

The Calligra Suite
White paper
for version 3.0 Snapshot 11st ed.

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1 Preface

This document describes the Calligra Suite, the office suite from the KDE community, version 3.0 Snapshot 1. The intended audience is people who want to find out what Calligra is, and decision-makers potentially interested in deploying Calligra software within their organization, either as applications or batch-processing document management tools.

2 Introduction to Calligra

Calligra comprises the following components:

- an **Open Source based application suite** with well integrated office and graphics applications that use the OpenDocument format (ODF) as its native format. The application suite has user interfaces for desktop and handset form factors from the open source community. Additionally, other third party user interfaces for tablets and handsets exist or are being developed.
- a set of **file conversion programs** that convert from one office document format to another. These so called *filters* are executed in the background by Calligra applications whenever documents in formats other than ODF are opened or saved. The filters can also be used as stand-alone programs to convert files with different formats.

The most comprehensive filters are those for the Microsoft Office formats.

- a **library of plugins** that lets the user manipulate advanced objects in their documents. These objects can be standard objects like charts or mathematical formulas, but also more specialized ones like music scores. Other types of plugins provide connectivity to web services, spell checking, and other types of extensions. The plugins and objects can be used in any Calligra application.
- an embeddable **Office Engine** that can be embedded into any other application. This engine is very much like WebKit that makes it easy to create applications with embedded web canvases. The Calligra Office Engine makes it extremely simple to embed office document functionality inside other applications.
- a set of **toolkit and libraries** for software developers that can be used to view and manipulate office document files. This toolkit can be used as building blocks in other applications to create solutions like batch document processing applications, simplified document viewers running on mobile devices or embedding office functionality inside in-house applications.

Calligra is built using the Qt toolkit (<http://qt.nokia.com/>) and the libraries from the KDE community (kdelibs). This makes Calligra portable to all major platforms. Calligra currently runs on Linux and other Unix variations, Windows, Mac OS X, and Haiku using the desktop interface. It also runs on mobile platforms like Maemo and MeeGo using the mobile interface.

Applications

Calligra 3.0 Snapshot 1 contains the following applications:

Office productivity:

- **Words** Word processor
- **Tables** Spreadsheet calculator
- **Stage** Presentation program
- **Flow** Diagramming application in the style of MS Visio
- **Kexi** Integrated data management in the style of MS Access

- **Braindump** Mind mapping and note taking

Creativity applications:

- **Karbon** Vector graphics
- **Krita** Painting and image manipulation

Management:

- **Plan** Project planning

Advanced plugins (see below):

- **Charts** Graphic data visualization
- **Formulas** Mathematical formulas

3 Calligra Applications

This section describes properties of Calligra that are visible to users. It describes the two major user experiences (UX) of Calligra and explains some of the choices that were made while designing the user interfaces.

Desktop Edition

The desktop edition is designed to fit on today's wide screens, using so-called dockers for formatting controls. This can be seen as a variation of the Microsoft ribbon introduced in Office 2007, except that the control area is not locked to the upper side of the document view. The standard configuration shows the dockers to the side of the document, making it a good choice for laptop and netbook computers. However, the user can change the position and size and the layout of the dockers very easily by moving them by dragging with the mouse. Dockers can also be dragged away from the main window and turned into separate windows.

