle"           string paragraph style name  
>  
  
</h3>
```

h4

```
<h4  
    style="myfavoritstyle"           string paragraph style name  
>  
  
</h4>
```

h5

```
<h5
    style="myfavoritstyle"
>
</h5>
```

string paragraph style name

h6

```
<h6
    style="myfavoritstyle"
>
</h6>
```

string paragraph style name

a

```
<a
    color="blue"
    fontSize="12"
    fontName="Helvetica"
    name="somename"
    backColor="cyan"
    href="someurl"
>
</a>
```

string color name
stringfont font size
string font name
string
string color string
string

evalString

```
<evalString
    imports="someimports"
    default="somedefault"
/>
```

string
string

Intra-Paragraph Markup

i

```
<i>
```

```
</i>
```

b

```
<b>
```

```
</b>
```

font

```
<font
```

```
  face="Helvetica"
```

```
  color="blue"
```

```
  size="34"
```

```
>
```

```
</font>
```

string font name

string color name

fontsize measurement

greek

```
<greek>
```

```
</greek>
```

sub

```
<sub>
```

```
</sub>
```

super

```
<super>
</super>
```

strike

```
<strike/>
```

sup

```
<sup/>
```

seq

```
<seq
    id="SecNum"                string
    template="% (Ch)s.%(SecNum)s" string
/>
```

seqDefault

```
<seqDefault
    id="SecNum"                string
/>
```

seqReset

```
<seqReset
    id="SecNum"                string
/>
```

seqChain

```
<seqChain
    order="id id id id"        string
/>
```


seqFormat

```
<seqFormat
    id="seqId"                string
    value="format char"      (1|i|l|a|A)
/>
```

onDraw

```
<onDraw
    name="somename"          string
    label="somelabel"        string
/>
```

br

```
<br/>
```

bullet

```
<bullet
    bulletColor="blue"       string color name
    bulletFontName=" "       string
    bulletFontSize="1in"     measurement
    bulletIndent="1in"       measurement
    bulletOffsetY="1in"      measurement
/>
```

link

```
<link
    destination="somedestination" string
    color="blue"             string color name
/>
```

setLink

```
<setLink
    destination="somedestination" string
    color="blue"             string color name
/>
```

unichar

```
<unichar
    name="somename"           string
    code="somecode"          string
/>
```

Page Level Flowables

nextFrame

```
<nextFrame
    name="frameindex"        int or string frame index
/>
```

setNextFrame

```
<setNextFrame
    name="frameindex"        int or string frame index required
/>
```

nextPage

```
<nextPage/>
```

setNextTemplate

```
<setNextTemplate
    name="indextemplate"     string template name required
/>
```

condPageBreak

