

OpenBerg e-Book Reader design and rationale

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Abstract. Edition of books has changed. Ten years ago, there were only two on-line publishers, both of them non-profit organisations. Nowadays, a number of companies provide one-size-fits-all on-line shops for on-line publishers or on-line self-published authors. On-line publications, however, tend to fall in one of the following categories

- project Gutenberg
- webpages
- proprietary formats
- open formats restricted by patents to proprietary readers.

The OpenBerg project aims at providing free, open-source and open-standard tools for digital publication (a.k.a. e-Publishing), for use by authors, readers and editors. In particular, our main effort is the development of OpenBerg Reader, a cross-platform, multi-format, e-Book reader targetted towards textbooks, exercise books and academic content.

This document describes the key notions of OpenBerg Reader, the choices we made regarding our tools and platforms, as well as the current status of the implementation and our plans for the future. The objective of this document is to serve as a reference for the developers of OpenBerg

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1 Introduction

It's about digital publications and the future of books, nothing less.

During the past ten years, edition has changed more than during the previous century. Not only are people less interested in traditional paper books and journals, new means of self-publication are now within the reach of anyone, even with limited technical skills, through websites, wikis, blogs, PDFs or even attached Word documents. There's even an open-

and the Swing Toolkit as implementation target has the same drawbacks as in the case of OSoft.

Comparison with Plucker Plucker [8] permits under-average pagination, a little degree of library management, and it is tied to PalmOS.

1.2 Our objective

OpenBerg Reader has recently been selected as a potential candidate for inclusion in project One Laptop Per Child [6], along with ThoutReader and EVince. If this happens, OpenBerg Reader will be distributed to millions of children of Third-World countries, and will serve as support for reading textbooks and the Wikipedia.

Our objective is to strive to be effectively selected. In order to do so, we are currently working on adding features to OpenBerg Reader and re-working features to make them usable on low-powered laptops with either small resolutions or grayscale display.

We believe that OpenBerg Reader will be judge acceptable when

- the current memory-related problems of the Mozilla platform are solved
- OpenBerg Reader is feature-complete with respect to Milestone 4 (see Section B.1)
- OpenBerg Reader is well-tested.

1.3 Contents of this document

This role of this document is to serve as a reference regarding the design of OpenBerg. In chapter 2, we present the tools used in the development of OpenBerg. In chapter 3, we detail the modules of OpenBerg. We conclude in chapter 4 by a review of our work, a discussion on the adequation of OpenBerg Reader with OLPC's goals and our plans for the future. Appendix 1 briefly presents the team, Appendix 2 details our Roadmap, Appendix 3 contains build instructions and Appendix 4 displays the licenses used in the project.

2 Tools and design choices

2.1 Formats

Most e-Book viewers are mono-format. Some, as EVince, are multi-format, insofar as they have to reimplement some of their features (e.g.

\LaTeX The \LaTeX format is actually a powerful programming language intended for compilation before display. It offers extremely rich pag-

- Gtk Very good toolkit, cross-platform, supporting internationalisation, open-source, but its display of XHTML + CSS is extremely limited.
- Gtk + WebKit This addition permits XHTML + CSS rendering, but WebKit hasn't reached alpha version yet (and didn't even exist when we started working on OpenBerg).
- wxWidgets wxWidgets (formerly wxWindows) is an open-source cross-platform meta-toolkit able to map to Gtk, MFC, Cocoa and others. Its support for internationalisation is limited and its XHTML component is extremely limited.
- wxWidgets + wxMozilla This addition permits XHTML + CSS ren-

2.4 Licensing

The matter of licensing is an important problem. Indeed, while we wish OpenBerg to be free software and to stay free software, it might be interesting to extend OpenBerg to proprietary formats. In fact, we have been approached by three publishers hoping that they could use OpenBerg on proprietary platforms and/or with proprietary formats, possibly with digital signatures or with so-called Digital Rights Management.

