

The Gnumeric File Format

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1 Introduction

1.1 Background

This document describes the Gnumeric file format. It has been compiled as part of a project (**JWorkbook**) to create a Java class library that can write data in a spreadsheet format.

For more information on this project, or to download the latest version of this document, please visit:

<http://www.object-refinery.com/jworkbook/index.html>

You should note that the author of this document is not involved directly in the Gnumeric project. Also, although Gnumeric is available in source code form, this source code has not yet been referred to for documentation purposes (it probably will be used at some point).

If you have any questions or comments about this document, please send an e-mail to: david.gilbert@object-refinery.com.

1.2 Gnumeric

Gnumeric is a spreadsheet application for the GNU/Linux operating system. It is developed as part of the Gnome Project:

<http://www.gnome.org>

The latest version of Gnumeric is 1.06. However, this document has been written using version 1.04 of Gnumeric (which is included with SuSE Linux 8.0).

1.3 Viewing the Gnumeric XML

Although Gnumeric uses XML for saving workbooks to file, it doesn't write a pure text file to disk. In order to save space, the raw XML is compressed using **gzip**. If you want to view the file in a text editor, first you must unzip the file using **gunzip**. Alternatively, you can use the **zcat** command to view the contents of the file.

2 File Format: Workbook

2.1 XML Identifier

All Gnumeric data files begin with the *XML identifier*:

```
<?xml version="1.0"?>
```

This identifier is present in all XML files and is not unique to the Gnumeric file format.

2.2 Workbook

A workbook is a collection of worksheets. Within the Gnumeric file, the *workbook* element is the *root element*. The workbook element begins with the following tag:

```
<gmr:Workbook xmlns:gmr="http://www.gnome.org/gnumeric/v7">  
  ...  
</gmr:Workbook>
```

Within this tag, the workbook needs to save information about each of the elements listed in the table below:

Element:	Description:
Attributes	Visibility of spreadsheet controls such as scroll bars, worksheet selection.
Summary	Properties of the document. The author, the creating application etc.
SheetNameIndex	Worksheet names.
Names	Names defined in the workbook.
Geometry	The size of the spreadsheet window.
Sheets	The individual worksheets that make up the workbook.
UIData	The selected tab.

Each of these elements is described in one of the following subsections.

2.3 Attributes

Each workbook has a set of attributes that the user can modify via the Gnumeric user interface. These attributes are recorded by subelements appearing between the following tags:

```
<gmr:Attributes>  
  ...  
</gmr:Attributes>
```

The table below lists the attributes that can be defined:

Attribute:	Description:
<code>show_horizontal_scrollbar</code>	Determines whether or not the horizontal scrollbar is visible for the workbook.
<code>show_vertical_scrollbar</code>	Determines whether or not the vertical scrollbar is visible for the workbook.
<code>show_notebook_tabs</code>	Determines whether or not the notebook tabs are visible for the workbook.
<code>do_auto_completion</code>	Determines whether or not auto-completion is on.

Note: the attributes all relate to the Gnumeric user interface rather than the actual content of the workbook.

2.3.1 Attribute

All attributes have three sub-elements: `name`, `type` and `value`. For example:

```
<gmr:Attribute>
  <gmr:name>WorkbookView::show_horizontal_scrollbar</gmr:name>
  <gmr:type>4</gmr:type>
  <gmr:value>TRUE</gmr:value>
</gmr:Attribute><gmr:Attributes>
```

2.4 Summary

In Gnumeric, the *document summary* is a set of properties that attach to the document. These properties define such things as the document's title and author. All summary information appears between the following tags:

```
<gmr:Summary>
  ...
</gmr:Summary>
```

The items that can appear in the document summary are listed in the table below:

Item:	Description:
<code>application</code>	The name of the application used to create the workbook. Normally this will be <code>gnnumeric</code> , but you might have another application that generates data in this format.
<code>title</code>	The title of the document.
<code>author</code>	The author of the document.
<code>category</code>	The category of the document.
<code>keywords</code>	Keywords associated with the document.
<code>manager</code>	The author's manager.
<code>company</code>	The author's company.
<code>comments</code>	Comments relating to the document.

