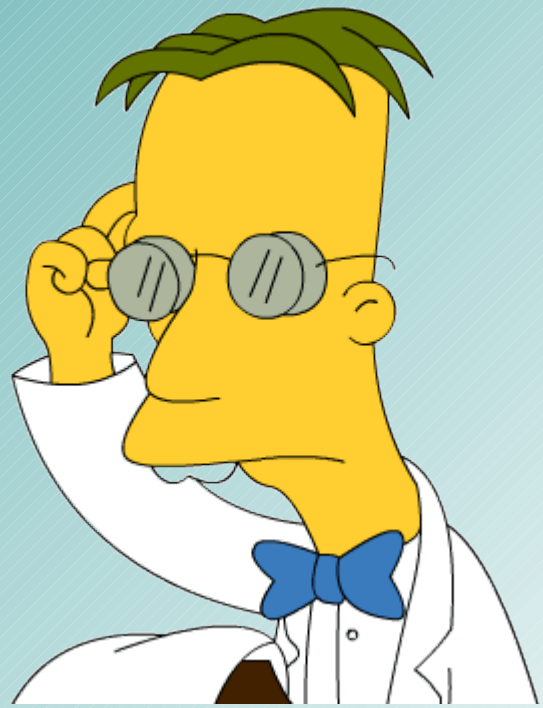
Open Source Libraries?



- **License** "...PROJ.4 has been placed under an MIT license. I believe this to be as close as possible to public domain while satisfying those who say that a copyright notice is required in some countries..."
- **URL** http://trac.osgeo.org/proj/
- **Originally By** Frank Warmerdam

Mercator Projection

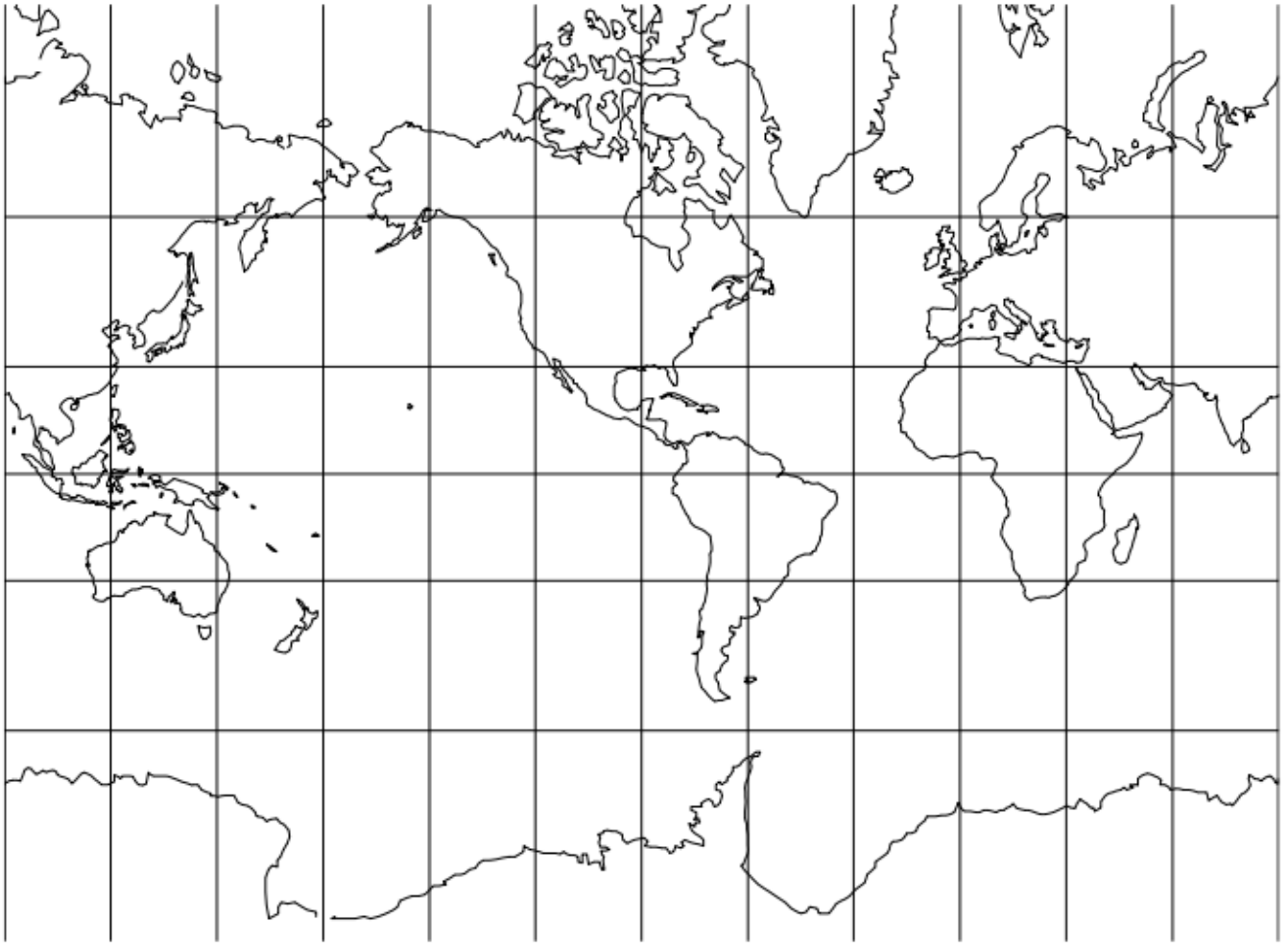


Figure 1: Mercator projection, with shorelines and 30° graticule. Central meridian 90° W (`+proj=merc +lon_0=90w`).

PROJ.4

- Pretty much solve any map projection needs a programmer would ever have
- Supported by the U.S. Department of the Interior
- What many, many products and tools use behind the scenes
- Mature and Reliable
- Simple API (only 5 main functions!)

Robinson Projection

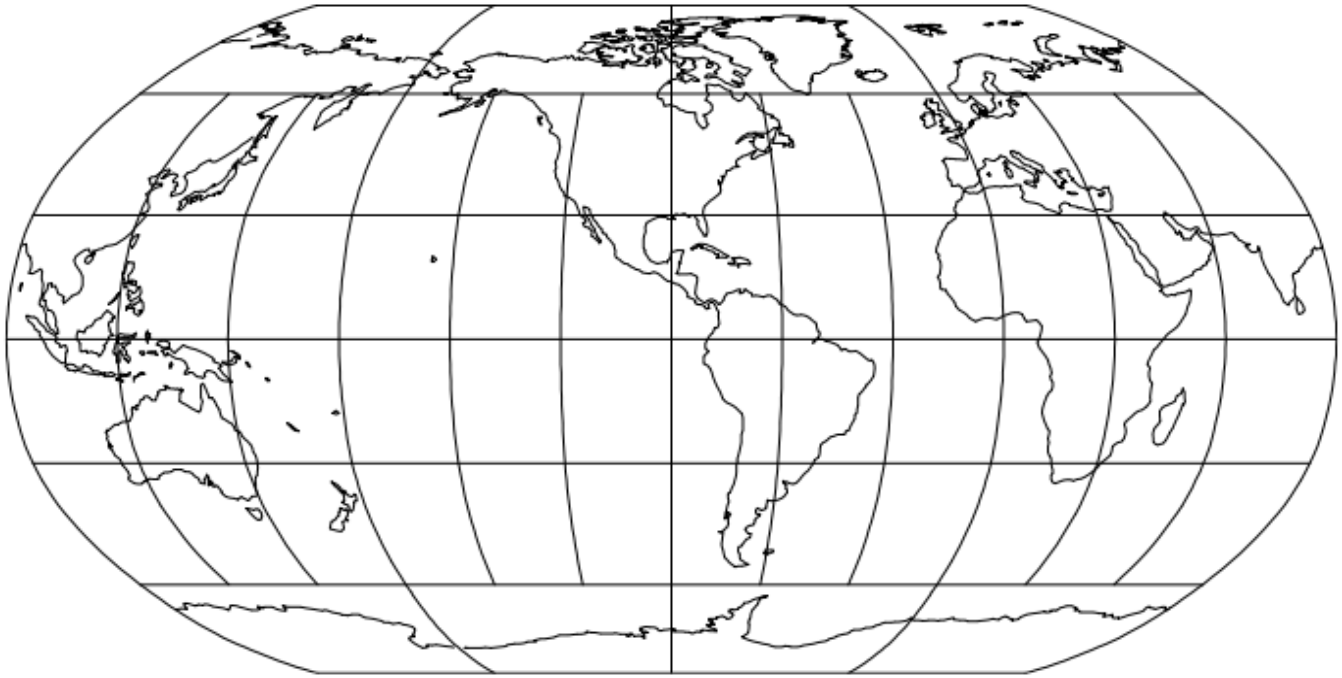


Figure 16: Robinson projection, with shorelines and 30° graticule. Central Meridian 90° W (`+proj=robin +lon_0=90w`).

Classifications: Miscellaneous conformal.

Aliases: Orthophanic.

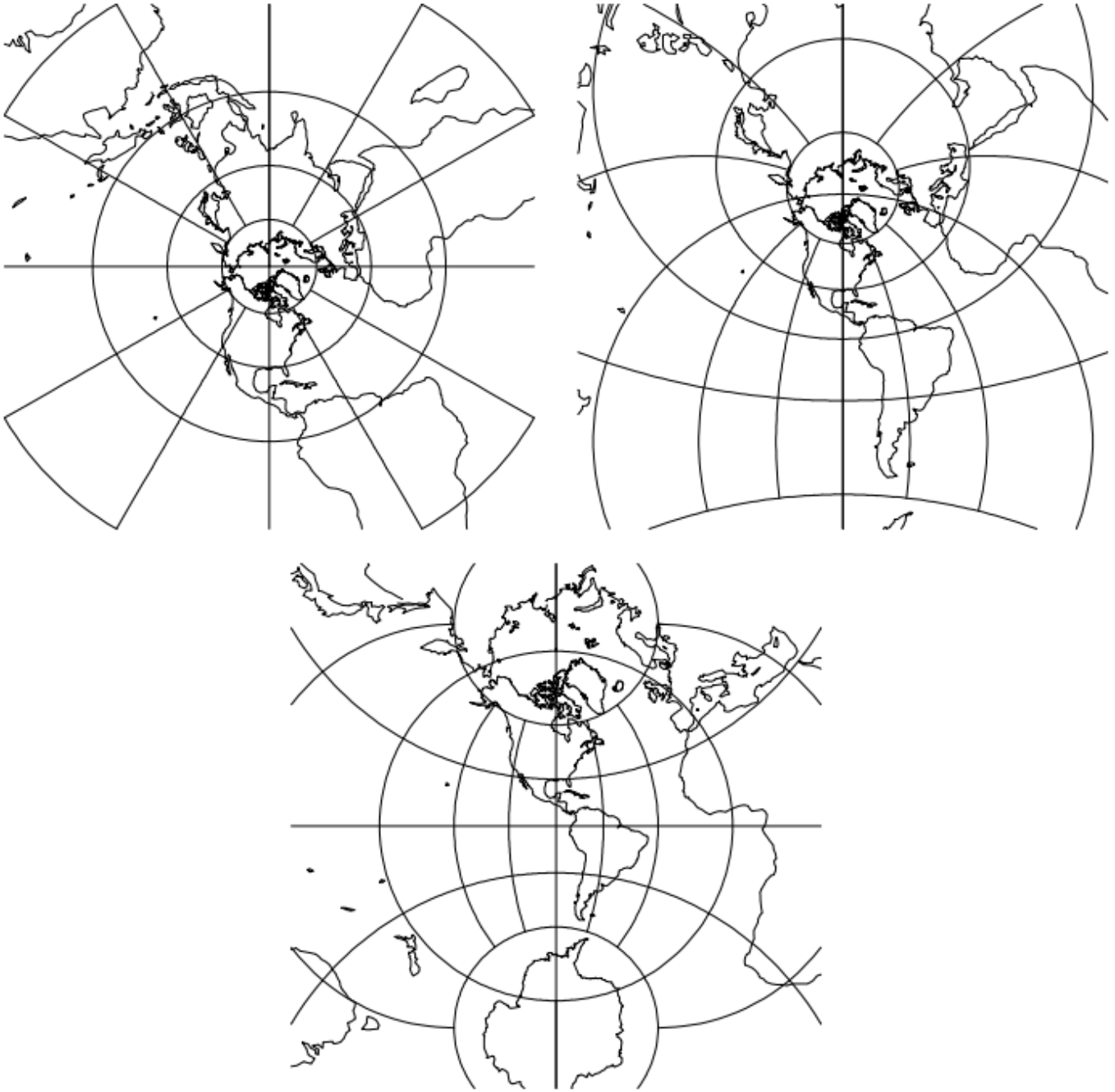
Available forms: Forward and inverse, spherical projection.