At the moment, this question is not fully resolved. Our plans are to release everything under the Gnu General Public License (see Section D.1), double-licensing the XPidl interfaces under the Gnu Lesser General Public License (see Section D.2). This choice should give us the maximal freedom, while ensuring that our work will stay free software and while giving publishers the possibility of adding new input formats. Note that a consequence of this choice is that publishers will be able to customise the user interface with proprietary extensions through the use of Mozilla's extension mechanism (mostly with ui overlaying techniques) but not by altering the source code of OpenBerg Reader.

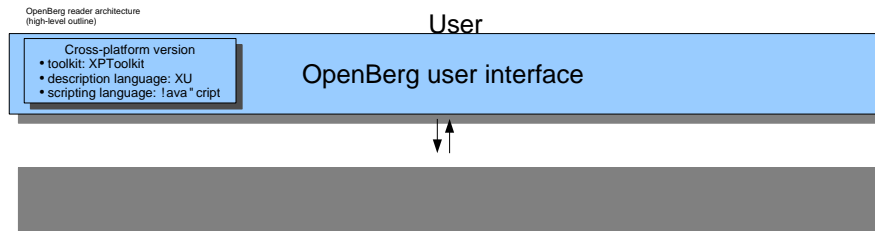


Figure 1: High-level outline of OpenBerg

3.3 Cross-platform UI

3.3.1 Overview

Figure 2 presents an overview of the structure of OpenBerg's cross-platform UI.

The cross-platform UI is composed exclusively of cross-platform code and data, i.e.

- XUL for the description of the user-interface itself
- XBL for the definition of XUL components
- JavaScript to add behaviours to the UI
- CSS for the styling of components
- PNG for icons
- Java/JavaScript string bundles, as `.properties` files, containing the internationalised, human-readable, texts for use in JavaScript code
- DTD for the definition of entities, containing the internationalised, human-readable, texts for use in XUL code.

may be referenced as `chrome://openberg/content/...`

3.4 Platform-specific UI

At the moment, one platform-specific UI is under development, for Windows Mobile, on top of Minimo. This platform is currently at an early stage of specifications.

3.5 OpenBerg Core

3.5.1 Overview

The core is developed exclusively in C++, using Mozilla's XPCOM libraries. Among other things, this means that the code should contain no call to libc. The objective of this being to make OpenBerg as platform-independent as Mozilla itself. Note that this limitation should not be constraining as Mozilla itself is built on top of

-

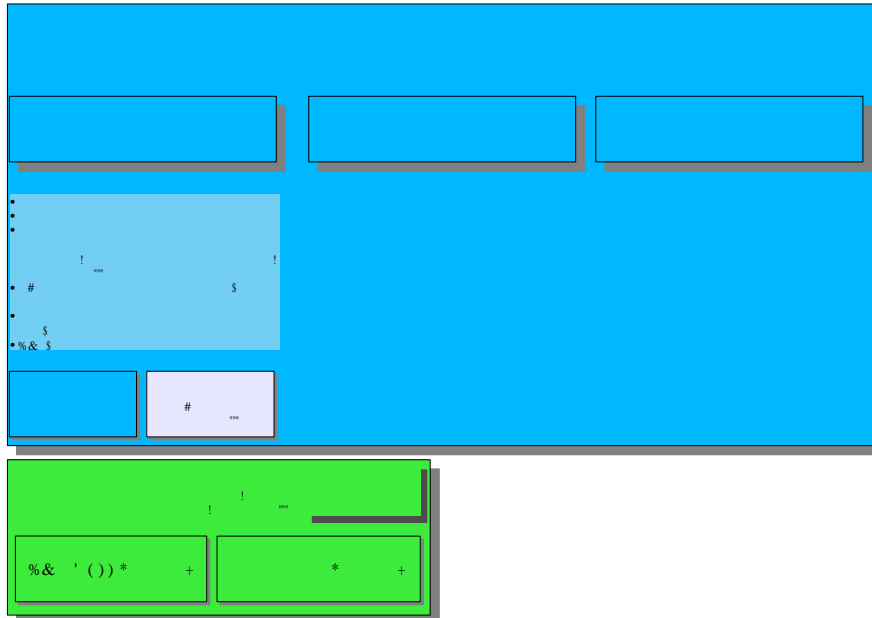


Figure 3: OpenBerg's core

obl, while Mozilla's interfaces see their name prefixed with nsI. Examples: oblBook, nsIStreamListener.