```
<condPageBreak
    height="10cm"           measurement required
/>
```

storyPlace

<code><storyPlace</code>		
<code>x="1in"</code>	measurement	<i>required</i>
<code>y="7in"</code>	measurement	<i>required</i>
<code>width="5in"</code>	measurement	<i>required</i>
<code>height="3in"</code>	measurement	<i>required</i>
<code>origin="page"</code>	"page", "frame", or "local"	<i>optional</i>
<code>></code>		
<code><para>...</para></code>		<i>(Sequence of</i>
<code>...</code>		<i>top level</i>
<code><table>...</table></code>		<i>flowables)</i>
<code></storyPlace></code>		

keepInFrame

<code><keepInFrame</code>		
<code>maxWidth="int"</code>	maximum width or 0	
<code>maxHeight="int"</code>	maximum height or 0	
<code>frame="frameindex"</code>	optional frameindex to start in	
<code>mergeSpace="1 0"</code>	whether padding space is merged	
<code>onOverflow="error overflow </code>		
<code>..... shrink truncate"</code>	over flow behaviour	
<code>id="name"</code>	name for identification purposes	
<code>></code>		
<code><para>...</para></code>		<i>(Sequence of</i>
<code>...</code>		<i>top level</i>
<code><table>...</table></code>		<i>flowables)</i>
<code></keepInFrame></code>		

imageAndFlowables

<pre> <imageAndFlowables imageName="path" imageWidth="float" imageHeight="float" imageMask="color" imageLeftPadding="float" imageRightPadding="float" imageTopPadding="float" imageBottomPadding="float" imageSide="left" > <para>...</para> ... <table>...</table> </imageAndFlowables> </pre>	<pre> path to image file or url image width or 0 image height or 0 image transparency color or "auto" space on left of image space on right of image space on top of image space on bottom of image horizontal image location left right </pre>	<p><i>(Sequence of top level flowables)</i></p>
---	---	---

pto

<pre> <pto> <pto_trailer>...</pto_trailer> <pto_header>...</pto_header> <para>...</para> ... <table>...</table> </pto> </pre>	<p><i>optional optional (Sequence of top level flowables)</i></p>
---	---

pto_trailer

<pre> <pto_trailer> <para>...</para> ... <table>...</table> </pto_trailer> </pre>	<p><i>Only in PTO (Sequence of top level flowables)</i></p>
---	---

pto_header

<pre> <pto_header> <para>...</para> ... <table>...</table> </pto_header> </pre>	<p><i>Only in PTO (Sequence of top level flowables)</i></p>
---	---

indent

<pre><indent left="1in" right="1cm" > <para>...</para> ... <table>...</table> </indent></pre>	<pre>measurement measurement</pre>	<pre>optional optional</pre>
		<pre>(Sequence of top level flowables)</pre>

frameBackground

<pre><frameBackground color="pink" left="1in" right="1cm" start="1" /></pre>	<pre>color measurement measurement boolean</pre>	<pre>optional optional optional optional</pre>
--	--	--

fixedSize

<pre><fixedSize width="1in" height="1cm" > <para>...</para> ... <table>...</table> </fixedSize></pre>	<pre>measurement measurement</pre>	<pre>optional optional</pre>
		<pre>(Sequence of top level flowables)</pre>

Graphical Drawing Operations

drawString

<pre><drawString x="1in" y="7in" > </drawString></pre>	<pre>measurement measurement</pre>	<pre>required required</pre>
--	------------------------------------	------------------------------

drawRightString

<code><drawRightString</code>		
<code>x="1in"</code>	measurement	<i>required</i>
<code>y="7in"</code>	measurement	<i>required</i>
<code>></code>		
<code></drawRightString></code>		

drawCentredString

<code><drawCentredString</code>		
<code>x="1in"</code>	measurement	<i>required</i>
<code>y="7in"</code>	measurement	<i>required</i>
<code>></code>		
<code></drawCentredString></code>		

drawCenteredString

<code><drawCenteredString</code>		
<code>x="1in"</code>	measurement	<i>required</i>
<code>y="7in"</code>	measurement	<i>required</i>
<code>></code>		
<code></drawCenteredString></code>		

ellipse

<code><ellipse</code>		
<code>x="1in"</code>	measurement	<i>required</i>
<code>y="7in"</code>	measurement	<i>required</i>
<code>width="5cm"</code>	measurement	<i>required</i>
<code>height="3cm"</code>	measurement	<i>required</i>
<code>fill="true"</code>	truth value	
<code>stroke="false"</code>	truth value	
<code>/></code>		

circle

<code><circle</code>			
	<code>x="1in"</code>	measurement	<i>required</i>
	<code>y="7in"</code>	measurement	<i>required</i>
	<code>radius="3cm"</code>	measurement	<i>required</i>
	<code>fill="true"</code>	truth value	
	<code>stroke="false"</code>	truth value	
<code>></code>			

rect

<code><rect</code>			
	<code>x="1in"</code>	measurement	<i>required</i>
	<code>y="7in"</code>	measurement	<i>required</i>
	<code>width="5cm"</code>	measurement	<i>required</i>
	<code>height="3cm"</code>	measurement	<i>required</i>
	<code>round="1.2cm"</code>	measurement	
	<code>fill="true"</code>	truth value	
	<code>stroke="false"</code>	truth value	
<code>></code>			

grid

<code><grid</code>			
	<code>xs="1in 2in 3in"</code>	measurements	<i>required</i>
	<code>ys="7in 7.2in 7.4in"</code>	measurements	<i>required</i>
<code>></code>			

lines

<code><lines></code>			
	<code>1in 1in 2in 2in</code>		<i>quadruples of measurements representing line segments</i>
	<code>1in 2in 2in 3in</code>		
	<code>1in 3in 2in 4in</code>		
	<code>...</code>		
<code></lines></code>			

curves