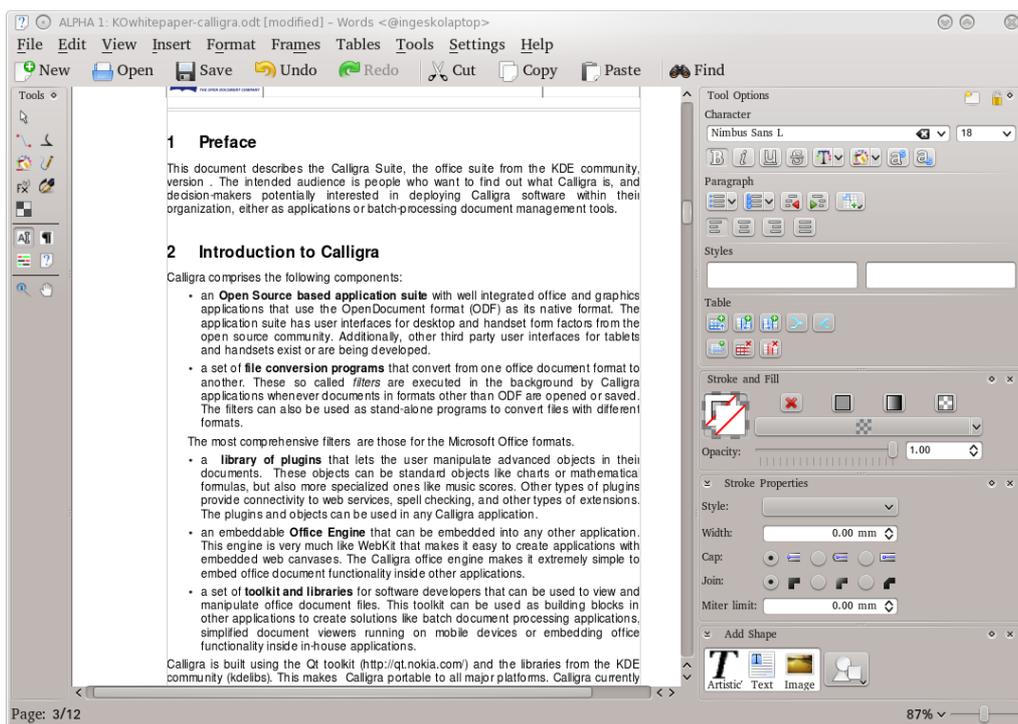


Illustration 1: Words with the standard desktop user interface.

All Calligra applications share a common pool of controls so the user can easily reuse knowledge from one application to another. It is also possible to embed all types of shapes into every application. The applications' controls look native to the underlying operating system, so Windows or Mac OS X users see the Calligra applications as native programs, running without emulation.

Mobile Edition

The mobile edition of Calligra is designed to fit on a much smaller screen, using other input devices than the desktop edition. At this time, the Calligra mobile edition provides viewing and simple editing. It uses a touch screen interface with a much simpler UI than the desktop edition.

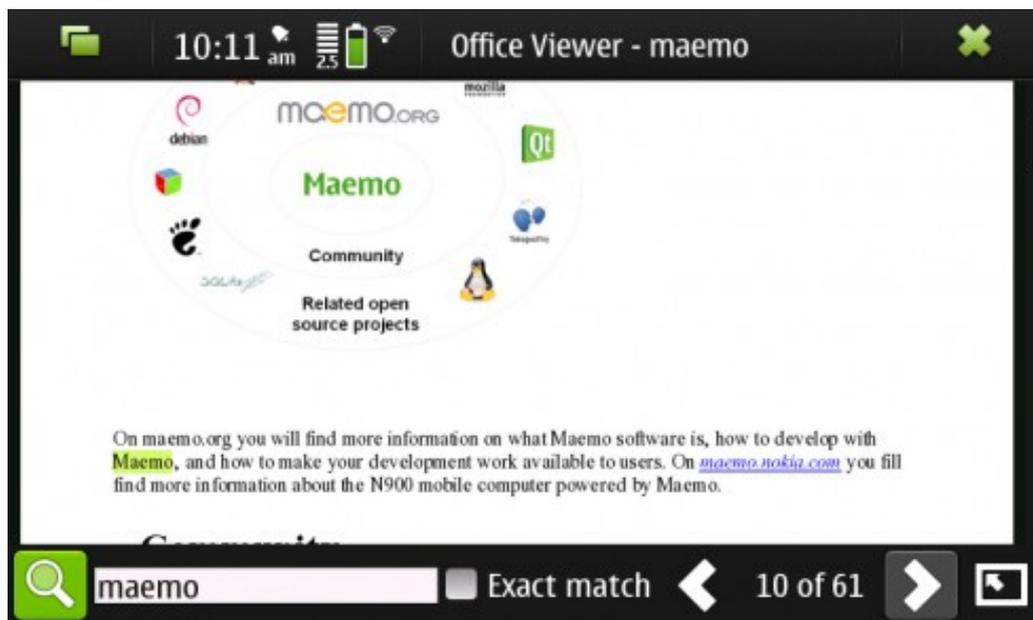


Illustration 2: The Maemo version of Calligra Words using a simplified user interface and a touch screen for control.