Functions In the absence of namespace and/or language-level module features, functions (by oppositions to methods) should be regrouped inside classes, as static methods.

Mozilla guidelines We respect Mozilla's portability guidelines, as defined in [20]

Mozilla guidelines We respect Mozilla's coding guidelines are [10]

Everything else When they are not in contradiction with the above, we use Ted Ho's C++ coding guidelines, as expressed in [11]

3.5.3 Loader

Overview

The loader is the first unit of OpenBerg to be loaded and the last to be unloaded. It is in charge of initialisation of other units, of components and registration of components wrt XPCOM.

Details

From the point of view of the Mozilla platform, the loader is a nsI Module, that is a structure which can dynamically be loaded and unloaded and is associated with an entry and an exit point. Semantically, this is similar to the notion of component.

Indeed, the Loader is itself loaded dynamically whenever the UI attempts to instantiate any of the components of OpenBerg. The task of the loader is to overview

- initialise debugging/error-reporting structures
- adapt the configuration of OpenBerg to the platform (at the moment, FireFox or XULRunner)
- overview instantiation of OpenBerg's components – from the point of view of the Mozilla platform, the Loader contains a nsI Factory per component.
- overview the unloading of OpenBerg.

The loader is defined as class `obOpenbergModule`, by file `openberg.cpp`.

Dependencies

This unit depends on

Library Loader initialises Library and permits instantiation of all its components.

Annotations Loader initialises Annotations and permits instantiation of all its components.

Find Loader initialises Find and permits instantiation of all its components.

Utilities Loader initialises Utilities.

3.5.4 Library

Overview

The Library unit abstracts the format of e-Books, contains the low-level primitives used by the UI to trigger the loading of a book, warn listeners of the completion of book loading, or access the per-book storage.

Detail

Warning 1. *All functions, methods, etc. of the Library unit must be invoked from the UI thread. Ensuring that a call is executed in the UI thread is the task of interface nsIProxy, provided by the Mozilla library.*

Access to books The first role of the Library unit is to permit access to books regardless of the format in which they are stored. To perform this, the Library unit relies on plug-ins implementing the asynchronous loading of book formats and on-the-fly conversion to OEBPS. Components adding input formats – or *Book Loaders* – implement interface `oblBook` and must be registered with respect to the mime types they can interpret. They are then loaded dynamically when a request for the opening of such a book is emitted. Loading of books is asynchronous, i.e. requests should be accompanied with a listener (a.k.a. continuation). At a later point, once the book is ready for consultation, the listener will be triggered by the Library unit. Note that the listener may potentially be triggered from any thread and should therefore usually be protected by a `nsIProxy`.

All functions related to loading are accessed through the *Book Librarian*, itself a component implementing interface `oblBookLibrarian`.

Access to book storage The second role of the Library is to permit access to a per-book storage, or *book repository*. This storage is intended to contain

- book-specific preferences (e.g. stylesheet overrides)
- book-specific annotations (see Section 3.5.5)
- a cache for book metadata (e.g. chapter's titles)

Book repository-related functions are usable as soon as a book is fully loaded and until the closure of `OpenBerg`. They are accessible through the *Persistence Service*, itself a component implementing interface `oblPersistenceService`.

At the moment, these functions make heavy use of Mozilla's preference system. This is expected to change in a future version.

Access to library storage The third role of the Library is to permit access to a library storage, or *main repository*. This storage is intended to contain

- `BookRepository` functions

Dependencies

This unit depends on

Utilities Uses miscellaneous functions of Utilities.

3.5.5 Annotations

Overview

The Annotations unit contains the low-level primitives used by the UI to manage annotations to the text, i.e. undoable modifications performed by the user and transparently stored in a different file.

Detail

The Annotations unit is currently being designed and will most likely be the object of a future report by itself.

The role of this unit is to provide the low-level primitives required by the application and deapplication of user annotations to a text. By annotations, we mean features such as

- bookmarking
- underlining
- highlighting
- user-provided hyperlinks
- adding comments
- in the future, voice annotations, etc.