```
<curves>
  1in 1in 2in 2in 2in 3in 1in 3in
  1in 2in 2in 3in 2in 4in 1in 4in
  1in 3in 2in 4in 2in 5in 1in 5in
  ...
</curves>
```

*octuples of
measurements
representing
Bezier curves*

image

```
<image
  file="cute.jpg"
  x="1in"
  y="7in"
  width="5cm"
  height="3cm"
/>
```

string
measurement
measurement
measurement
measurement

*required
required
required*

place

```
<place
  x="1in"
  y="7in"
  width="5in"
  height="3in"
>
<para>...</para>
...
<illustration>...</illustration>
</place>
```

measurement
measurement
measurement
measurement

*required
required
required
required*

*(Sequence of
top level
flowables)*

doForm

```
<doForm
  name="logo"
/>
```

string

required

includePdfPages

<code><includePdfPages</code>		
<code>filename="path"</code>	string	<i>required: path to included file</i>
<code>pages="1-3,6"</code>	string	<i>optional: , separated page list</i>
<code>template="name"</code>	string	<i>optional: pagetemplate name</i>
<code>outlineText="text"</code>	string	<i>optional: text for outline entry</i>
<code>outlineLevel="1"</code>	int	<i>optional: outline level default 0</i>
<code>outlineClose="0"</code>	int	<i>optional: 0 for closed outline entry</i>
<code>leadingFrame="no"</code>	bool	<i>optional: no if you don't want a page</i>
<code>isdata="yes"</code>	bool	<i>optional: true if filename is a page</i>
<code>orientation="auto"</code>	string	<i>optional: 0 90 180 270 auto lands</i>
<code>sx="0.9"</code>	float	
<code>sy="0.9"</code>	float	
<code>dx="2in"</code>	measurement	
<code>dy="2in"</code>	measurement	
<code>degrees="45"</code>	angle in degrees	
<code>/></code>		

textField

<code><textField</code>		
<code>id="name"</code>	name of field	<i>required</i>
<code>value="initial"</code>	field initial value	<i>optional</i>
<code>x="34"</code>	x coord	
<code>y="500"</code>	y coord	
<code>width="72"</code>	width	
<code>height="12"</code>	height	
<code>maxlen="1200"</code>	maximum #chars	
<code>multiline="0/1"</code>	1 for multiline text	
<code>></code>		
<code></textField></code>		

textAnnotation

```
<textAnnotation>

</textAnnotation>
```

plugInGraphic

<code><plugInGraphic</code>			
<code>module="mymodule"</code>	string	<i>required</i>	
<code>function="myfunction"</code>	string	<i>required</i>	
<code>></code>			
<code>string data for plug in</code>			<i>unformatted data</i>
<code></plugInGraphic></code>			

path

<code><path</code>			
<code>x="1in"</code>	measurement	<i>required</i>	
<code>y="7in"</code>	measurement	<i>required</i>	
<code>close="true"</code>	truth value		
<code>fill="true"</code>	truth value		
<code>stroke="false"</code>	truth value		
<code>></code>			
<code>lin 6in</code>			<i>measurement pairs</i>
<code>lin 7in</code>			<i>representing points</i>
<code>...</code>			<i>or path operations</i>
<code></path></code>			

barCodeFlowable

<pre> <barcodeFlowable code="Code11" value="somevalue" fontName="Helvetica" tracking="sometracking" routing="somerouting" barStrokeColor="blue" barFillColor="blue" textColor="blue" barStrokeWidth="1in" gap="1in" ratio="I2of5" bearers="" barHeight="1in" barWidth="1in" fontSize="12" spaceWidth="1in" spaceHeight="1in" widthSize="1in" heightSize="1in" checksum="-1" quiet="yes" lquiet="yes" rquiet="yes" humanReadable="yes" stop="yes" /> </pre>	<pre> (I2of5 Code128 Standard93 Extended93 Standard39 string string font name string string string color name string color name string color name measurement measurement string string measurement measurement stringform font size measurement measurement measurement measurement (-1 0 1 2) (yes no 0 1) (yes no 0 1) (yes no 0 1) (yes no 0 1) (yes no 0 1) </pre>
--	---

figure

<pre> <figure showBoundary="no" shrinkToFit="no" growToFit="no" scaleFactor="somescaleFactor" /> </pre>	<pre> (0 1 yes no) (0 1 yes no) (0 1 yes no) string </pre>
---	--

imageFigure