The mobile edition contains viewers for text documents, spreadsheet documents and presentations. It has support for Microsoft file formats, both the binary ones (doc, xls, ppt) and the XML based ones (docx, xlsx, pptx).

Input devices

In addition to keyboard and mouse, Calligra has support for many types of input devices like pressure sensitive input tablets. Other, more exotic ones, include the SPNav 3D input device (<http://www.3dconnexion.com/products/spacepilot-pro.html>). The Maemo 5 and MeeGo versions of the Calligra document viewer use a touch screen interface.

Platforms

Calligra is one of the most portable office suites. The desktop edition runs on Windows, Mac OS X, Linux and other Unix platforms. The mobile edition currently runs on the Nokia N900 using the Maemo 5 OS and MeeGo on various form factors. A special interface for tablets is under development.

The different editions all use the same common underlying engine. Different user interfaces can be used to maximize the user experience.

OpenDocument Format

Calligra uses the ISO standardized Open Document Format (ISO/IEC 26300:2006), also known as ODF, as its native format. ODF is adopted by many governments around the world

as the standard format for document interchange and/or storage. As ODF is also the file format that OpenOffice.org and LibreOffice use, using this document format ensures maximum compatibility with those office suites.

Compatibility with Other Office Software

The Calligra applications can read files from many other office applications. Most notable are the Microsoft Office formats DOC, XLS and PPT. Calligra also has good support for the XML-based Microsoft formats DOCX, XLSX and PPTX, commonly known as Microsoft Office Open XML. Other formats that are supported by Calligra are the older OpenOffice.org formats, Word Perfect, PalmDoc, dbase, html, csv and mdb (MS Access).

The best compatibility is achieved with other OpenDocument-based applications like OpenOffice.org. Calligra also works very well with other office applications offered by the KDE community, including the Kontact Suite (Mail, Calendar, Address book, To do list and RSS feed reader) and KDE business applications like Kraft and KMyMoney.

4 Software Architecture

This section describes the overall technical architecture of Calligra. It lays a foundation for the next section, that gives a deeper understanding of the internals.

Calligra is a third generation office application with a much more modern architecture than the previous generation. It is largely based on **plugins**, which makes it easily extensible, but also provides a flexible way to create custom office applications with a subset of the available feature set.

Each plugin can be used in any application. Some types of plugins can store special types of data. Other types can provide access to web services, like the Google Docs access plugin. There are over 20 types of plugins in Calligra, which makes it uniquely extensible.

Toolkits and libraries

Calligra uses the Qt toolkit from Nokia (previously TrollTech). Qt is a cross-platform toolkit which is portable between many platforms, among them Windows, Mac OS X, Linux and other Unix platforms, Symbian and Windows CE. On top of the Qt toolkit, Calligra makes use of the KDE libraries, which among other things gives it better network transparency and integration with the semantic desktop.

Calligra also builds on other industry standard libraries like zlib (compression), png, jpeg, dbus, glib and GObject. All of these are platform independent.

Embeddable Objects -- Shapes

One type of plugins in Calligra lets the user embed objects within the document. These objects are called *shapes*.¹ Each object type is contained in a separate plugin that handles storage, display, and possibly also editing of the object by using so called *tools* to manipulate them.

The shape plugins can vary from the extremely simple, like a line, rectangle or ellipse to the very complex like a 3D chart or music score. Calligra comes with a sizable library of shapes out of the box, and it is easy for a third-party developer to develop new shapes that can either be used stand-alone or interface to other resources like databases or web services. While it is not mandatory, Calligra extensibility is standardized on XML-based formats for saving and loading such as ODF or other similar standards like MathML or MusicML.

¹Internally in Calligra they are called *Flake Shapes*, after the subsystem that implements it.