The associated primitives are

- DOM-based transformation of a XML document to add an annotation
- DOM-based transformation of a XML document to remove an annotation
- localisation of a position in the text – independently from the set of annotations added in the mean time
- (de)serialisation of a position in the text.

Let us consider an extract of a book, running as follows:

This is an `important` text .

A user may wish to emphasise the whole sentence, hence resulting in

This is an important text.

or

<

Questions:

- How should a reference to the occurrence of 2 be represented in memory ? Note that this reference should stay valid even if other annotations are added or removed.
- What should happen if the hyperlink is removed while it is highlighted ? Should the reference be invalidated ?
- What should happen if a third hyperlink appears during the highlighting ? What should happen if that third hyperlink appears inside the highlighted area ?
- What should happen if the highlight is removed afterwards – and how can the annotation be stored in a manner which will permit reloading it at the next opening of the chapter and restoring it to the correct position ?

One possible answer to this is to not let search find occurrences of annotations. This, however, is an important limitation.

Note that the order of removal problem appears also without the find feature. Let us consider the following extract

```
This is
<span class=" user:some_annotation ">
  an important
</span>
text .
```

Let us now assume that the user intends to add an overlapping annotation.

```
This is
  <span class=" user:some_annotation ">an
    <span class=" user:other_annotation ">important</span>
  </span>
  <span class=" user:other_annotation " continued=" true">
    text
  </span>.
```

Questions:

- what is the correct representation in the case of overlapping annotations ?
- what should happen if the user decides to remove the instance of some_annotati on before that of another_annotati on ?

One possible answer to this is to forbid overlapping (including stacked)

annotations, or to force the order of removal. Both choices, however, will prove disconcerting for the end-user.

Most likely, this implementation will stay in the future versions of OpenBerg Reader as

4 Conclusion

4.1 The work so far

So far, the bulk of the work we have provided was the design and implementation of OpenBerg's architecture, from the choice of the tools to the two build systems to the organisation of modules and of files inside modules. The bulk of the implementation were the prototype cross-platform

Done, in part	<i>User definable "style sheets" to control font size and type face, etc.</i>
Done	<i>Display graphics in various formats; both vector and bitmap formats.</i>
Working on	<i>Display complex formulae.</i>
Done	<i>Link in multimedia elements such as sound or video files.</i>
Working on	<i>Bookmarking, preferably sharable via network.</i>
Working on	<i>Annotations, preferably sharable via network.</i>
?	<i>Link to external programs for coursework such as worksheets, labs, etc. which can be forwarded BY the teacher to the students, and sent back to the teacher once the homework is done.</i>
Done	<i>Human readable, yet efficient markup language.</i>
Done	<i>Compressed files (easily decompressed to access original files).</i>
Done	<i>Simple, intuitive interface.</i>
Done	<i>Localizeable.</i>
Untested	<i>Supports complex-text language rendering (for example, arabic and thai).</i>
Supported	<i>A standardized schema of metadata for categorizing work.</i>
Done, in part	<i>Sorting on any of the fields in the schema, plus system generated data like last page read, etc.</i>
?	<i>Full-text search capability across all titles - MUST be speedy so indexing will be necessary.</i>
Planned	<i>Network access to larger library to allow downloads of additional titles.</i>

Most of these features should be integrated in the Milestone 3 of OpenBerg. A more detailed list of planned features is available in Chapter B.

4.3 The future

The team has recently grown with the addition of

- a XUL developer working on livesearch
- a C++ developer working on annotations
- a newsmaster.

We hope that this new blood will increase the dynamism – and the speed of development – of OpenBerg Reader. Our current objective is to release Milestone 2 of OpenBerg by June 2006, with the addition of

live search and comprehension of Gutenberg e-Books. That day, we will consider officially that OpenBerg has become a useful project.

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A The team

A.1 Senior members

(aka people who have already contributed some code, by order of ancienty)

David Teller aka Yoric, project manager. In this project, does a bit in everything. In real-life, post-doctoral research fellow, working on concurrent programming languages and static analysis of programming languages.