Any items not defined are omitted from the file. It appears that the application and author take default values.

I've noticed the following items in a worksheet imported from Excel:

Item:	Description:
codepage	For example: 1252.
created	For example: Sat Oct 27 01:01:00 2001.
security	For example: 0.
thumbnail_scaling	For example: False.
links_uptodate	For example: False.
last_author	The last author to edit the document.

2.4.1 Summary Items

Each summary item is defined in the following format:

```
<gmr:Item>
  <gmr:name>application</gmr:name>
  <gmr:val-string>gnumeric</gmr:val-string>
</gmr:Item>
```

2.5 SheetNameIndex

This element contains the names of the worksheets in the workbook:

```
<gmr:SheetNameIndex>
  <gmr:SheetName>Sheet1</gmr:SheetName>
</gmr:SheetNameIndex>
```

The same information also appears in the name element within the sheets element. I'm not sure of the reason for the duplication, but I'm sure there will be one!

2.6 Names

Gnumeric allows individual cells to be assigned names. Any formulae in the workbook that reference a named cell can use the name instead of the cell's column and row references. This improves the readability of formulae within a workbook.

All the names defined for a workbook are included in this element. Here is an example:

```
<gmr:Names>
  <gmr:Name>
    <gmr:name>NameForA4</gmr:name>
    <gmr:value>A4</gmr:value>
  </gmr:Name>
</gmr:Names>
```

2.7 Geometry

This element records the current size of the window used to display the workbook. Presumably this is so that Gnumeric can restore the window to its previous size when the document is re-opened. A typical entry looks like this:

```
<gmr:Geometry Width="552" Height="402"/>
```

2.8 Sheets

This element records the worksheets that make up the workbook.

```
<gmr:Sheets>  
  ...  
</gmr:Sheets>
```

Each worksheet can hold a lot of information with a very flexible structure. Since the worksheet element is a major component of the file format, the description continues in the next section.

2.9 UIData

This element defines the selected tab (corresponds to a worksheet) within the workbook. For example:

```
<gmr:UIData SelectedTab="0"/>
```


3 File Format: Worksheets

3.1 Introduction

In the previous section, we deferred a full description of the <Sheets> element. This description is provided in this section.

3.2 Sheet

This element defines the contents of a single worksheet.

```
<gmr:Sheet DisplayFormulas="false" HideZero="false" ... >
  ...
</gmr:Sheet>
```

The list of attributes defined in the `Sheet` tag include:

Attribute:	Description:
<code>DisplayFormulas</code>	A flag indicating that the worksheet should display formulae rather than calculated values.
<code>HideZero</code>	A flag indicating that zero values should not be displayed.
<code>HideGrid</code>	A flag indicating that the grid should not be displayed.
<code>HideColHeader</code>	A flag indicating that the column header should not be displayed.
<code>HideRowHeader</code>	A flag indicating that the row header should not be displayed.
<code>DisplayOutlines</code>	Outline settings.
<code>OutlineSymbolsBelow</code>	Outline settings.
<code>OutlineSymbolsRight</code>	Outline settings.

Each sheet is defined by a collection of subelements, listed in the following table:

Element:	Description:
<code>Name</code>	The name of the worksheet.
<code>MaxCol</code>	The last column that contains data.
<code>MaxRow</code>	The last row that contains data.
<code>Zoom</code>	The current zoom setting.
<code>Names</code>	Names defined.
<code>PrintInformation</code>	Print setup details.
<code>Styles</code>	Formatting information.
<code>Cols</code>	Column attributes.
<code>Rows</code>	Row attributes.
<code>Selections</code>	Selected ranges.
<code>Objects</code>	Objects (including comments) that are attached to the worksheet.
<code>Cells</code>	The contents of individual cells.
<code>Solver</code>	Settings for the solver utility.