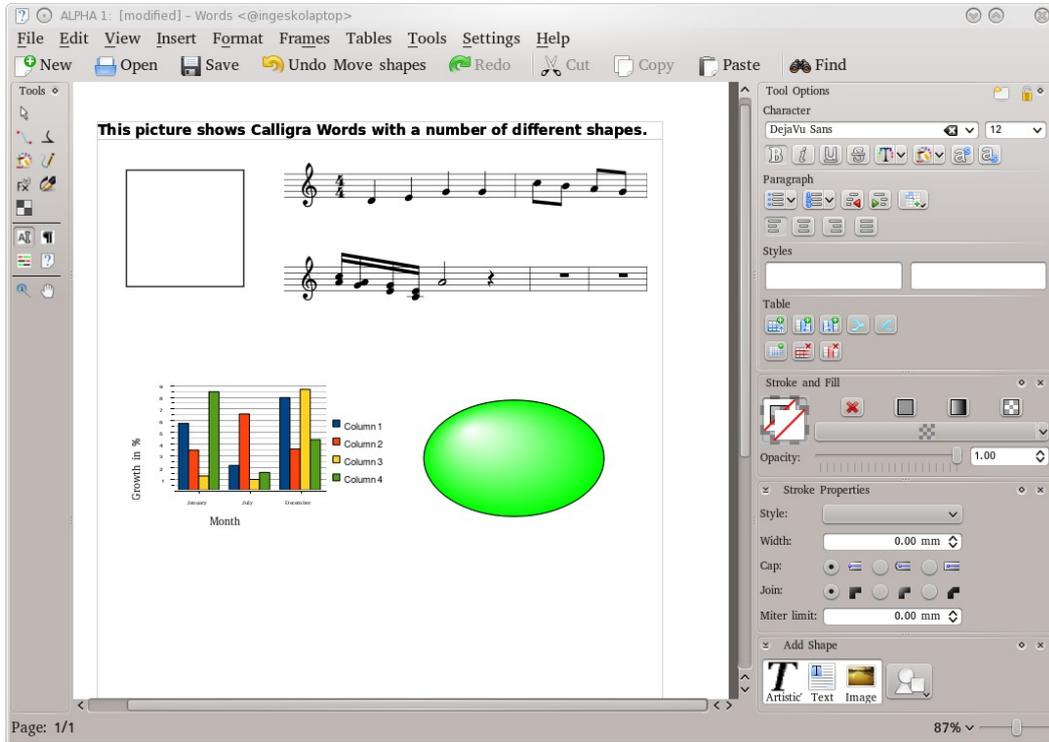


Illustration 3: Calligra Words with a set of different shapes

For the user, each shape is natural to insert and manipulate. For the system integrator, the *Flake* system makes it very easy to integrate Calligra applications into other systems. Each shape can be used in any application, with the same editor controls in all the applications.

Scripting with Kross

Calligra supports scripting using the *Kross* programming framework, a cross-language scripting tool. It largely simplifies making applications scriptable by exposing their features to system integrators and extension developers. A number of programming languages are available, like Javascript, Python, Ruby, and Java. Scripts written in different languages can cooperate and even call each other. This infrastructure is thus even more rich than the extension system of Firefox or Eclipse.

Kross is also the standard scripting framework for KDE applications.

Color Models

Calligra contains support for a full set of color models, i.e. not only the standard RGB colors with 8 bits per channel. The most important other color model that is used in Calligra is **CMYK** (Cyan, Magenta, Yellow, Black) that is standard in the printing industry. Other color models are grayscale, ycbcr and lms in 8, 16 and 32 bit integer and floating point colors. There are also more advanced color models such as sampled wavelength models. The Calligra color models also support a full range of color selectors for these color models as well as realistic color mixing.

Some applications based on Calligra technology, notably the paint application Krita, make full use of all these possibilities. Others currently only use a subset of them. A limitation is that the OpenDocument format currently only supports RGB, but this can be solved by introducing extensions to the format using a Calligra-specific namespace. For the office productivity applications, this has not yet been implemented.

5 Building Custom Solutions

Calligra is the application suite that is easiest to use when you are creating customized solutions. The powerful and flexible architecture makes it easy to both embed Calligra applications in your own internal applications or to create customized user interfaces for the existing applications. This section describes internal properties of Calligra and how to use them to create similar customizations.

What follows is a summary of the properties of Calligra that make it easy to work with for the developer. Features that makes Calligra the preferred open source based office suite for embedded platforms are also explained.

Plugin Based

The design of Calligra is dominated by the use of plugins. There are approximately 20 types of plugins within Calligra, from the Flake shapes to file format filters, text fields, text editing features and color models.