```

<imageFigure
    imageName="someimageName"           string
    imageWidth="1in"                    measurement
    imageHeight="1in"                   measurement
    imageMask="someimageMask"           string
    preserveAspectRatio="yes"            (yes | no | 0 | 1)
    showBoundary="yes"                   (yes | no | 0 | 1)
    pdfBoxType="MediaBox"                (MediaBox | CropBox | TrimBox | BleedBox | ArtBox)
    pdfPageNumber="4"                    integer
    showBoundary="no"                    (0|1|yes|no)
    shrinkToFit="no"                     (0|1|yes|no)
    growToFit="no"                       (0|1|yes|no)
    caption="somecaption"                string
    captionFont="12"                      stringform font name
    captionSize="1in"                    measurement
    captionGap="somecaptionGap"          string
    captionColor="blue"                  string color name
    spaceAfter="4"                        integer
    spaceBefore="4"                       integer
    align="center|centre|left|right"      (center|centre|left|right|CENTER|CENTRE|LEFT|RIGHT)
/>

```

img

```



```

Path Operations

moveto

```

<moveto>
5in 3in
</moveto>

```

measurement pair

curvesto

```
<curvesto>
lin lin lin 4in 4in 4in
2in 2in 2in 5in 5in 5in
...
</curvesto>
```

*sexuples of
measurements for
bezier curves*

Form Field Elements**barCode**

```
<barCode
  x="lin"
  y="lin"
  code="Code 11"