Usage and options: `+proj=robin`

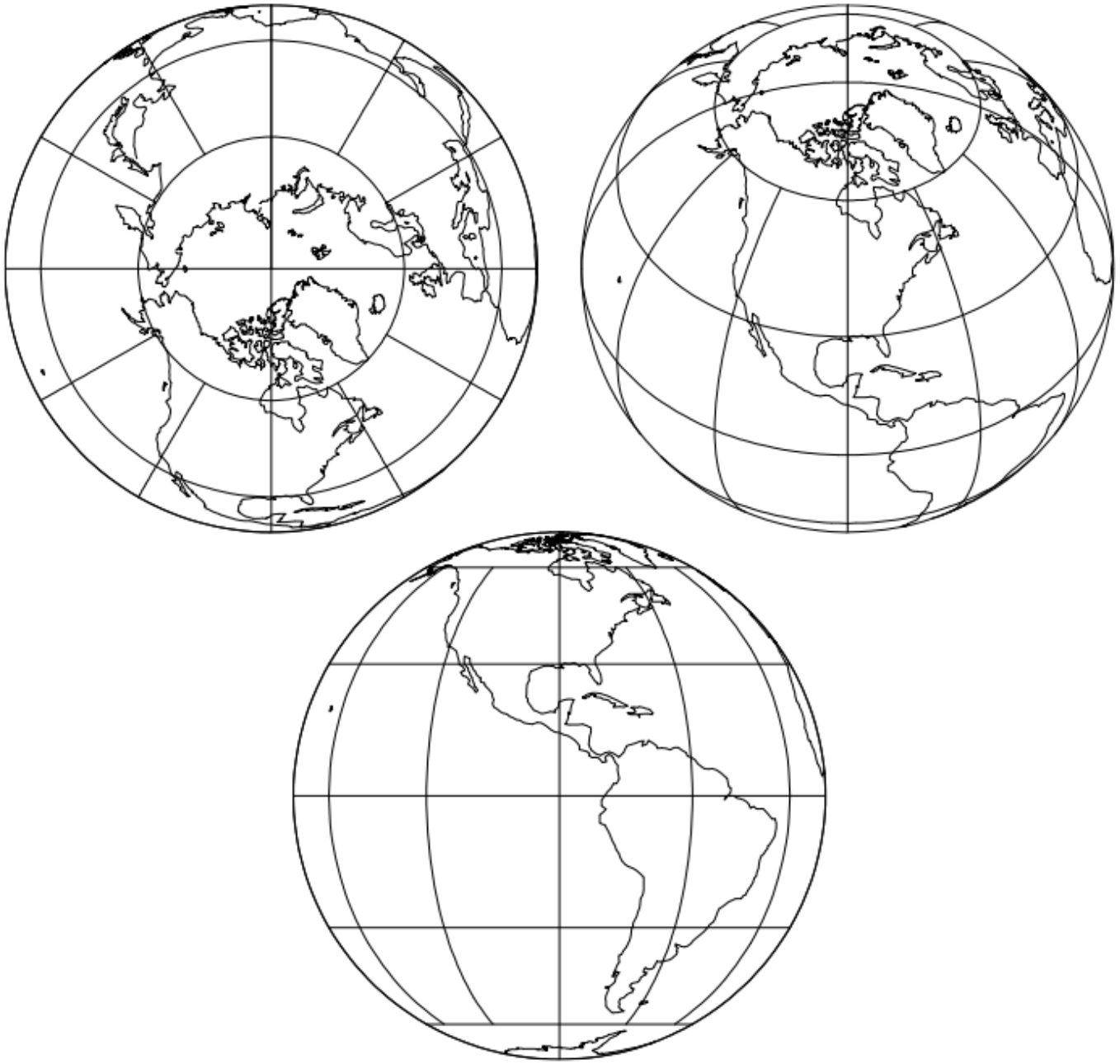
Lambert Conformal Conic Projection

Figure 37: Lambert Conformal Conic projection, with shorelines and 30° graticule. Central Meridian 90° W. and standard parallels at 20° N and 60° N (`+proj=lcc +lon_0=90w +lat_1=20n +lat_2=60n`).

Stereographic Projection



Orthographic Projection



Eisenlohr Projection

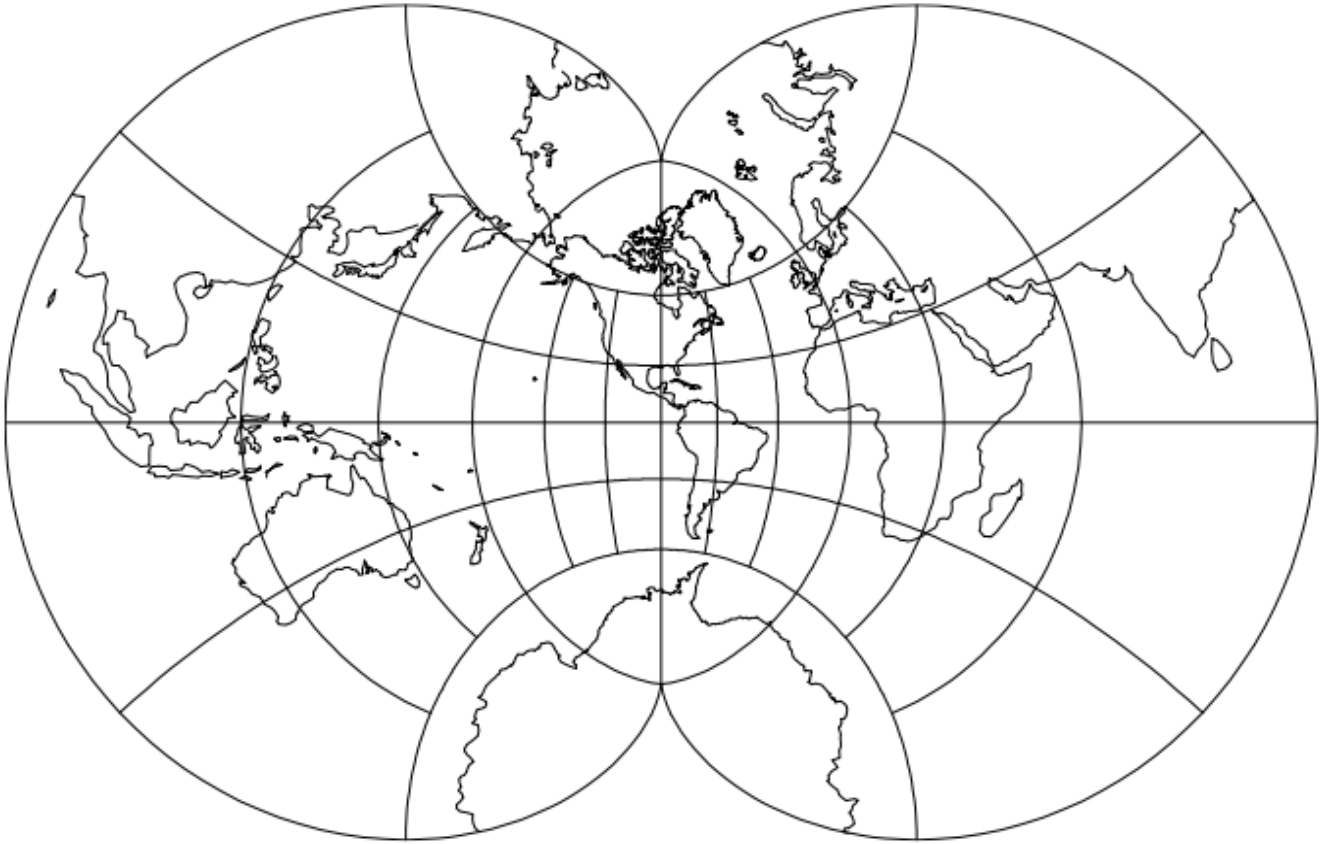


Figure 64: Eisenlohr projection, with shorelines and 30° graticule. Central Meridian 90° W (`+proj=eisen +lon_0=90w`).

Classifications: Miscellaneous. Conformal.

Available forms: Forward and inverse, spherical projection.

Usage and options: `+proj=eisen`

Language Bindings

- C, Native Interface
- Python, Pyrex Generated
- Perl, Geo::Proj4
- PHP, “Map Server” project
- Java, JH Labs (port) or JNI
- Ruby, Proj4rb
- .NET, DIY wrappers (examples on google)
- Fortran, pretty complete wrappers examples online
- Others, DIY wrappers

Different Types of “Open Source”

- Fake Open Source: legal tricks, NDAs, lies, “pay for source”, only printed on paper, ext.
- Junk: useful license, worthless software
- Pay-for-commercial-use: free only for non-commercial use, license fees / royalties required otherwise; not much new there
- GPL style: Great for applications, kernels, ext. (even in commercial environments) Useless for libraries in commercial projects.
- L-GPL / Apache / MIT / BSD style: *the sweet spot*

OpenSSL

- The *standard* cryptographic tool kit for most of the software world
- Well respected, mature, used practically everywhere; finally approved for US govt. use
- Support for hardware based cryptographic acceleration, although limited implementations (e.g. VIA padlock)
- The only kind of crypto package you can “trust”

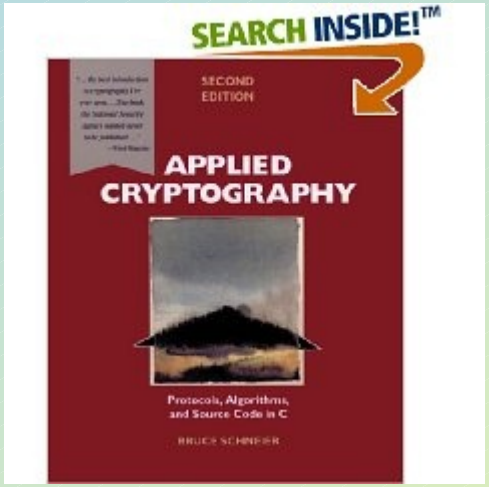
OpenSSL

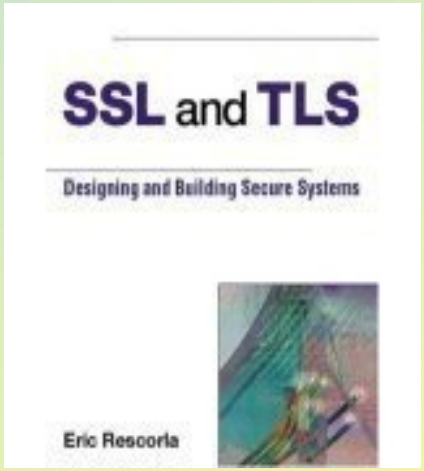
What does OpenSSL give you?