3.3 Name

The name of the spreadsheet. For example:

```
<gmr:Name>Worksheet 1</gmr:Name>
```

There does not appear to be a maximum length for this item.

3.4 MaxCol

The last column in the sheet that contains data. For example:

```
<gmr:MaxCol>8</gmr:MaxCol>
```

Note the following points:

- the maximum number of columns in a worksheet is 256;
- for an empty worksheet, the value of `MaxCol` is set to -1.

3.5 MaxRow

The last row in the sheet that contains data. For example:

```
<gmr:MaxRow>200</gmr:MaxRow>
```

Note the following points:

- the maximum number of rows in a worksheet is 65,536;
- for an empty worksheet, the value of `MaxRow` is set to -1.

3.6 Zoom

The current zoom setting for the sheet. For example:

```
<gmr:Zoom>1.000000</gmr:Zoom>
```

This can be anything in the range 0.05 to 5.00 (that is, 5% to 500%).

3.7 Names

Names defined for the worksheet. For example:

```
<gmr:Names>
  <gmr:Name>
    <gmr:name>Total</gmr:name>
    </gmr:value>Sheet1!$B$5</gmr:value>
  </gmr:Name>
</gmr:Names>
```

If there are no names defined, an empty element is included in the file:

```
<gmr:Names/>
```

3.8 PrintInformation

Printing information is recorded within these tags:

```
<gmr:PrintInformation>
  ...
</gmr:PrintInformation>
```

The following sub-elements are recorded:

Element:	Description:
Margins	Page margins.
vcenter	Indicates whether or not each page is centered vertically.
hcenter	Indicates whether or not each page is centered horizontally.
grid	Indicates whether or not the grid lines are shown in the printed output.
even_if_only_style	???
monochrome	Print in monochrome only.
draft	Print in draft quality only.
titles	???
repeat_top	???
repeat_left	???
order	???
orientation	The page orientation (portrait or landscape).
Header	Items to be printed at the head of every page.
Footer	Items to be printed at the foot of every page.
paper	The paper size (A4, US-Letter).

3.8.1 Margins

Defines the page margins. For example:

```
<gmr:Margins>
  <gmr:top Points="28.3" PrefUnit="cm"/>
  <gmr:bottom Points="28.3" PrefUnit="cm"/>
  <gmr:left Points="28.3" PrefUnit="cm"/>
  <gmr:right Points="28.3" PrefUnit="cm"/>
  <gmr:header Points="14.2" PrefUnit="cm"/>
  <gmr:footer Points="14.2" PrefUnit="cm"/>
</gmr:Margins>
```

3.8.2 VCenter

Controls whether or not the worksheet content is centered (vertically) on the page when it is printed. For example:

```
<gmr:vcenter value="1"/>
```

A value of 0 represents **false** and a value of 1 represents **true**. The default is **false**.

3.8.3 HCenter

Controls whether or not the worksheet content is centered (horizontally) on the page when it is printed. For example:

```
<gmr:hcenter value="1"/>
```

A value of 0 represents `false` and a value of 1 represents `true`. The default is `false`.

3.8.4 Grid

Controls whether or not the grid is printed for the worksheet. For example:

```
<gmr:grid value="1"/>
```

A value of 0 represents `false` and a value of 1 represents `true`. The default is `false`.

3.8.5 Monochrome

Controls whether or not printing is in monochrome. For example:

```
<gmr:monochrome value="0"/>
```

A value of 0 represents `false` and a value of 1 represents `true`.

3.8.6 Draft

Controls whether or not the worksheet is printed in draft format. For example:

```
<gmr:draft value="0"/>
```

A value of 0 represents `false` and a value of 1 represents `true`.

3.8.7 Titles

Indicates whether or not the titles are printed for the worksheet. For example:

```
<gmr:titles value="0"/>
```

A value of 0 represents `false` and a value of 1 represents `true`.