>
01234545634563
</barCode>
```

measurement *required*
measurement *required*
"Codabar", "Code11", *required*
"Code128", "I2of5"
"Standard39", "Standard93",
"Extended39", "Extended93"
"MSI", "FIM", "POSTNET"

unformatted barcode data

checkBox

<code><checkBox</code>		
<code> style="myboxstyle"</code>	string box style name	
<code> x="1in"</code>	measurement	<i>required</i>
<code> y="1in"</code>	measurement	<i>required</i>
<code> labelFontName="Helvetica"</code>	string font name	
<code> labelFontSize="12"</code>	fontsize measurement	
<code> labelTextColor="blue"</code>	string color name	
<code> boxWidth="1in"</code>	measurement	
<code> boxHeight="1in"</code>	measurement	
<code> checkStrokeColor="blue"</code>	string color name	
<code> boxStrokeColor="blue"</code>	string color name	
<code> boxFillColor="blue"</code>	string color name	
<code> lineWidth="1"</code>	measurement	
<code> line1="label text 1"</code>	string	
<code> line2="label text 2"</code>	string	
<code> line3="label text 3"</code>	string	
<code> checked="false"</code>	truth value	
<code> bold="false"</code>	truth value	
<code> graphicOn="cute_on.jpg"</code>	string file name	
<code> graphicOff="cute_off.jpg"</code>	string file name	
<code>/></code>		

letterBoxes

<code><letterBoxes</code>		
<code>style="myboxstyle"</code>	string box style name	
<code>x="1in"</code>	measurement	<i>required</i>
<code>y="1in"</code>	measurement	<i>required</i>
<code>count="10"</code>	integer	<i>required</i>
<code>label="label text"</code>	string	
<code>labelFontName="Helvetica"</code>	string font name	
<code>labelFontSize="12"</code>	fontsize measurement	
<code>labelTextColor="blue"</code>	string color name	
<code>labelOffsetX="1in"</code>	measurement	
<code>labelOffsetY="1in"</code>	measurement	
<code>boxWidth="1in"</code>	measurement	
<code>boxHeight="1in"</code>	measurement	
<code>combHeight="0.25"</code>	float	
<code>boxStrokeColor="blue"</code>	string color name	
<code>boxFillColor="blue"</code>	string color name	
<code>textColor="blue"</code>	string color name	
<code>lineWidth="1in"</code>	measurement	
<code>fontName="Helvetica"</code>	string font name	
<code>fontSize="12"</code>	fontsize measurement	
<code>></code>		
<code>box contents goes here</code>		<i>unformatted data</i>
<code></letterBoxes></code>		

textBox

<code><textBox</code>			
<code> style="myboxstyle"</code>	string box style name		
<code> x="1in"</code>	measurement	<i>required</i>	
<code> y="1in"</code>	measurement	<i>required</i>	
<code> boxWidth="1in"</code>	measurement	<i>required</i>	
<code> boxHeight="1in"</code>	measurement	<i>required</i>	
<code> labelFontName="Helvetica"</code>	string font name		
<code> labelFontSize="12"</code>	fontsize measurement		
<code> labelTextColor="blue"</code>	string color name		
<code> labelOffsetX="1in"</code>	measurement		
<code> labelOffsetY="1in"</code>	measurement		
<code> boxStrokeColor="blue"</code>	string color name		
<code> boxFillColor="blue"</code>	string color name		
<code> textColor="blue"</code>	string color name		
<code> lineWidth="1in"</code>	measurement		
<code> fontName="Helvetica"</code>	string font name		
<code> fontSize="12"</code>	fontsize measurement		
<code> align="left"</code>	"left", "right" or "center"		
<code> shrinkToFit="false"</code>	truth value		
<code> label="label text"</code>	string		
<code>></code>			
<code> box contents goes here</code>			<i>unformatted data</i>
<code></textBox></code>			

Graphical State Change Operations

fill

<code><fill</code>			
<code> color="blue"</code>	string name	<i>required</i>	
<code>></code>			

stroke

<code><stroke</code>			
<code> color="blue"</code>	string name	<i>required</i>	
<code>></code>			

setFont

<pre><setFont</pre>	<pre> name="Helvetica"</pre>	<pre>string name</pre>	<pre>required</pre>
	<pre> size="1cm"</pre>	<pre>measurement</pre>	<pre>required</pre>
<pre>></pre>			

form

<pre><form</pre>	<pre> name="logo"</pre>	<pre>string name</pre>	<pre>required</pre>
<pre>></pre>			
<pre><drawString ...> ...</drawString></pre>			<pre>(Sequence of</pre>
<pre>...</pre>			<pre>graphical</pre>
<pre><place ...>...</place></pre>			<pre>operations)</pre>
<pre></form></pre>			

catchForms

<pre><catchForms</pre>	<pre> storageFile="storage.data"</pre>	<pre>string name</pre>	<pre>required</pre>
<pre>></pre>			

scale

<pre><scale</pre>	<pre> sx="0.8"</pre>	<pre>scale factor</pre>	<pre>required</pre>
	<pre> sy="1.3"</pre>	<pre>scale factor</pre>	<pre>required</pre>
<pre>></pre>			

translate

<pre><translate</pre>	<pre> dx="0.8in"</pre>	<pre>measurement</pre>	<pre>required</pre>
	<pre> dy="1.3in"</pre>	<pre>measurement</pre>	<pre>required</pre>
<pre>></pre>			

rotate

<pre><rotate</pre>	<pre> degrees="45"</pre>	<pre>angle in degrees</pre>	<pre>required</pre>
<pre>></pre>			

skew

```
<skew
    alpha="15"
    beta="5"
/>
```

angle in degrees *required*
angle in degrees *required*

transform

```
<transform>
1.0 0.3
-0.2 1.1
10.1 15
</transform>
```

six number affine transformation matrix

lineMode

```
<lineMode
    width="0.2cm"
    dash=".1cm .2cm"
    join="round"
    cap="square"
/>
```

measurement
measurements
"round", "mitered", or "bevelled"
"default", "round", or "square"

Style Elements

initialize

```
<initialize>
<alias.../>
<name.../>
<color.../>
</initialize>
```

sequence of alias, name or color tags

paraStyle