- Advanced Random Number Facilities
- One Way Hash/Digest (MD5, SHA, ...)
- Two Way Block / Stream Ciphers (AES, DES, BF, ..)
- Public Key Infrastructure (RSA, DSA, ...)
- High Level Protocol Suites (TLS, SSL, ...)
- The extra useful **openssl** command line utility
- Key File (PEM) Import / Export

OpenSSL

- 90% of figuring it out is understanding the underlying technologies, how they work together, and what you want to do
- 10% is understanding the implementation details





OpenSSL

Language Bindings

- C, native interface
- Python, PyOpenSSL
- Java, JavaSSL
- C#, OpenSSL.NET
- Some others not mentioned
- Others, DIY native wrappers (many examples on google)
- Perl, Crypt::OpenSSL
- PHP, Cryptography Extensions -> OpenSSL
- Ruby, RubyPKI
- Shell scripts, openssl command line tool

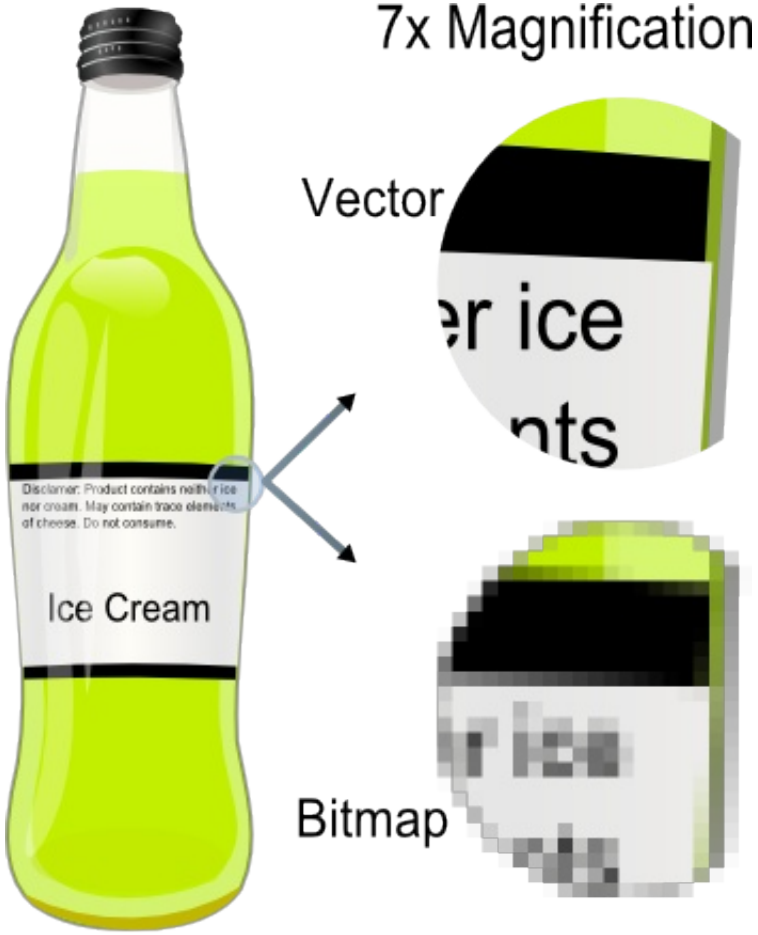
Common Cross Language Methods

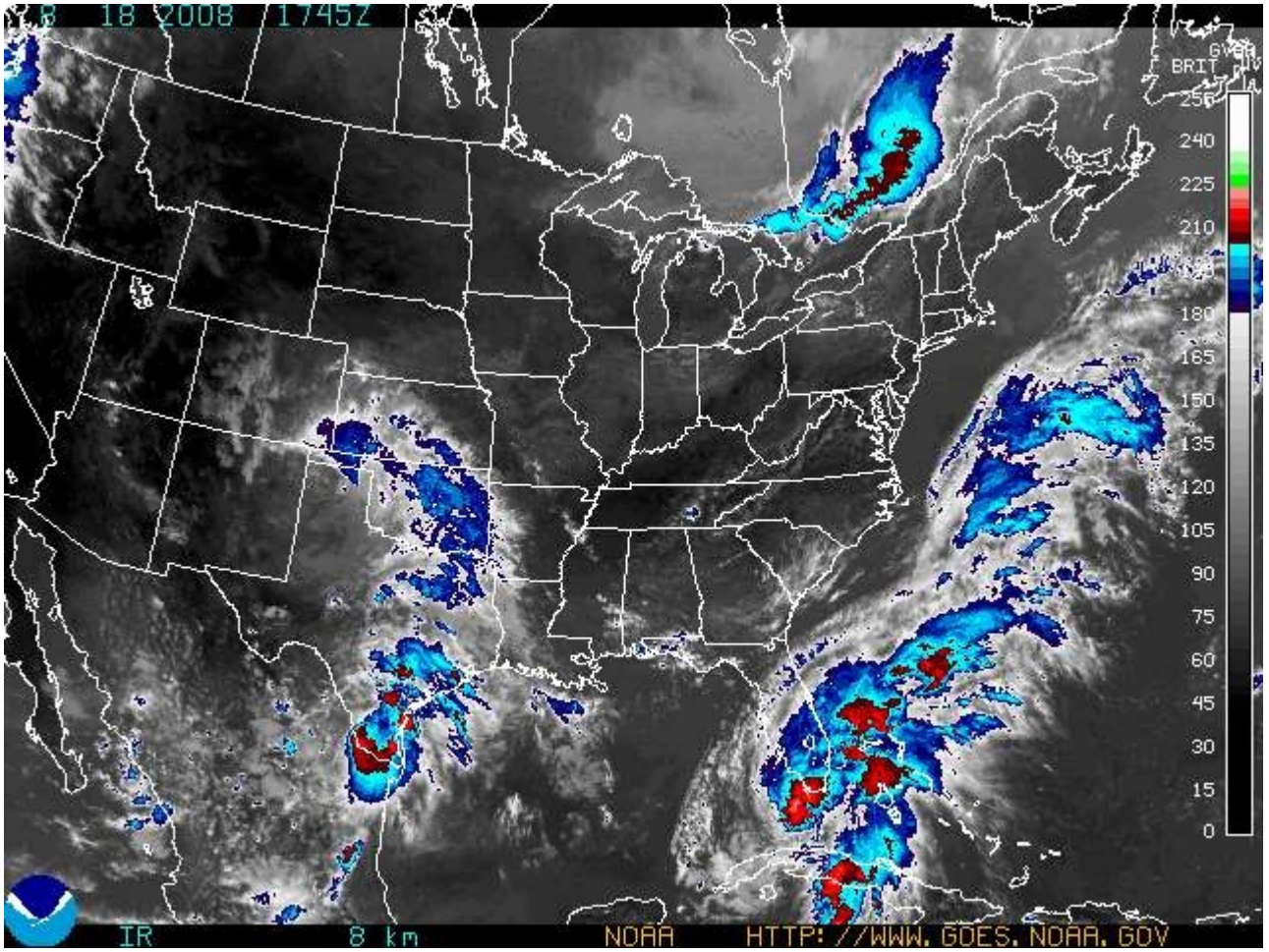
- Component Architectures (CORBA, COM, RPC, UNO, SOAP, .NET Remoting, ...)
- Virtual Machine Byte Code (JVM, .NET, AIR/SWF, LLVM...)
- Dynamic Symbols wrapped by language-native objects
- External helper processes w/ IPC
- Source Translation

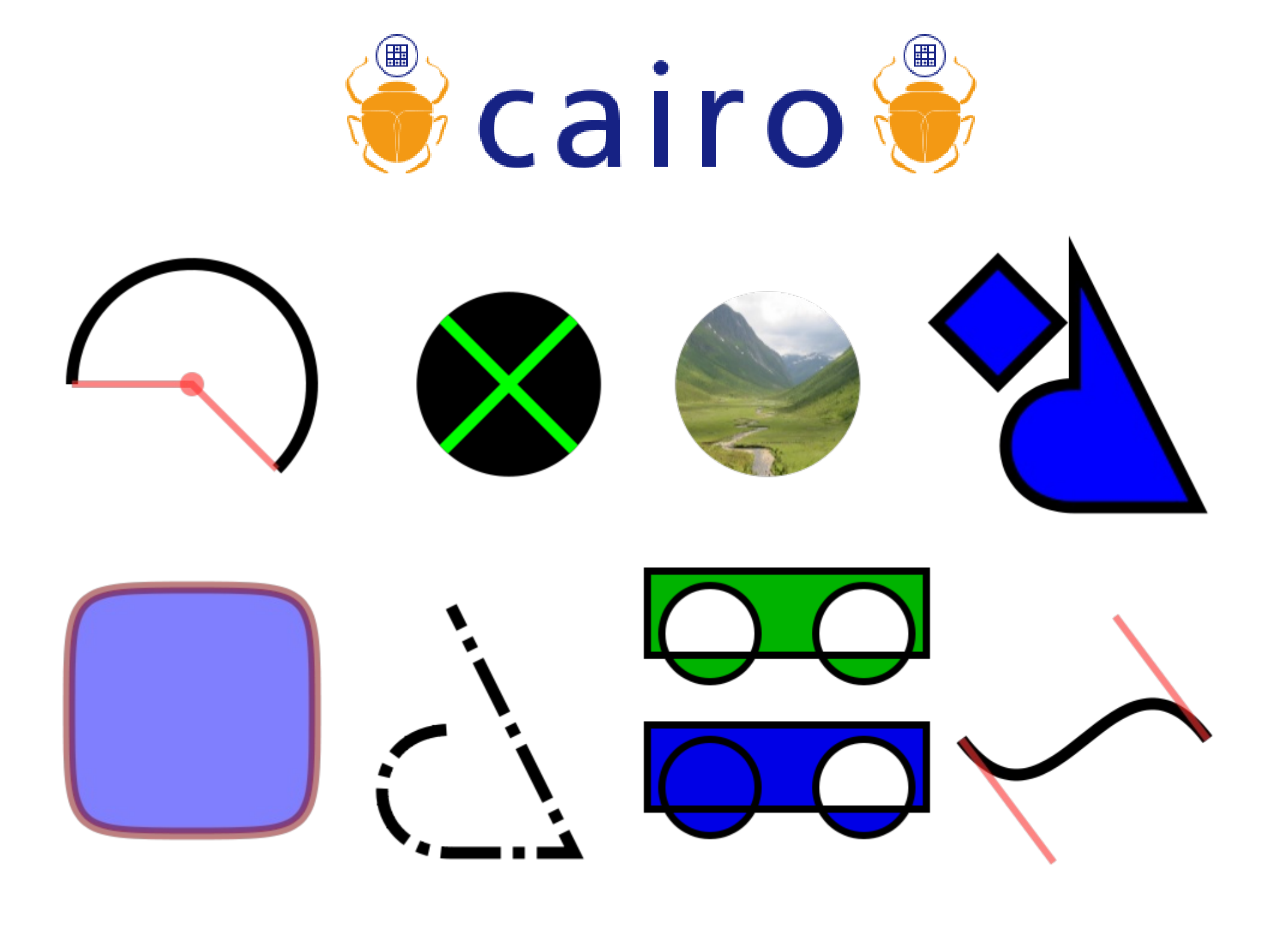
- **License**, LGPL2.1 or MPL1.1
- **URL**, www.cairographics.org
- **Big Sponsors**, Intel, RedHat, Mozilla, Novel, others...

cairo

Vector vs Raster

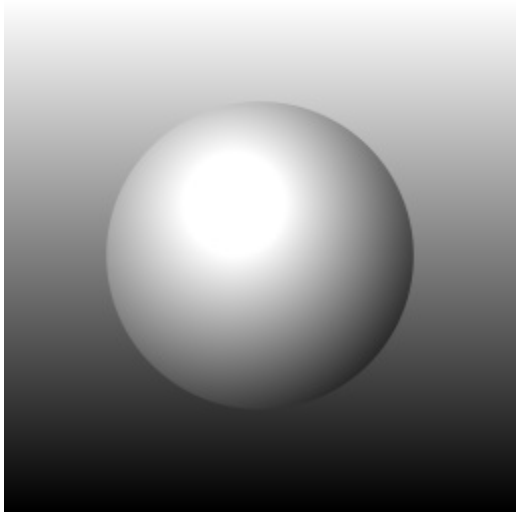


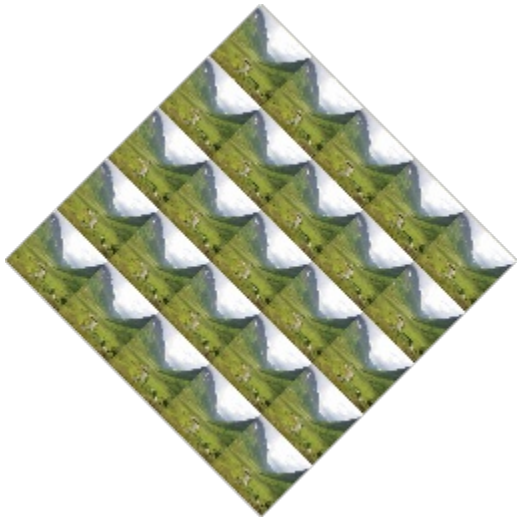



cairo

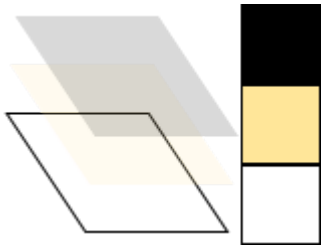
- Superior Anti-Aliasing
- Excellent Bezier Curves
- Path Based
- Sources (the paint) can be solids, patterns, images, ext.
- Full Alpha Blending
- Transformation Matrices
- Advanced Scaling Geometry
- Save & restore drawing context stack
- Mix cairo vector graphics with external raster sources (like Image Magick)
- Output to image formats (png natively), PDF, SVG, X11, GDI, Quartz, raw memory, postscript
- Integrated with FreeType, and Pango