3.8.8 Repeat_Top

For example:

```
<gmr:repeat_top value=""/>
```

3.8.9 Repeat_Left

For example:

```
<gmr:repeat_left value=""/>
```

3.8.10 Order

Controls the order of printing multiple pages. For example:

```
<gmr:order>r_then_d</gmr:order>
```

3.8.11 Orientation

The paper orientation. For example:

```
<gmr:orientation>landscape</gmr:orientation>
```

3.8.12 Header

Text to be printed at the top of every page. For example:

```
<gmr:Header Left="" Middle="&[TAB]" Right=""/>
```

3.8.13 Footer

Text to be printed at the bottom of every page. For example:

```
<gmr:Footer Left="" Middle="Page &[PAGE]" Right=""/>
```

3.8.14 Paper

The paper size. For example:

```
<gmr:paper>A4</gmr:paper>
```

The following table lists possible entries:

Value:	Description:
A4	Standard A4 size.
USLetter	US Letter size.

3.9 Styles

This element contains all the formatting information for the current worksheet.

```
<gmr:Styles>  
  ...  
</gmr:Styles>
```

A full description of this element is deferred to a later section.

3.10 Cols

This element records information about the columns in a worksheet. The `<Cols>` tag includes an attribute `DefaultSizePts` that defines the default column width. Subelements appear between the `<Cols>` tags:

```
<gmr:Cols DefaultSizePts="48">
  ...
</gmr:Cols>
```

3.10.1 ColInfo

This element contains the attributes for a single column. For example:

```
<gmr:ColInfo No="0" Unit="48" MarginA="2" MarginB="2" ... />
```

The attributes are listed in the table below:

Attribute:	Description:
No	The column number.
Unit	The column width.
MarginA	The left margin?
MarginB	The right margin?
HardSize	??
Hidden	A value of 1 indicates that the column is hidden.
Count	The number of consecutive columns that these attributes apply to.

3.11 Rows

This element records information about the rows in a worksheet. The `<Rows>` tag includes an attribute `DefaultSizePts` that defines the default row height. Subelements appear between the `<Rows>` tags:

```
<gmr:Rows DefaultSizePts='12.8'>
  ...
</gmr:Rows>
```

3.11.1 RowInfo

This element contains the attributes for a single row. For example:

```
<gmr:RowInfo No="0" Unit="12.8" MarginA="1" MarginB="0" ... />
```

The attributes are listed in the table below:

Attribute:	Description:
No	The row number;
Unit	The row height;
MarginA	The top margin?;
MarginB	The bottom margin?;
HardSize	??;
Hidden	A value of 0 indicates that the row is visible, while 1 indicates that the row is hidden.
Count	The number of consecutive rows sharing the same attributes.

3.12 Selections

This element records the current selection(s) within the worksheet. Many cells can be included within a selection, but only one cell on a worksheet can have the input focus—this cell is designated by the `CursorCol` and `CursorRow` attributes. For example:

```
<gmr:Selections CursorCol="4" CursorRow="0">
  ...
</gmr:Selections>
```

3.12.1 Selection

This element records the attributes for a single selection. For example:

```
<gmr:Selection startCol="4" startRow="0" endCol="6" endRow="65535"/>
```

The attributes are fairly self-explanatory.

3.13 Objects

This section records details about any objects that have been added to the worksheet. Cell comments are represented as objects:

```
<gmr:CellComment Author="" Text="" ObjectBound="D4"
  ObjectOffset="0 0 0 0" ObjectAnchorType="33 32 33 32"/>
```

3.14 Cells

Lists all the cells in the current worksheet.

```
<gmr:Cells>
  ...
</gmr:Cells>
```

Between the tags, there will usually appear a list of elements defining individual cells.

3.14.1 Cell

Defines the content and properties of a single cell. The `<Cell>` tag contains attributes that define the row and column numbers for the cell.

```
<gmr:Cell Col="0" Row="0" Style="0">  
  ...  
</gmr:Cell>
```

Between the opening and closing tags, there appears text that defines the content of the cell.