```

<paraStyle
    name="mystyle"                string
    alias="pretty"                string
    parent="oldstyle"            string
    fontname="Courier-Oblique"   string
    fontsize="13"                 measurement
    leading="20"                  measurement
    leftIndent="1.25in"          measurement
    rightIndent="2.5in"          measurement
    firstLineIndent="0.5in"      measurement
    spaceBefore="0.2in"          measurement
    spaceAfter="3cm"             measurement
    alignment="justify"           "left", "right", "center" or "justify"
    bulletFontname="Courier"     string
    bulletFontSize="13"          measurement
    bulletIndent="0.2in"         measurement
    textColor="red"               string
    backgroundColor="cyan"        string
/>

```

boxStyle

```

<boxStyle
    name="mystyle"                string
    alias="pretty"                string
    parent="oldstyle"            string
    fontname="Courier-Oblique"   string
    fontsize="13"                 measurement
    alignment="left"              "left", "right" or "center"
    textColor="blue"              string color name
    labelFontName="Courier"       string
    labelFontSize="13"            measurement
    labelAlignment="left"         "left", "right" or "center"
    labelTextColor="blue"         string color name
    boxFillColor="blue"           string color name
    boxStrokeColor="blue"         string color name
    cellWidth="1in"               measurement
    cellHeight="1in"              measurement
/>

```

blockTableStyle

```

<blockTableStyle
    id="mytablestyle"                string
>
<blockFont.../>                    table style
<blockLeading.../>                  block descriptors
</blockTableStyle>

```

Table Style Block Descriptors**blockFont**

```

<blockFont
    name="TimesRoman"                string                required
    size="8"                          measurement
    leading="10"                       measurement
    start="4"                          integer
    stop="11"                          integer
/>

```

blockLeading

```

<blockLeading
    length="10"                       measurement            required
    start="4"                          integer
    stop="11"                          integer
/>

```

blockTextColor

```

<blockTextColor
    colorName="pink"                  string                required
    start="4"                          integer
    stop="11"                          integer
/>

```

blockAlignment

```
<blockAlignment
    value="left"           "left", "right", or "center"
    start="4"             integer
    stop="11"            integer
/>
```

blockLeftPadding

```
<blockLeftPadding
    length="0.2in"       measurement required
    start="4"            integer
    stop="11"           integer
/>
```

blockRightPadding

```
<blockRightPadding
    length="0.2in"       measurement required
    start="4"            integer
    stop="11"           integer
/>
```

blockBottomPadding

```
<blockBottomPadding
    length="0.2in"       measurement required
    start="4"            integer
    stop="11"           integer
/>
```

blockTopPadding

```
<blockTopPadding
    length="0.2in"       measurement required
    start="4"            integer
    stop="11"           integer
/>
```

blockBackground

```

<blockBackground
    colorName="indigo"           string           required
    start="4"                    integer
    stop="11"                    integer
/>

```

blockValign

```

<blockValign
    value="left"                 "top", "middle", or "bottom"
    start="4"                    integer
    stop="11"                    integer
/>

```

blockSpan

```

<blockSpan
    start="4"                    integer
    stop="4"                     integer
/>

```

lineStyle

```

<lineStyle
    kind="BOX"                   line command       required
    thickness="4"                measurement       required
    colorName="magenta"          string            required
    start="4"                    integer
    stop="11"                    integer
    count="2"                    integer
    space="2"                     integer
    dash="2,2"                   integer,integer
/>

```

The line command names are: GRID, BOX, OUTLINE, INNERGRID, LINEBELOW, LINEABOVE, LINEBEFORE and LINEAFTER. BOX and OUTLINE are equivalent, and GRID is the equivalent of applying both BOX and INNERGRID.

bulkData

```

<bulkData
    stripBlock="yes"                (yes | no)
    stripLines="yes"                (yes | no)
    stripFields="yes"               (yes | no)
    fieldDelim=","                  string
    recordDelim=","                 string
/>

```

excelData

```

<excelData
    fileName="somefileName"         string
    sheetName="somesheetName"       string
    range="A1:B7"                   string
    rangeName="somerangeName"       string
/>

```

Page Layout Tags

pageTemplate

```

<pageTemplate
    id="frontpage"                  string required
    pageSize="(8.5in, 11in)"        override template page size
    rotation="270"                   override template page angular orientation
>
<pageGraphics>...</pageGraphics>... optional 1 or 2
<frame.../> one or more