cairo

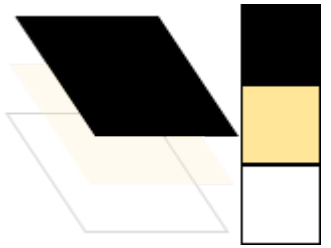


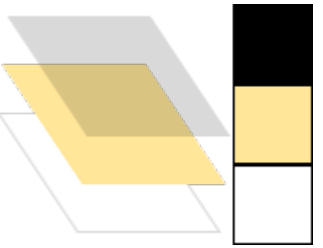



cairo

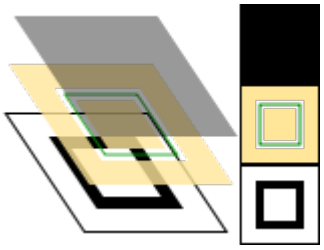


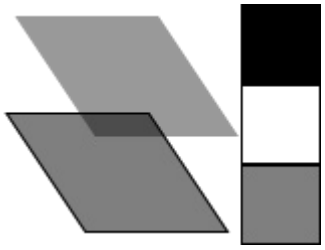

Hello
voic

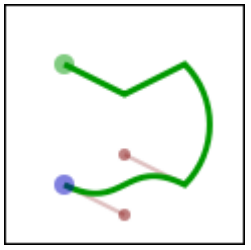


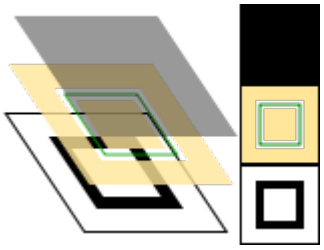


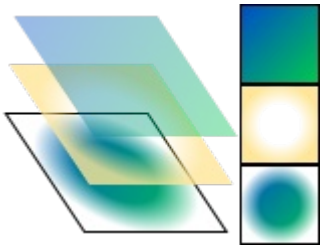
cairo

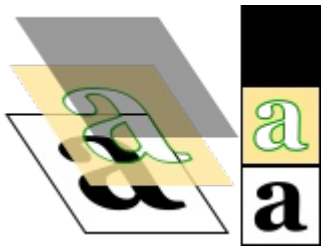


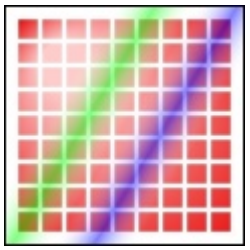


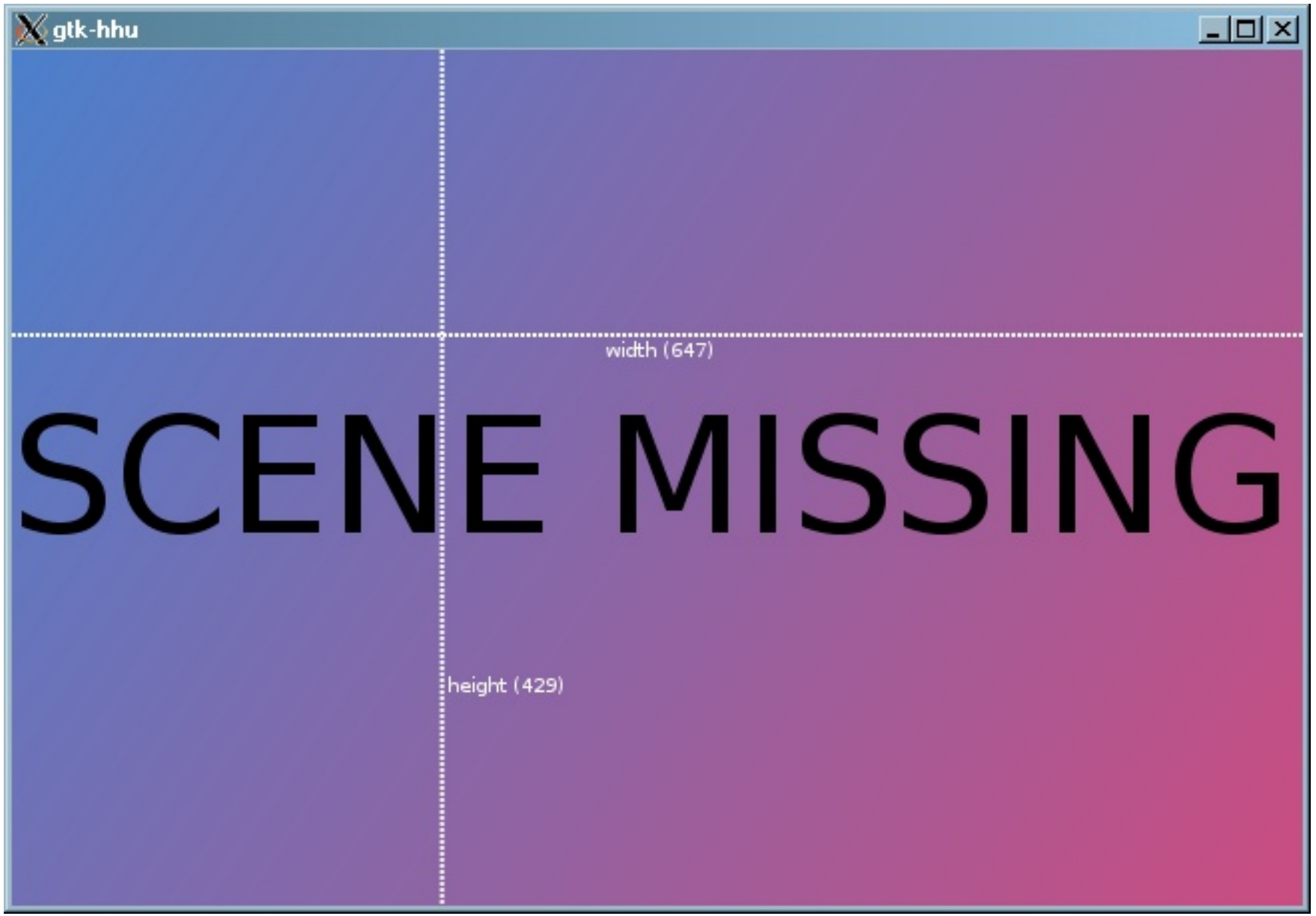











gtk-hhu
width (647)
SCENE MISSING
height (429)

First the background gradient...

```
pattern = cairo_pattern_create_linear(0, 0, width, height);
cairo_pattern_add_color_stop_rgba(pattern, 1, .8, .3, .5, 1);
cairo_pattern_add_color_stop_rgba(pattern, 0, .3, .5, .8, 1);

cairo_set_source(cr, pattern);
cairo_rectangle(cr, 0, 0, width, height);
cairo_fill(cr);
cairo_pattern_destroy(pattern);
```

- *cr* is the cairo context object
- *width* & *height* are the window's size in pixels

Scaled “Scene Missing” Text...


```
cairo_save(cr);
cairo_set_source_rgb(cr, 0, 0, 0);
cairo_text_extents(cr, "SCENE MISSING", &extents);

scaler = width / extents.width;
text_x = (width / 2) - ((extents.width * scaler) / 2);
text_y = (height / 2) + ((extents.height * scaler) / 2);
if(extents.height * scaler > height)
{
    scaler = height / extents.height;
    text_y = (height / 2) + ((extents.height * scaler) / 2);
    text_x = (width / 2) - ((extents.width * scaler) / 2);
}

cairo_move_to(cr, text_x, text_y);
cairo_scale(cr, scaler, scaler);
cairo_show_text(cr, "SCENE MISSING");
cairo_stroke(cr);
cairo_restore(cr);
```

Dashed lines and labels...

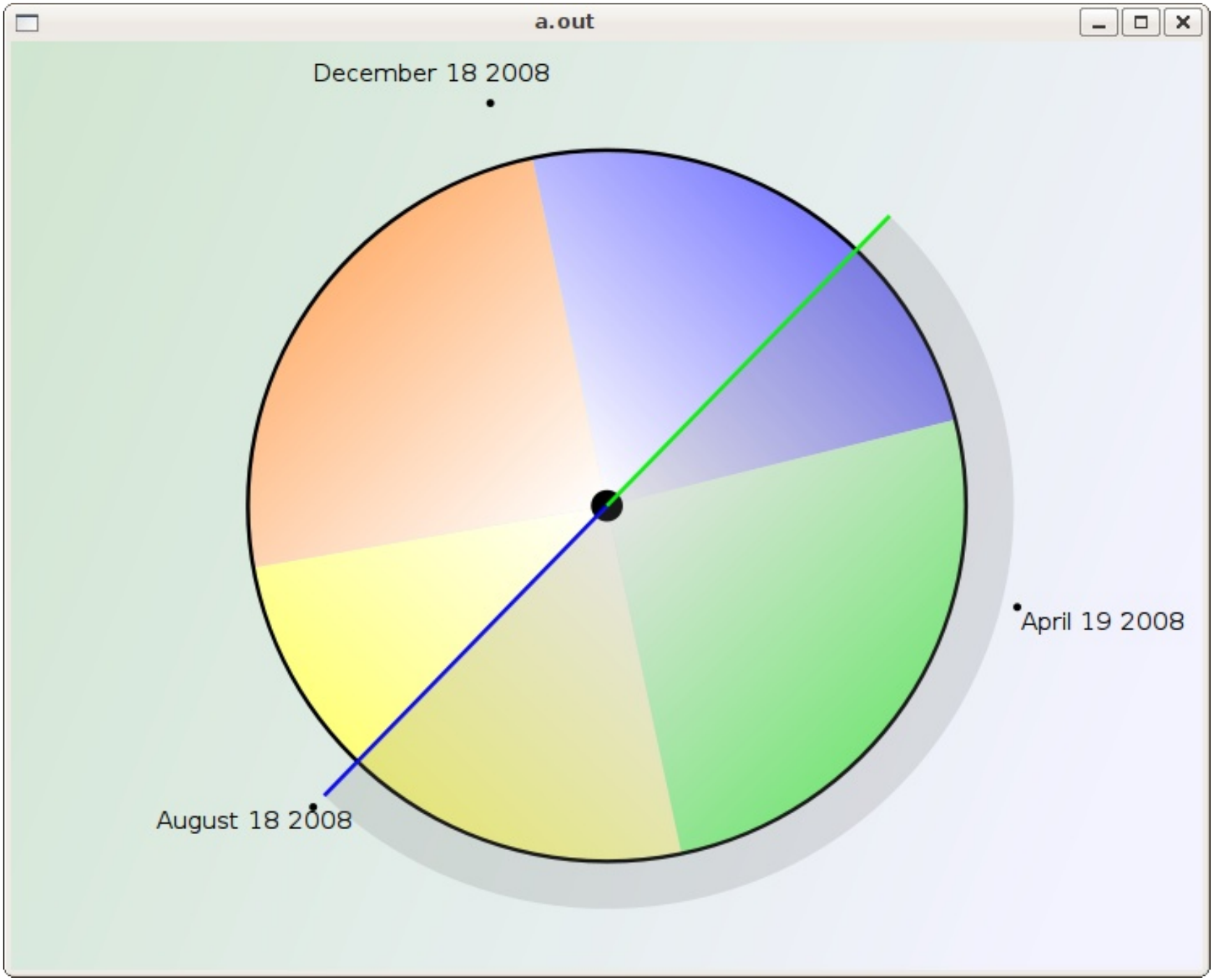

```
cairo_set_source_rgb(cr, 1, 1, 1);
dashes[0] = 2;  dashes[1] = 1;
cairo_set_dash(cr, dashes, 2, 0);

cairo_move_to(cr, width / 3, 0);
cairo_line_to(cr, width / 3, height);
cairo_move_to(cr, 0, height / 3);
cairo_line_to(cr, width, height / 3);
cairo_stroke(cr);
cairo_set_dash(cr, NULL, 0, 0);

snprintf(string, 25, "width (%d)", width);
cairo_text_extents(cr, string, &extents);
cairo_move_to(cr, (width / 2) - (extents.width / 2),
              height / 3 + extents.height);
cairo_show_text(cr, string);
snprintf(string, 25, "height (%d)", height);
cairo_text_extents(cr, string, &extents);
cairo_move_to(cr, width / 3 + 2, height * .75);
cairo_show_text(cr, string);
cairo_stroke(cr);
```

cairo

Advanced scaling geometry greatly simplifies code.


a.out
December 18 2008
April 19 2008
August 18 2008

Language Bindings

- C, Native Interface
- C++, cairomm
- Python, PyCairo
- .NET, Mono.Cairo
- Ruby, rcairo
- PHP, cairo-php
- Perl, cairo-perl
- Java, cairo-java & CairoJava
- D, cairoD
- Others for Haskell, Common Lisp, Nickle, Objective Caml, Scheme, Squeak, Lua, Vala, and more!