3.15 Solver

This element records the settings for the Solver tool, if it has been used.

Attribute:	Description:
TargetCol	The column number of the target cell.
TargetRow	The row number of the target cell.
ProblemType	??
Inputs	??

For a worksheet where the solver tool has not been used, this element appears as follows:

```
<gmr:Solver TargetCol="-1" TargetRow="-1" ProblemType="1" Inputs=""/>
```


4 File Format: Styles

In the previous section, we deferred the description of one important element in the worksheet definition, the *styles element*. This element defines the formatting of all of the content of a worksheet.

All the style information is contained within the worksheet element between the styles tags:

```
<gmr:Styles>
  ...
</gmr:Styles>
```

Inside these tags is a list of non-overlapping style regions.

4.1 StyleRegions

The style region element defines the region that it applies to, be referring to the start column and row, and the end column and row. Inside the style region element, a single style element defines the style that applies to the region:

```
<gmr:StyleRegion startCol="1" startRow="1" endCol="1" endRow="1">
  <gmr:Style HAlign="2"...
  ...
  <gmr:Style>
</gmr:StyleRegion>
```

Between the opening and closing tags for the style element, there will appear two sub-elements defining the font and border settings for the region. These elements will be described shortly, but first we cover the attributes for the style element, a full list appears in the following table:

Attribute:	Description:
HAlign	The horizontal alignment (codes listed below).
VAlign	The vertical alignment (codes listed below).
WrapText	A flag indicating whether text should be wrapped within cells.
Orient	The text orientation.
Shade	The shade.
Indent	Indentation.
Fore	The foreground color.
Back	The background color.
PatternColor	The pattern color.
Format	The text formatting pattern.

The horizontal alignment codes are listed in the table below:

Gnumeric Code:	Horizontal Alignment:
1	General.
2	Left.
4	Right.
8	Center.
16	Fill.
32	Justify.
64	Center across selection.

The vertical alignment codes are listed in the table below:

Gnumeric Code:	Vertical Alignment:
1	Top.
2	Bottom.
4	Center.
8	Justify.

4.1.1 Colors

The `Fore`, `Back` and `PatternColor` attributes require a color to be specified. Gnumeric uses RGB values, with each value being specified in the range 0000 to FFFF. For example:

```
Fore="3000:3000:9800"
```

This allows an incredible range of colors. In both Gnumeric and Microsoft Excel, the user interface provides for a selection from a standard range of 40 colors (with the option to select custom colors as well). The following tables list the standard colors that are supplied in each product:

Gnumeric Color:	Value:
Black	"0:0:0"
Light Brown	"9800:3000:0"
Brown Gold	"3000:3000:0"
Dark Green #2	"0:3000:0"
Navy	"0:3000:6000"
Dark Blue	"0:0:8000"
Purple #2	"3000:3000:9800"
Very Dark Gray	"3000:3000:3000"
Dark Red	"8000:0:0"
Red Orange	"F800:6400:0"
Gold	"8000:8000:0"
Dark Green	"0:8000:0"
Dull Blue	"0:8000:8000"
Blue	"0:0:F800"
Dull Purple	"6000:6400:9800"
Dark Gray	"8000:8000:8000"
Red	"F800:0:0"
Orange	"F800:9800:0"
Lime	"9800:CC00:0"
Dull Green	"3000:9800:6000"
Dull Blue #2	"3000:CC00:C800"
Sky Blue #2	"3000:6400:F800"
Purple	"8000:0:8000"
Gray	"9000:9400:9000"
Magenta	"F800:0:F800"
Bright Orange	"F800:CC00:0"
Yellow	"F800:FC00:0"
Green	"0:FC00:0"
Cyan	"0:FC00:F800"
Bright Blue	"0:CC00:F800"
Red Purple	"9800:3000:6000"
Light Gray	"C000:C000:C000"
Pink	"F800:9800:C800"
Light Orange	"F800:CC00:9800"
Light Yellow	"F800:FC00:9800"
Light Green	"C800:FC00:C800"
Light Cyan	"C800:FC00:F800"
Light Blue	"9800:CC00:F800"
Light Purple	"C800:9800:F800"
White	"FFFF:FFFF:FFFF"