</pageTemplate>

```

frame

```

<frame
    id="left"                       string required
    x1="1in"                         measurement required
    y1="1in"                         measurement required
    width="50cm"                     measurement required
    height="90cm"                    measurement required
/>

```

pageGraphics

```
<pageGraphics/>
```

Special Tags**name**

```
<name
    id="chapterName"           string           required
    value="Introduction"       string           required
/>
```

alias

```
<alias
    id="footerString"         string           required
    value="chapterName"       string           required
/>
```

getName

```
<getName
    id="footerString"         string           required
/>
```

color

```
<color
    id="footerString"         string           required
    RGB="77aa00"             hexadecimal red/green/blue values
/>
```

pageNumber

```
<pageNumber
    countingFrom="2"          integer
/>
```


outlineAdd

```

<outlineAdd
    level="1"                integer
    closed="true"           truth value
>
Chapter 1, section 2      outline entry text
</outlineAdd>

```

cropMarks

```

<cropMarks
    borderWidth="36"        integer
    markWidth="0.5"        float
    markColor="green"      color
    markLength="18"        integer
/>

```

startIndex

```

<startIndex
    name="somename"        string
    offset="0"             integer
    format="ABC"           123||i|ABC|abc
/>

```

index

```

<index
    name="somename"        string
    offset="0"             integer
    format="ABC"           123||i|ABC|abc
/>

```

showIndex

```

<showIndex
    name="somename"        string
    dot="-"                string
    style="sometstyle"     string
    tableStyle="sometablestyle" string
/>

```

bookmark

```

<bookmark
    name="somename"           string
    x="lin"                   measurement
    y="lin"                   measurement
/>

```

bookmarkPage

```

<bookmarkPage
    name="somename"           string
    fit="XYZ|Fit|FitH|FitV|FitR" (XYZ|Fit|FitH|FitV|FitR)
    top="lin"                 measurement
    bottom="lin"              measurement
    left="lin"                measurement
    right="lin"               measurement
    zoom="somezoom"           string
/>

```

join

```

<join
    type="sometype"           string
/>

```

length

```

<length
    id="someid"               string
    value="4"                 integer
/>

```

namedString

```

<namedString
    id="someid"               string
    type="sometype"           string
    default="somedefault"     string
/>

```

param

```
<param
    name="somename"                string
/>
```

registerCidFont

```
<registerCidFont
    faceName="VeraBold"            font name string
    encName="WinAnsiEncoding"     string
/>
```

registerFont

```
<registerFont
    name="somename"                string
    faceName="VeraBold"            font name string
    encName="WinAnsiEncoding"     string
/>
```

registerFontFamily

```
<registerFontFamily
    normal="VeraBold"              font name string
    bold="VeraBold"                font name string
    italic="VeraBold"              font name string
    boldItalic="VeraBold"          font name string
/>
```

registerTTFont

```
<registerTTFont
    faceName="VeraBold"            font name string
    fileName="somefileName"        string
/>
```

registerType1Face

```
<registerType1Face
    afmFile="DarkGardenMK.afm"     string
    pfbFile="DarkGardenMK.pfb"     string
/>
```

restoreState

```
<restoreState/>
```

saveState

```
<saveState/>
```

setFont

```
<setFont
    name="somename"           font name string
    size="1in"                measurement
    leading="4"               integer
/>
```

setFontSize

```
<setFontSize
    size="1in"                measurement
    leading="4"               integer
/>
```

Log tags

log

```
<log
    log="evel"                (DEBUG | INFO | WARNING | ERROR | CRITICAL)
>
</log>
```

debug

```
<debug>
</debug>
```

info

```
<info>
```

```
</info>
```

warning

```
<warning>
```

```
</warning>
```

error

```
<error>
```

```
</error>
```

critical

```
<critical>
```

```
</critical>
```

logConfig

```
<logConfig
```

level="DEBUG"	(DEBUG INFO WARNING ERROR CRITICAL)
format="The value of i is %(__exp__)"	format string
filename="somefilename"	string
filemode="WRITE"	(WRITE APPEND)
datefmt="somedatefmt "	string

```
/>
```

Not implemented

The following tags are allowed for in the DTD but are not implemented by the current version of RML2PDF:

li, ol, u, ul, dd, dl, dt