Switchable UI

The standard desktop edition of Calligra is designed as a full-featured editor for office documents. It is possible to adapt the UI for different needs, like a viewer-only application or a more limited screen size.

The standard desktop UI can even be completely replaced by a new one as was shown for the Maemo based Nokia N900 smart phone. The mobile edition of Calligra uses a touch interface with custom controls on a very limited screen for a completely different user experience. All this was done in less than 2500 lines of code².

Advanced Build System

The build process of Calligra is both flexible and quite simple. The build system is based on CMake, the cross-platform build tool from KitWare Inc. (<http://www.cmake.org/>).

When building Calligra, the engineer can decide whether to include into the result any application and any plugin. Most parts of Calligra can be easily included or excluded from the build, giving a fine-grained control of the final result. The build process is also well optimized thanks to extensive dependency calculations. If a component depends on another component that is excluded, e.g. a certain library, this component is also automatically excluded.

The engineer can also use a more high-level build option, named 'TINY', which creates a smaller build that is suitable for embedded devices. The 'TINY' option offers a pre-selected set of applications, features and document format filters. Other similar build options can easily be created by developers.

Calligra can be cross-compiled to other hardware and software platforms using the same CMake buildsystem, thus making it possible to develop on fast workstations for less powerful embedded platforms.

Flexibility and Adaptability

There are many design solutions that lead to Calligra being the most flexible and adaptable office suite openly available. The plugin based architecture is one. The many build options is another. It is also extremely easy to embed any Calligra application (including all the customizations mentioned above) into your own application. The reason for this is the concept of the Office Engine, as outlined below.

²See the subdirectory `calligra/tools/mobile` for the actual source code.

The Office Engine

The Office Engine loads, stores, saves and renders the contents of the office documents. The interface it provides is a graphic canvas where the contents of the document is rendered and an API to manipulate the display and also the content itself. Using the Calligra Office Engine, a simple viewer can be produced in as little as 20 lines of code. So far, the Office Engine has been used to produce a number of different UI's, and with more being developed.

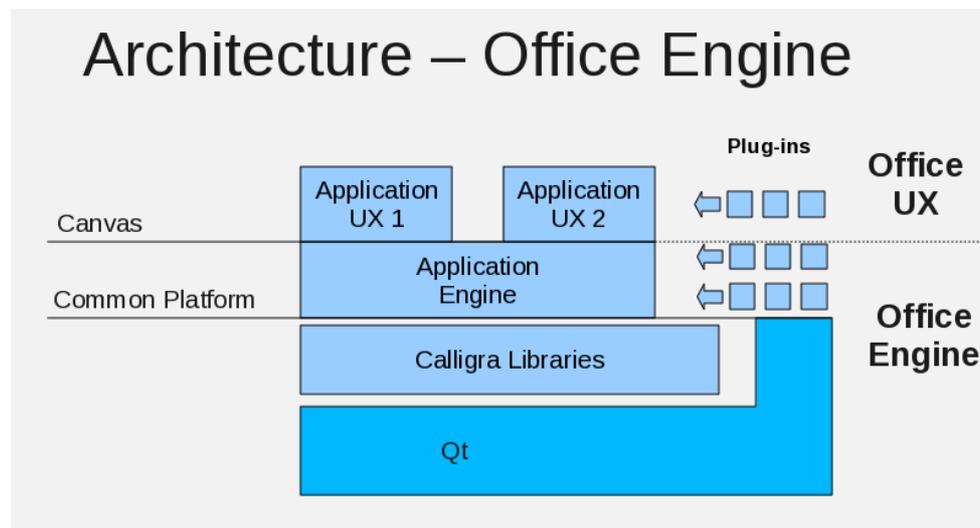


Illustration 4: The architecture of a Calligra application, using the office engine

The end result is that if your needs are not covered by the standard desktop edition, it can be faster and easier to create a customized version of Calligra than of any other similar application.

Light on Resources

Calligra is very light on resources like CPU and memory. It is suitable to use in embedded and mobile devices like smartphones or other portable units.

Since it is an Open Source product, Calligra can be easily altered in order to further limit memory and/or CPU consumption by exchanging some algorithms for leaner, but possibly slower algorithms. That way the perfect trade-off between resource usage and performance can be created.