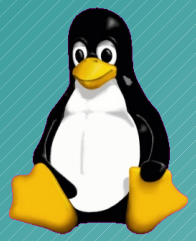
Toolkit Support

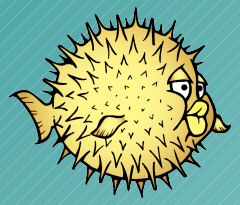
- GTK+
- FLTK

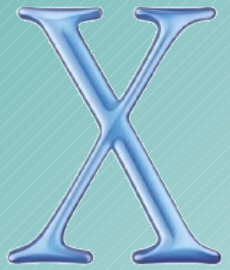
What is *Cross Platform*?

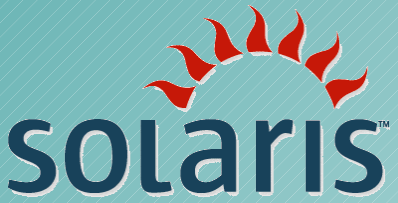
- Practically speaking, cross-platform means support for two things:

The Modern Unix / Posix Family





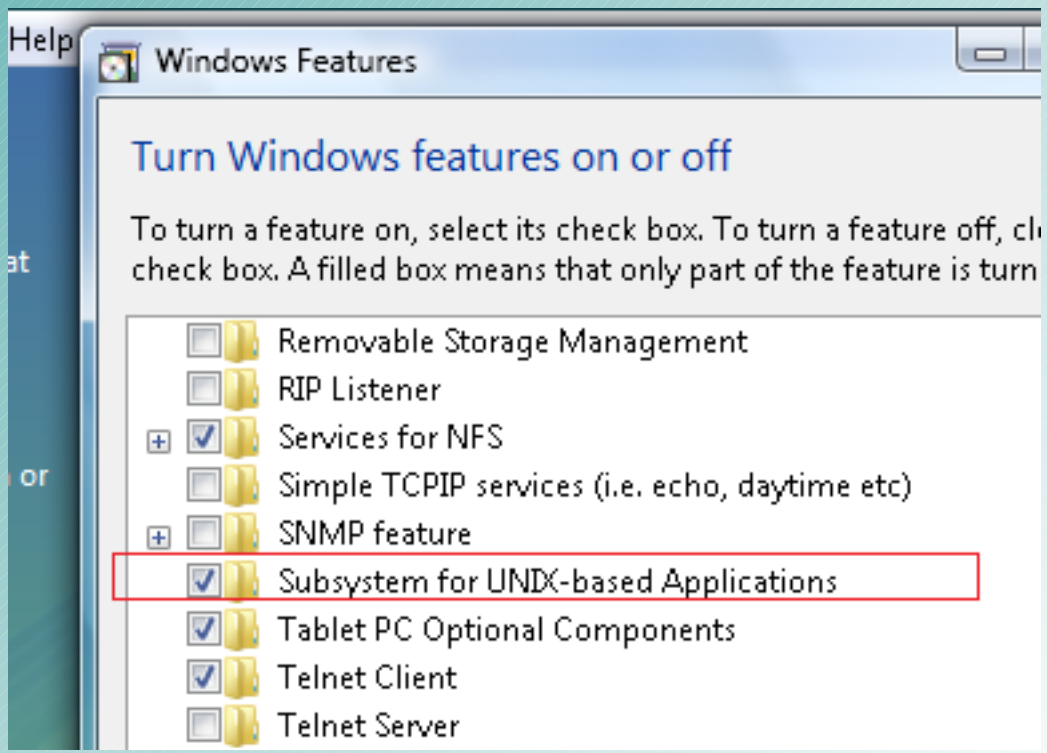




Windows

What is *Cross Platform*?

- Often times it also means support for even less common environments.



- **URL**, ww.zlib.net
- **License**, BSDish
- **Authors**, Jean-loup Gailly and Mark Adler

- Patent free
- Works everywhere
- Very good compression
- Tons of things use it behind the scenes

Language Bindings

- C, native
- C++, gzstream
- Java, java.util.zip & JZlib (pure Java re-implementation)
- Perl, Compres::Zlib
- .NET, ZLIB.NET (pure .NET re-implementation)
- Python, included
- Delphi, delphi-zlib
- Tcl, mkziplib
- Pascal, zlib-pascal
- PHP, included
- Ruby, included

Libraries vs Other Concepts

- Application Frameworks
- Specialized Languages
- Published Algorithms
- RFCs & IEEE specs

- **URL**, curl.haxx.se.libcurl
- **License**, BSDish

- Free (of course)
- thread-safe
- IPv6 compatible
- Good documentation
- TLS/SSL support
- High Quality
- Fast
- File transfer resume

- FTP, FTPS, HTTP, HTTPS, SCP, SFTP, TFTP, TELNET, DICT, LDAP, LDAPS
- SSL Certificates
- HTTP POST/PUT/GET, cookies
- Proxy support
- Password auth, NTLM, Negotiate, Kerberos4

Language Bindings

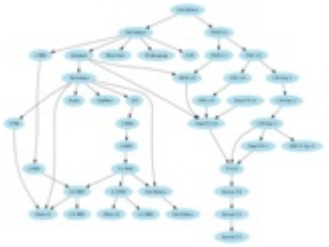
- C (native)
- Ada95
- Basic
- C++
- OCaml
- D
- R
- TCL
- Python
- Ruby
- PHP
- Pascal
- Scheme
- Smalltalk
- .Net
- Java
- Lisp
- Lua
- Visual Basic
- Q
- SP-Forth
- SPL
- Gambas
- More crazy ones...

Integration with other Libraries & Tools

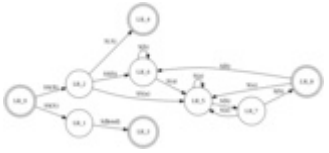
- Glib
- WxWidgets
- PostgreSQL
- Cocoa
- Way more...

Importing Native/Dynamic Symbols

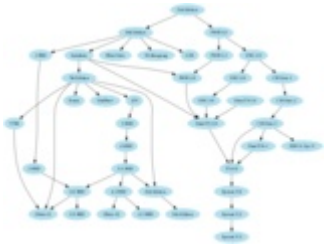
- Java, JNI
- Python, Perl, PHP, Ruby, module APIs
- .NET, Pinvoke() or -(somewhat different concept) COM
- C++, built in
- ObjC, built in
- Fortran (sometimes), gcc tricks
- Pascal (sometimes), gcc tricks
- TCL, CriTcl
- Almost everything, SWIG
- Gobject type system



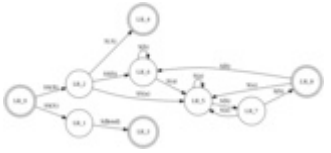
Graphviz

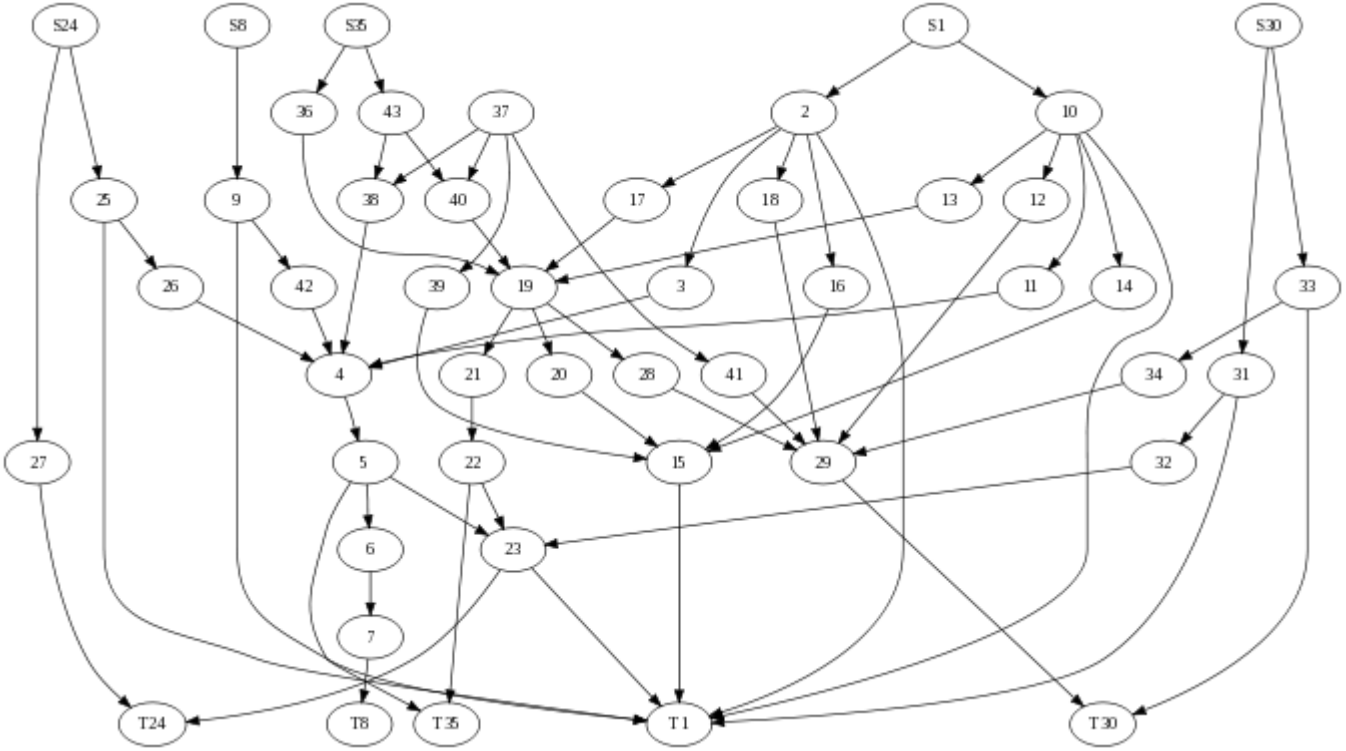


- **URL**, www.graphviz.org
- **License**, CPL 1.0
- **Original Author**, AT&T Research