Excel Color:	Value:
Black	"0:0:0"
Brown	"9999:3333:0"
Olive Green	"3333:3333:0"
Dark Green	"0:3333:0"
Dark Teal	"0:3333:6666"
Dark Blue	"0:0:8080"
Indigo	"3333:3333:9999"
Gray-80%	"3333:3333:3333"
Dark Red	"8080:0:0"
Orange	"FFFF:6666:0"
Dark Yellow	"8080:8080:0"
Green	"0:8080:0"
Teal	"0:8080:8080"
Blue	"0:0:FFFF"
Blue-Gray	"6666:6666:9999"
Gray-50%	"8080:8080:8080"
Red	"FFFF:0:0"
Light Orange	"FFFF:9999:0"
Lime	"9999:CCCC:0"
Sea Green	"3333:9999:6666"
Aqua	"3333:CCCC:CCCC"
Light Blue	"3333:6666:FFFF"
Violet	"8080:0:8080"
Gray-40%	"9696:9696:9696"
Pink	"FFFF:0:FFFF"
Gold	"FFFF:CCCC:0"
Yellow	"FFFF:FFFF:0"
Bright Green	"0:FFFF:0"
Turquoise	"0:FFFF:FFFF"
Sky Blue	"0:CCCC:FFFF"
Plum	"9999:3333:6666"
Gray-25%	"C0C0:C0C0:C0C0"
Rose	"FFFF:9999:CCCC"
Tan	"FFFF:CCCC:9999"
Light Yellow	"FFFF:FFFF:9999"
Light Green	"CCCC:FFFF:CCCC"
Light Turquoise	"CCCC:FFFF:FFFF"
Pale Blue	"9999:CCCC:FFFF"
Lavender	"CCCC:9999:FFFF"
White	"FFFF:FFFF:FFFF"

4.1.2 Font

This element defines the font that is used for a style region. A typical font element looks like this:

```
<gmr:Font Unit="9" Bold="0" ... >Helvetica</gmr:Font>
```

The text between the tags specifies the name of the font, while the elements attributes control the font size and other characteristics. The following table lists all the attributes for the font element:

Attribute:	Description:
Unit	The font size (in points).
Bold	Bold text.
Italic	Italic text.
Underline	Underlined text.
StrikeThrough	Strikethrough text.

For the **Bold**, **Italic**, **Underline** and **StrikeThrough** attributes, a value of 1 indicates **yes**, **true** or **on**, while a value of 0 indicates **no**, **false** or **off**.

4.1.3 StyleBorder

This element defines the borders that are used for a style region. A typical border entry looks like this:

```
<gmr:StyleBorder>
  <gmr:Top Style="0"/>
  <gmr:Bottom Style="0"/>
  <gmr:Left Style="0"/>
  <gmr:Right Style="0"/>
  <gmr:Diagonal Style="0"/>
  <gmr:Rev-Diagonal Style="0"/>
</gmr:StyleBorder>
```

The border codes are listed¹ in the table below:

Gnumeric Code:	Border Type:
0	None
7	Dotted Line
4	Dashed Line 1
11	Dashed Line 2
9	Dashed Line 3
3	Dashed Line 4
1	Line
12	Thick Dashed Line 1
13	Thick Dashed Line 2
10	Thick Dashed Line 3
8	Thick Dashed Line 4
2	Thick Line
5	Extra Thick Line
6	Double Line

¹If you are curious about the ordering, I've simply followed the order in which the borders appear in the Gnumeric user interface.

A An Empty Workbook

Listed here is a Gnumeric file representing an empty workbook. I've found this useful for understanding the overall structure of the file, without being distracted by particular workbook content.

```
<?xml version="1.0"?>
<gmr:Workbook xmlns:gmr="http://www.gnumeric.org/v10.dtd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
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