The Code Base

The main deciding success factor when it comes to adapting a software for new use cases is the code base of the application. Calligra is known for having a very clean code base, making it easy to extend both with new functionality inside the code itself and also with new plugins without interfering in the code base.

Examples of the flexibility are the plugin-based architecture and build options. Calligra source code uses the kdelibs coding standards and much of the code is documented using the popular Doxygen system (see below). This lowers barrier for new developers.

Calligra is written mainly in C++. Some parts of the GUI are created in the Qt Designer GUI tool, so can be reviewed by non-developers and reused for creating custom versions of the office suite. A few scripts are written in other languages like Javascript.

Size

As of March 1st 2011, the source code of Calligra contains approximately 1.2 (1.0) Million Lines of Code (MLoC) including empty lines and comments. Figures in parenthesis are from March 1st 2010. This is split into approximately:

Applications	704 KLoC (676)
Plugins	105 KLoC (53)
Common Libraries	143 KLoC (133)
Filters	205 KLoC (178)
Total	1157 KLoC³ (1040)

This should be compared to OpenOffice.org that comprises around 5,5 MLoC, i.e. over 5 times as much, but with fewer applications. Also note that between the previous figures and now, there have been created 2 new applications: Flow and Braindump. Even so, the additional lines in the Applications section is only 28 KLoC, a real tribute to the power of the Calligra libraries and plugins.

Source Code Documentation

Many of the classes in the applications and all the libraries are documented using Doxygen (<http://www.doxygen.org>). Doxygen can generate documentation for source code files, classes, all methods of a class. It can also generate more high-level information like call graphs and inheritance diagrams. The Calligra community runs a web service that automatically generates fresh documentation every night, which can be seen on <http://api.kde.org/>.

License

All the core libraries and almost all of the applications and plugins are licensed under the GNU LGPL version 2 or later. LGPL-licensing of the libraries allows to dynamically link them with 3rd-party code of any license, including closed-source applications. The parts that are not using LGPL are using the GNU GPL (two external libraries).

6 The Calligra Community

The Calligra community consists of a combination of volunteers and paid developers. All the core developers are professional software developers and designers.

Open Source Community

Calligra is part of the KDE community (see <http://www.kde.org/>). KDE is a community comprising around 2000 developers that together develop the KDE Plasma Desktop, and around 100 end user and system applications. KDE is one of the largest open source communities in the world.

The Calligra core team consists of between 15 and 20 developers. These people all have several years of experience with Calligra, KDE and Qt development. Around this core team, there is a bigger group of people who contribute more irregularly. This total group counts around 70 members.

Calligra also makes use of the KDE infrastructure for version control, bug tracking, project planning, marketing and translation services. Calligra is translated into almost 30 languages, and including the translators, the full Calligra team consists of over 100 contributors.

Commercial Support

The German-based consulting company KO GmbH is founded by a number of core Calligra developers. It offers professional services around Calligra and the OpenDocument Format.

³ All numbers were calculated using the sloccount utility.

See <http://www.kogmbh.com/> for more information.

Resources

There are many resources for finding out more about Calligra and its community.

Calligra website: <http://www.calligra-suite.org/>
Krita website: <http://www.krita.org/>
Developer Wiki: <http://community.kde.org/Calligra>
Calligra bug tracker: <http://bugs.kde.org/> (search for individual applications)
Calligra Source code: <https://projects.kde.org/projects/calligra>
http://community.kde.org/Calligra/Building/Building_Calligra
Developer mailing list: calligra-devel@kde.org
IRC channel: #calligra at <irc://irc.freenode.org>

7 Comparison to Other Free Office Suites

Here follows a short comparison between Calligra and three other free office suites. A more comprehensive comparison can be seen on Wikipedia⁴.

OpenOffice.org

OpenOffice.org (OOo) is one of the most used open source end-user programs in the world. The suite comprises a word processor (**Writer**), a spreadsheet (**Calc**), and a presentation program (**Impress**). In addition to the three main applications, there is a vector drawing program, an editor for mathematical formulas and a database creator.

OOo is well integrated, although somewhat big and monolithic. Because of these factors, OpenOffice.org is not considered for deploying for mobile/embedded devices. The code base is very large, and considered as somewhat difficult to penetrate.