Nick Thomas aka *cf*, cross-platform build system maintainer, Windows port manager.

Vincent Bernardi aka Enzo, Mac OS X port manager.

A.2 Junior members

(aka people who have already contributed some enthousiasm)

Abbey (real name unknown) C++ developer, Windows Mobile port manager.

Giuseppe de Francesco C++ developer, working on bookmarks and annotations.

Claudio Bernardes aka *obs*, XUL developer, XULRunner port manager.

Julien Appert , XUL developer, working on the cross-platform UI.

A.3 Support sta

Christopher Lannoo webmaster.

A.4 Former senior members

Philippe Gervais aka *Phyxie*, CVS manager, in charge of XML preferences. Researcher in the field of physics.

B RoadMap

B.1 Features

This roadmap is not necessarily representative of the time necessary to

RoadMap

(continued from last page)

	M1	M2	M3	M4	Beyond	Current
JavaScript	Works	Works	Works	Works	Works	Works
Java applets	Works ¹	Works ¹	Works ¹	Works ¹	Works ¹	

(continued from last page)

	M1	M2	M3	M4	Beyond	Current
Navigation						
Along the spine	Works	Works	Works	Works	Works	Works
Out-of-order spine		Works	Works	Works	Works	Works
Along tours			Works	Works	Works	
Along guides			Works	Works	Works	
UI						
Full-screen browsing		Works	Works	Works	Works	
Zooming		Works	Works	Works	Works	Works
Tabbed browsing			Works	Works	Works	
Preferences dialog			Works	Works	Works	
Custom style-sheets			Works	Works	Works	
Mouse browsing	Works	Works	Works	Works	Works	
Keyboard browsing		Ongoing	Works	Works	Works	Ongoing
Help system	Ongoing	Ongoing	Works	Works	Works	Ongoing
Scroll-based display	Works	Works	Works	Works	Works	Works
Page-based display					Works	
Ok on Color Display	Works	Works	Works	Works	Works	Works
Ok on 1024x768+ Display	Works	Works	Works	Works	Works	Works
Ok on Grayscale Display		Ongoing	Works	Works	Works	Ongoing
Ok on 640x480 Display		Ongoing	Ongoing	Works	Works	Ongoing
Print / export						
Copy as text	Works	Works	Works	Works	Works	Works
Copy as XHTML	Works	Works	Works	Works	Works	Works
Printing				Works	Works	
Others						
book: protocol		Works	Works	Works	Works	
External tools (not part .919penBergeader)						
Conversion from L ^A T _E X		Works	Works	Works	Works	
Conversion from LIT				Works	Works	

B.2 Estimated calendar

Milestone 2 alpha April 2006.

Milestone 2 beta May 2006.

Milestone 2 release June 2006.

Milestone 3 alpha August 2006.

Milestone 3 beta September 2006.

Milestone 3 release October 2006.

Milestone 4 alpha December 2007.

Milestone 4 beta January 2007.

Milestone 4 release February 2007.

OpenBerg 1.0 March 2007.

C Build instructions

OpenBerg Reader has two different build systems. A fast and mostly painless Unix build system, detailed in Section C.4 and a slow and painful cross-platform build system, based on Mozilla's build system and detailed in Section C.3. If you have the choice, use the Unix build system.

C.1 Obtaining the code – anonymously

1. Get a computer with cvs or install cvs on your computer. It's a tool used to manage source code and share it between developers.
2. Open a shell (or a command line, or a dos session, or whatever is the equivalent on your operating system).
3. In that shell, go to the directory in which you wish to download the sources.