Graphviz

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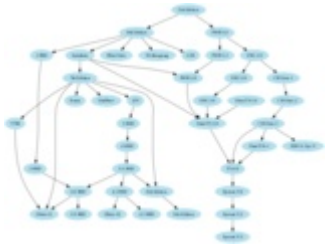
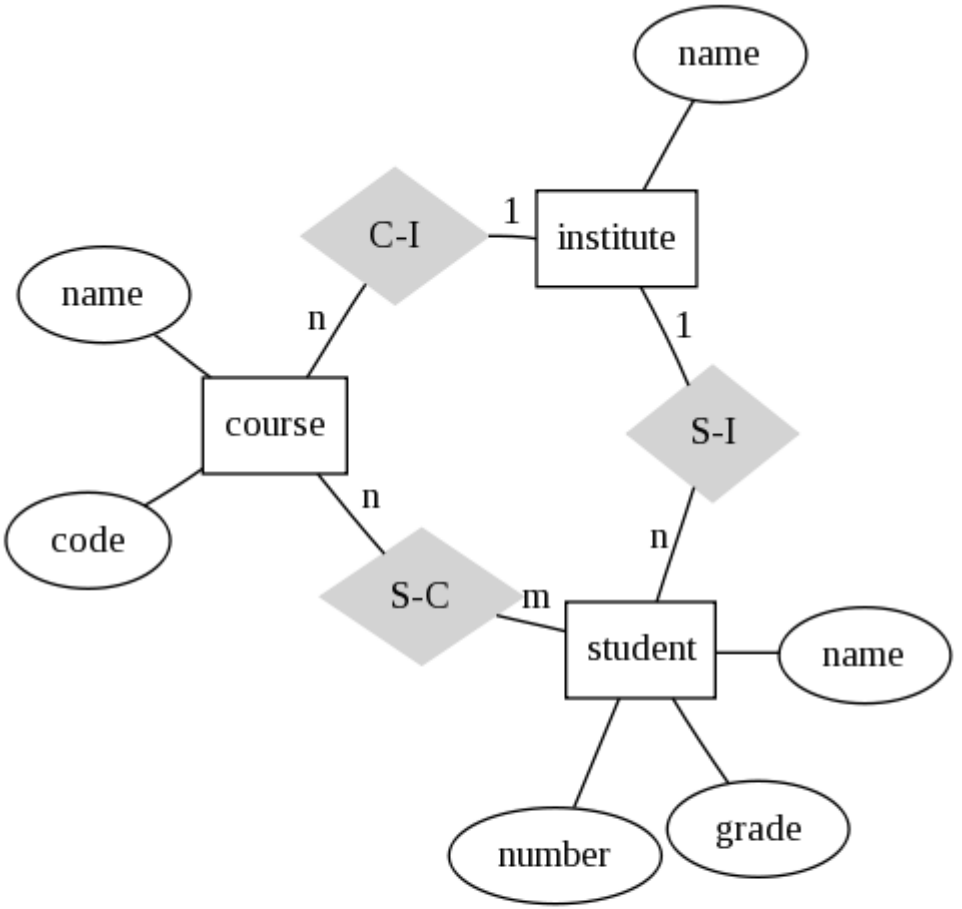
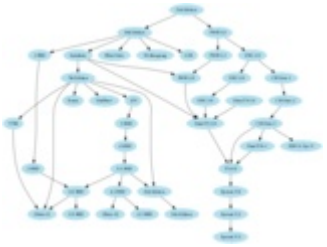


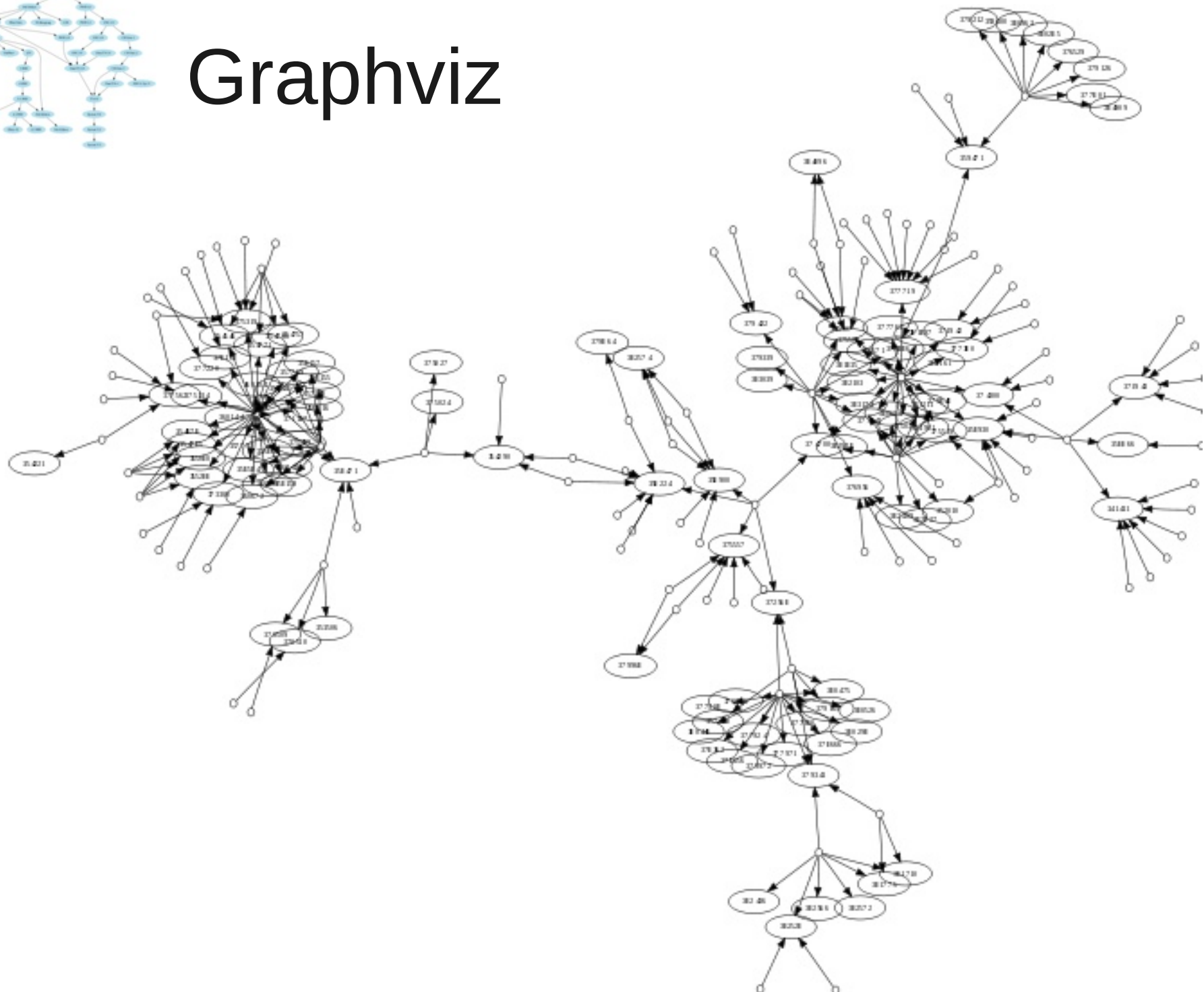
Graphviz

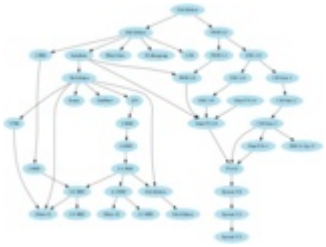


Entity Relation Diagram
drawn by NEATO

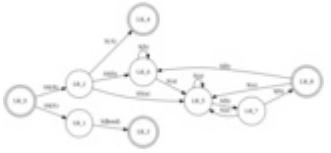


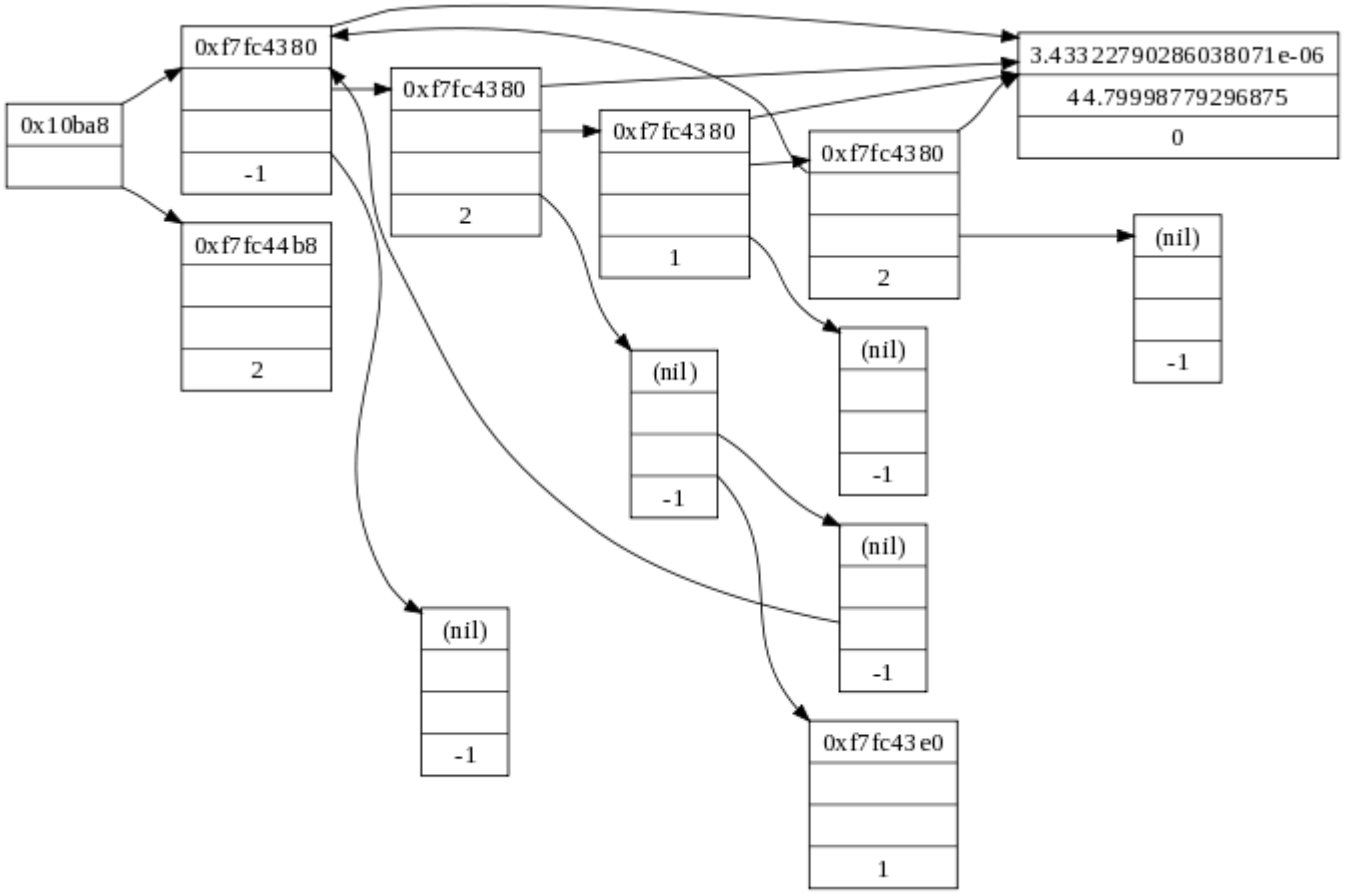
Graphviz





Graphviz




0x10ba8
0xf7fc4380
-1
0xf7fc44b8
2
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2
0xf7fc4380
1
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2
3.433227902860380 71e-06
44.79998779296875
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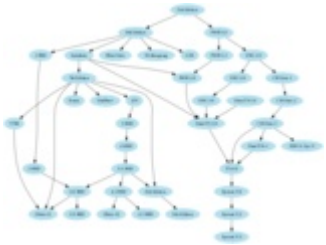
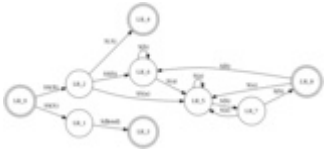
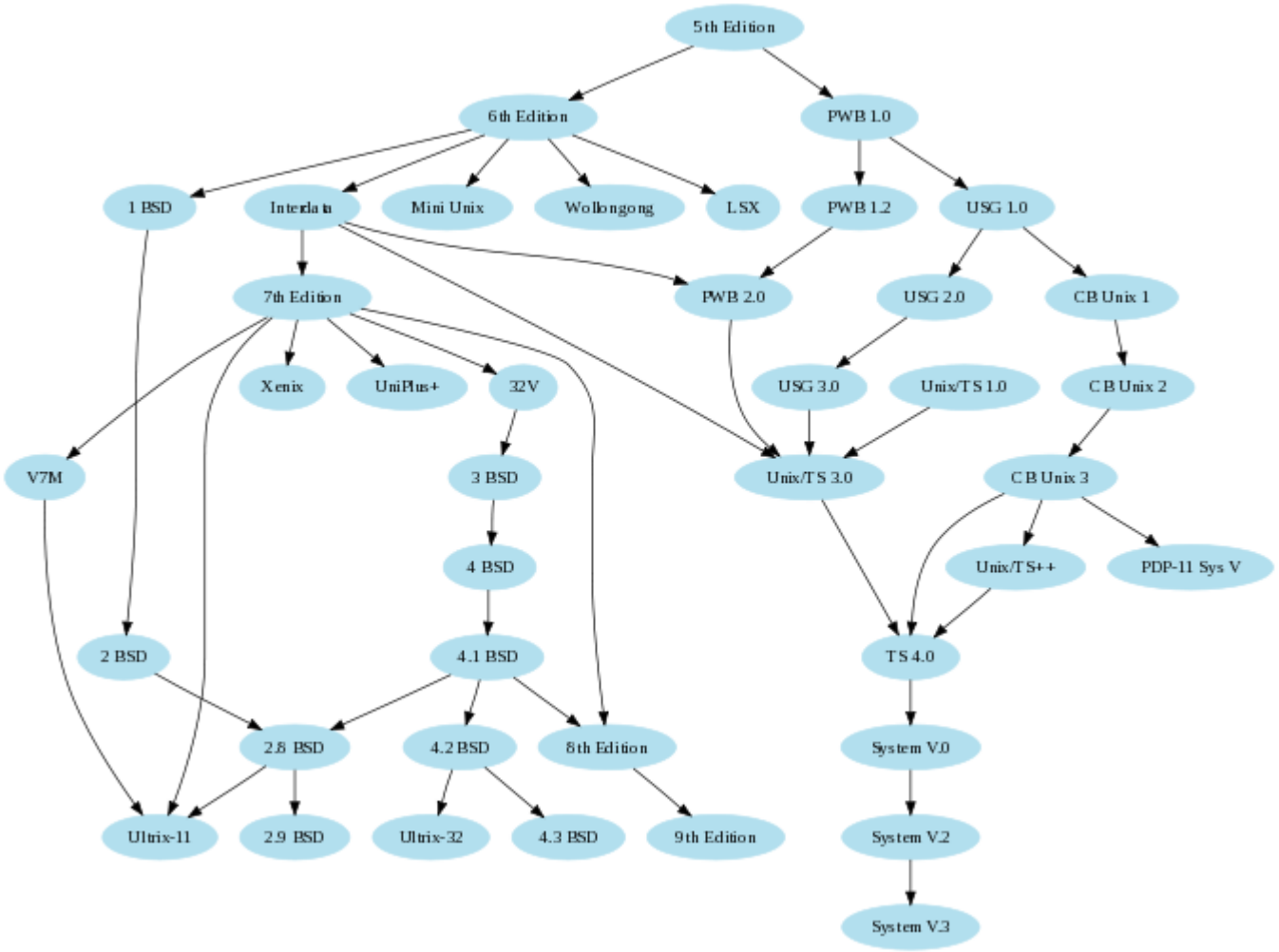
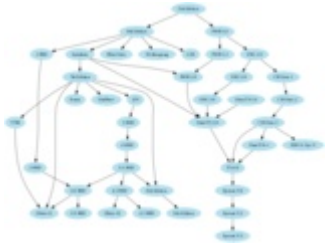