Usage

OOo has all or most of the features that are needed for modern office work. It runs on Windows, Mac OS X and many Unix variations including Linux. Many organizations have switched from MS Office to OOo because of the richness and low cost.

The biggest weakness of OOo is the large use of resources like memory and CPU, and its slow startup times.

File Formats

OpenDocument is the native file format for all OOo components, which makes it compatible with Calligra and other standard-compliant office applications. It has very good support for the MS Office binary file formats doc, xls and ppt. It also has limited, though often adequate, support for the MS Xml based formats and many other file formats.

Custom Solutions

OOo can be extended through a mechanism called UNO. If OOo already supports a certain platform, it can be programmed using a number of programming languages including Java and Python. Many so called extensions already exist for all parts of OOo.

Since OOo includes its own non-standard toolkit for user interfaces, it can be difficult to port to a new platform, and made to look native in the new environment. Because of the large code base, it is also difficult to make changes to the internals of OOo.

LibreOffice

LibreOffice (<http://www.thedocumentfoundation.org/>) is a fork of OpenOffice.org. The developers of OOo did not like many of the decisions that were taken by Oracle Corp, that

⁴http://en.wikipedia.org/wiki/Comparison_of_office_suites

owns OOo, and created their own branch of the source code.

In all technical aspects, LibreOffice is equivalent to OOo, although this will most likely change in the future.

Gnome Office

Gnome Office is a set of loosely connected stand-alone applications. Gnome Office consists of the **Abiword** word processor (<http://www.abisource.com/>), and the **Gnumeric** spreadsheet (<http://www.gnumeric.org/>). At <http://live.gnome.org/GnomeOffice/>, Gnome also lists the Evolution groupware and email application and the Evince document viewer as part of Gnome Office. We will not treat them further here, but if the reader wants to make a comparison with Calligra, the equivalent counterparts are the Kontact groupware client (<http://kontact.kde.org/>) and the Okular document viewer (<http://okular.kde.org/>).

In addition, the Gnome page also lists the Glom database designer, but that doesn't seem to be part of the actual suite. The applications in Gnome Office build on the Gtk+ toolkit, which is also used in the Gnome desktop. There is no presentation program.

Usage

Both Abiword and Gnumeric are mature programs with comprehensive feature sets. Abiword and Gnumeric each have more features than the Calligra counterparts Words and Tables but less features than OpenOffice.org. Abiword runs on a number of operating systems including Windows, Mac OS X and Linux and Gnumeric runs on Linux and Windows XP and later according to the website.

Both Abiword and Gnumeric are relatively lightweight applications. In particular Abiword is used in environments where memory and CPU resources are limited, like the One Laptop Per Child project.

File Formats

Abiword uses its own file format for storing documents. The Microsoft Doc format is supported as well as WordPerfect, RTF and HTML. OpenDocument is supported but only partly. A number of other file formats are supported, mostly for import. We recommend the user to study the table of file formats supported on the Abiword wiki.

Gnumeric offers support for MS Excel files. It also imports a number of other formats but with less accuracy. Gnumeric will import OpenDocument spreadsheets but saving is incomplete.

Custom Solutions

Abiword has a plugin system which is described like this in the website: "*A variety of plugins can be used to extend AbiWord's functionality, ranging from Document Importers to a Thesaurus, Image Importers and a Text Summarizer.*" Gnumeric also has a plugin system, but there seems to be only one plugin at this time.

8 Conclusion

For those who look for an office solution with the 3 standard applications (word processor, spreadsheet and presentations), OpenOffice.org is probably the best choice at this point in time.

Calligra applications or the Calligra toolkit should be evaluated if any of the following special needs are important:

- working with non-standard formats, protocols or objects
- providing document-handling interface to other applications or systems
- embedding an office application into another application or system

- creating a special user interface for specific needs or adjusted to the hardware limitations
- building a lightweight office document system
- batch, possibly headless, processing of office documents
- using office document components or toolkit in other applications.

9 Postscript

For questions that are not answered in this white paper, contact the author Inge Wallin, send a mail to one of the developer mailing list or talk with the developers in the IRC channel. The Team is always happy to help.