4. Enter the command

```
cvs -d: pserver: anonymous@cvs.sourceforge.net: /cvsroot/openberg login
```

5. When prompted for a password, just press Enter

6. Enter the command

```
cvs -z3 -d: pserver: anonymous@cvs.sourceforge.net: /cvsroot/openberg co -P proj e
```

7. If you receive an error message, chances are that the server is busy, try again a bit later
8. Once the operation completes without error messages, you have succeeded in getting the source of OpenBerg. Congratulations.
9. If you later wish to get updates to that source, open a shell / command line / dos session, go to the same directory and write (on one line)

```
cvs update
```

Note that there are graphical tools which you can use to access cvs without having to write down instructions. In our experience, these tools

2. Get a SourceForge account.
3. Be accepted as a developer of OpenBerg.
4. Open a shell (or a command line, or a dos session, or whatever is the equivalent on your operating system).
5. In that shell, go to the directory in which you wish to download the sources.
6. Enter the command
`export CVS_RSH=ssh`
7. Enter the command
`cvs -z3 -d:ext:<youraccount>@cvs.sourceforge.net:/cvsroot/openberg co -P projects/openber`
8. When prompted for a password, enter your SourceForge password.
9. If you receive an error message, chances are that the server is busy, try again a bit later.
10. Once the operation completes without error messages, you have succeeded in getting the source of OpenBerg. Congratulations.
11. If you later wish to get updates to that source, open a shell / command line / dos session, go to the same directory and write (on one line)
`cvs update`

Note that there are graphical tools which you can use to access cvs without having to write down instructions. In our experience, these tools don't work. But you're free to try.

C.3 Cross-platform build system

This section describes a the cross-platform build mechanism for OpenBerg. This mechanism should work on all platforms which support Mozilla, with the exact same prerequisites as for compiling Mozilla. If you have any choice, you should rather use the method described in Section C.4, as it is incredibly faster (i.e. a matter of minutes to set it up instead of hours, a matter of minutes to compile, instead of fifteen minutes).

If you have any problem with the compilation of OpenBerg, a good place to ask for help is

<http://www.openberg.org/contact.php>.

Please make sure that this is an OpenBerg problem and not a Firefox problem, as we can probably not help you with the compilation of Firefox.

C.3.3 Build OpenBerg's installer

This is an optional but useful step, especially if you already have a Firefox profile. This step is optional but useful, especially if you already have a Firefox profile.

```
export NSPR_LOG_MODULES=openberg:5
```

This will instruct Mozilla to print OpenBerg's error messages to the standard error channel.

If you want to help, to be kept up to date, or for any further inquiry, do not hesitate to visit our website at <http://www.openberg.org>.

There is a list of tasks awaiting taker http://www.openberg.org/how_can_i_help.php

Enjoy !

C.4 Unix build system

What you need to compile OpenBerg under Unix

- Firefox 1.5.x or XULRunner 1.8.0.1

-

C.4.1 Compilation and first installation

To get OpenBerg to compile, you will open file `Makefile.Linux` and change the value of the following variables

`XPIDLXX`

D Licenses

D.1 GNU Public License, version 2

D.1.1 Copyright

Version 2, June 1991

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End of Terms and Conditions

Appendix: How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the program's name and a brief idea of what it
does.>
```

```
Copyright (C) <year> <name of author>
```

```
This program is free software; you can redistribute it and/or
modify it under the terms of the GNU General Public License as
published by the Free Software Foundation; either version 2 of the
License, or (at your option) any later version.
```

```
This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied war-
ranty of MERCHANTABILITY or FITNESS FOR A PARTICU-
LAR PURPOSE. See the GNU General Public License for more
details.
```

```
You should have received a copy of the GNU General Public
License along with this program; if not, write to the Free Software
Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-
1301, USA.
```

Also add information on how to contact you by electronic and paper

mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
Gnomovision version 69, Copyright (C) <year> <name of author>  
Gnomovision comes with ABSOLUTELY NO WARRANTY; for  
details type 'show w'.
```

```
This is free software, and you are welcome to redistribute it under  
certain conditions; type 'show c' for details.
```

The hypothetical commands `show w` and `show c` should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w` and `show c`; they

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For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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- (a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)
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- (c) Accompany the work with a written offer, valid for at least three

years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

- (d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- (e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

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 - (a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
 - (b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.
- 7. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long

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Appendix: How to Apply These Terms to Your New Programs

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the library's name and a brief idea of what it

does (if you can) (for example: "libfoo.so: mathematical functions for use in graphics")

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library 'Frob' (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990 Ty Coon, President of Vice

That's all there is to it!