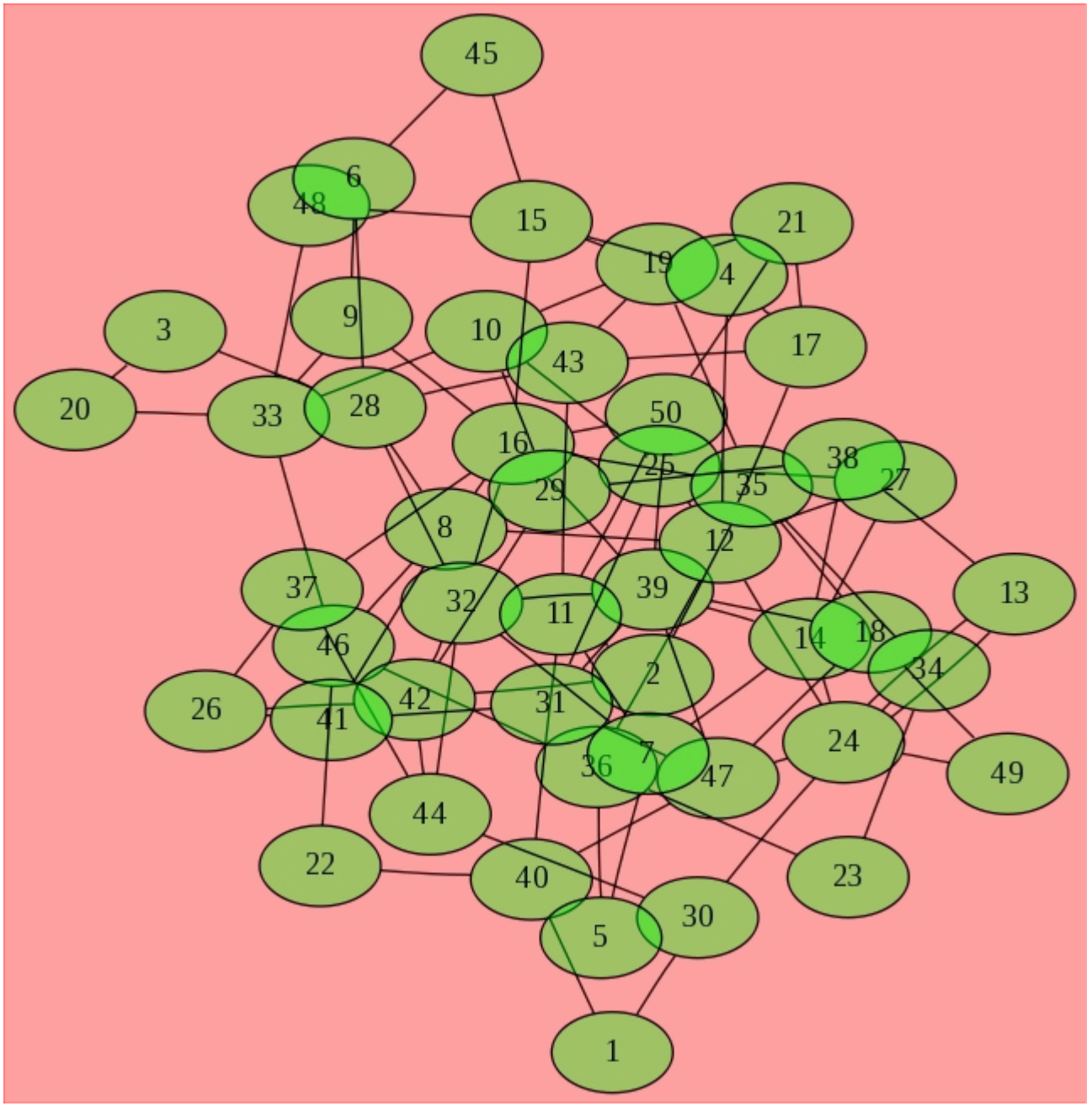
Graphviz




5th Edition
6th Edition
PWB 1.0
1 BSD
Interdata
Mini Unix
Wollongong
LSX
PWB 1.2
USG 1.0
7th Edition
PWB 2.0
USG 2.0
CB Unix 1
Xenix
UniPlus+
32V
USG 3.0
Unix/TS 1.0
CB Unix 2
V7M
3 BSD
Unix/TS 3.0
CB Unix 3
4 BSD
Unix/TS++
PDP-11 Sys V
2 BSD
4.1 BSD
TS 4.0
2.8 BSD
4.2 BSD
8th Edition
System V.0
Ultrix-11
2.9 BSD
Ultrix-32
4.3 BSD
9th Edition
System V.2
System V.3



Graphviz


45
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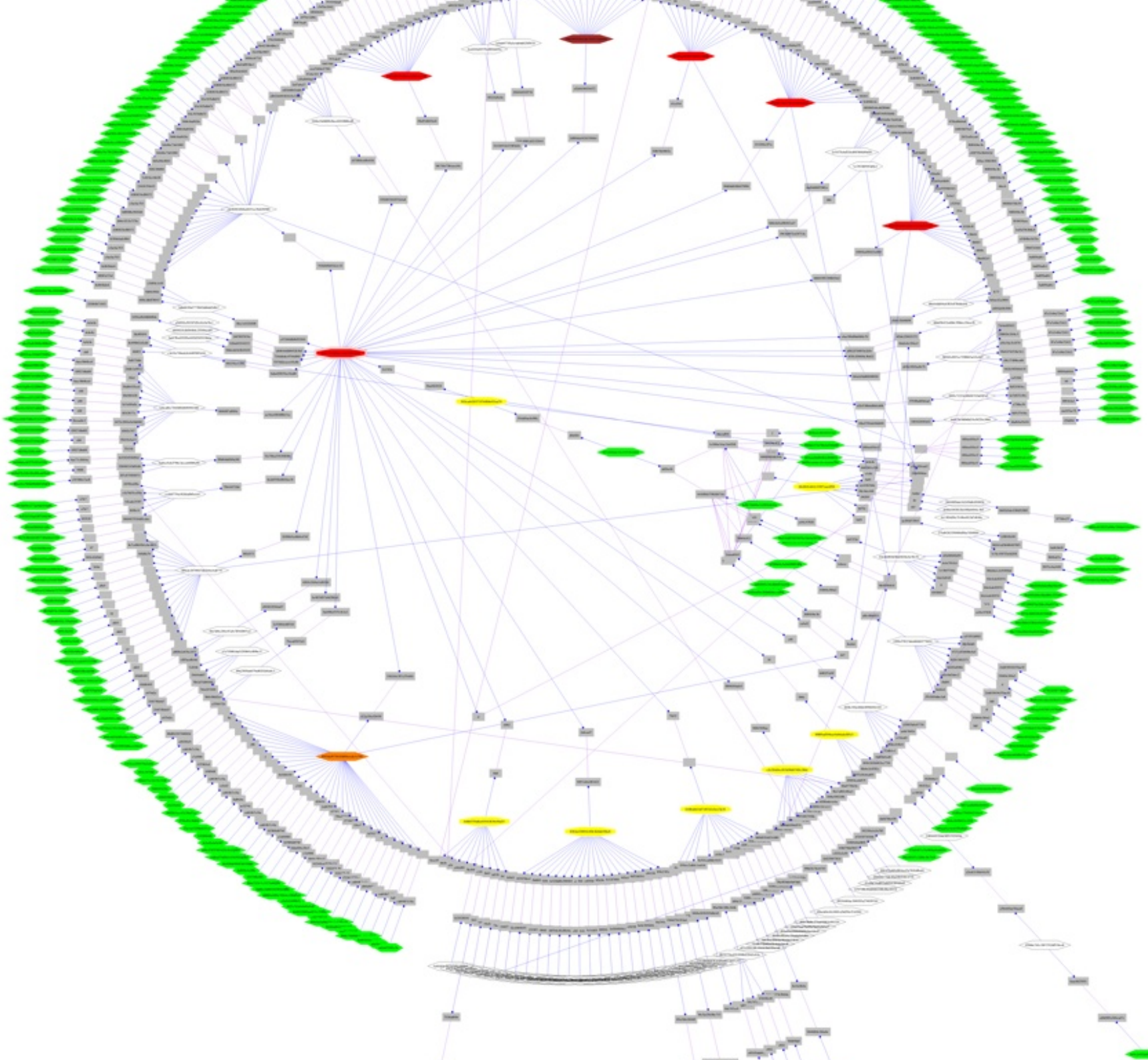
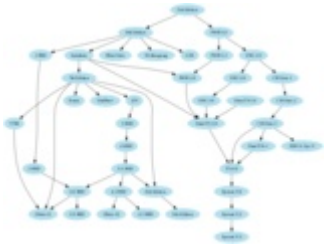
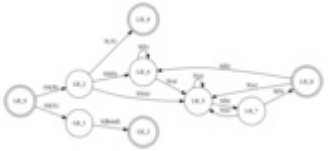
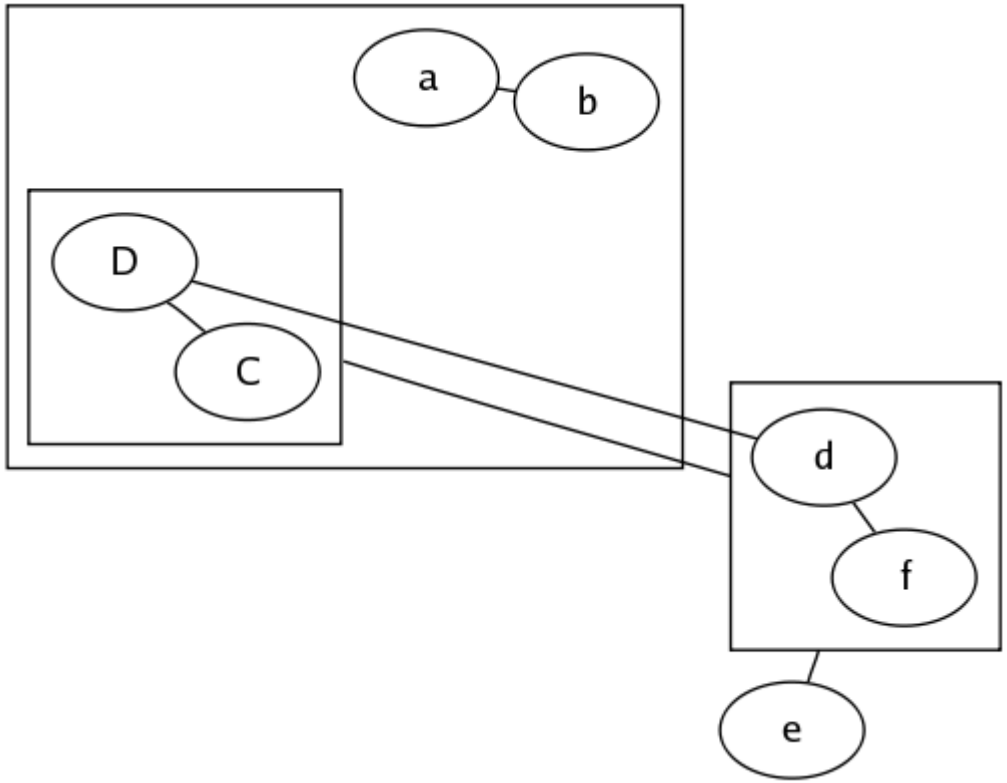


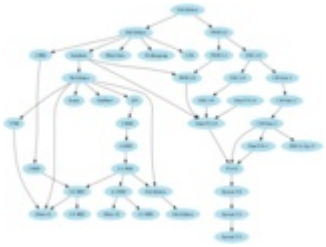


Graphviz

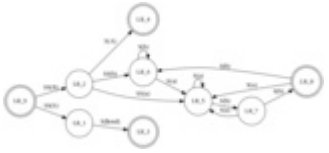


```
graph G {
  e
  subgraph clusterA {
    a -- b;
    subgraph clusterC {
      C -- D;
    }
  }
  subgraph clusterB {
    d -- f
  }
  d -- D
  e -- clusterB
  clusterC -- clusterB
}
```

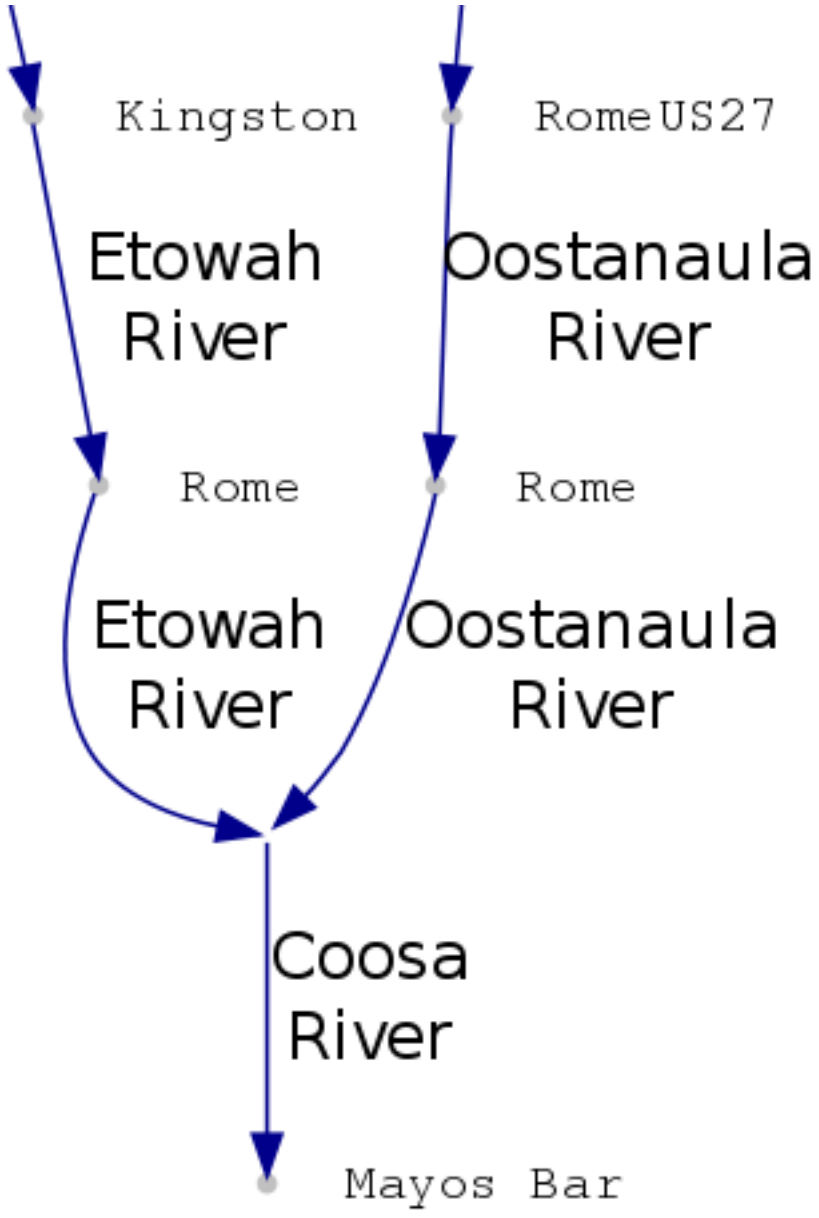


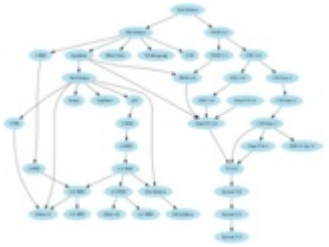


Graphviz

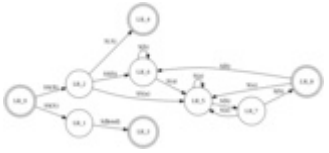


Graphviz rendering directly to a cairo drawing context embedded inside a Gtk+ GUI application...





Graphviz



Language Bindings

- C: native
- C++: mfgraph
- C#: QuickGraph
- Java: Grappa
- Python: pydot, yapgvb, mfgraph
- Ruby: RAA, GraphR
- TCL: tcldot
- Perl: Tons of wrappers
- PHP: in PEAR

Other

- COM: WinGraphviz
- R: R-Grpahviz
- MatLab support

Image Magick

- **URL**, www.imagemagick.org
- License, “GPL compatible”; commercial use OK
- Yes, that is how it's spelled

Image Magick

"*It can read, convert and write images in a variety of formats (over 100) including DPX, EXR, GIF, JPEG, JPEG-2000, PDF, PhotoCD, PNG, Postscript, SVG, and TIFF. Use ImageMagick to translate, flip, mirror, rotate, scale, shear and transform images, adjust image colors, apply various special effects, or draw text, lines, polygons, ellipses and Bézier curves*."

- from the website

Image Magick

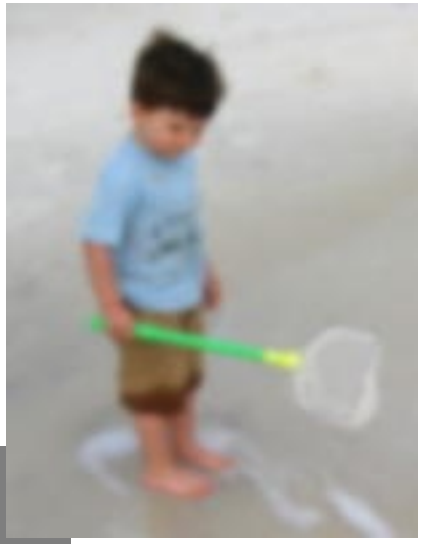


Image Magick

- Good for adding file formats and advanced raster functions to Cairo
- Manipulate image file comments and meta data
- Great way to automate / batch process
- Allows for decoding and encoding image formats to and from raw memory buffers. (i.e. take files straight from libcurl and render them to screen with no disk IO)

Image Magick

Language Bindings

- C, native (MagickWand)
- C++, Magick++
- Java, JMagick
- Perl, PerlMagic
- .NET, MagickNet
- Ruby, RMagick
- Python, PythonMagick
- COM+, ImageMagickObject
- Tcl, TclMagick
- Pascal, PascalMagick
- PHP, MagickWand for PHP
- Ada, G2F
- Lisp, L-Magick

What is *Commercial* Use?

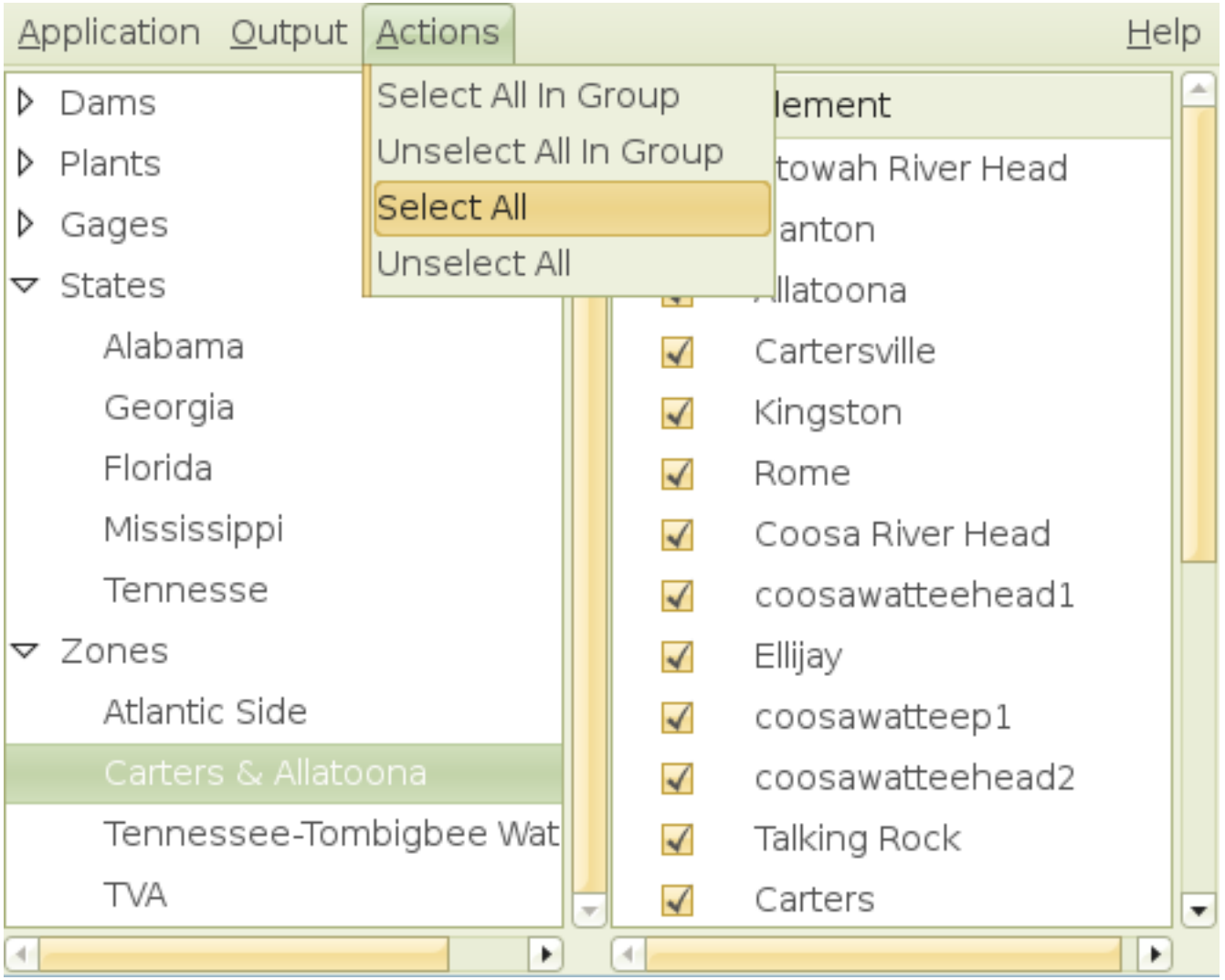
- A rough edge term over generalizing any situation that you don't want to, or can't, release the source code of your project
- “Normal” software licensed for money, or written for clients that will own the copyrights and retain legal rights to the work

GTK

- Gtk ≠ GNOME
- *Callback* based, not message or inheritance based
- Automatic geometry
- Theme-able
- No special macro language
- Highly portable; multiple interfaces
- Tight cairo integration

GTK

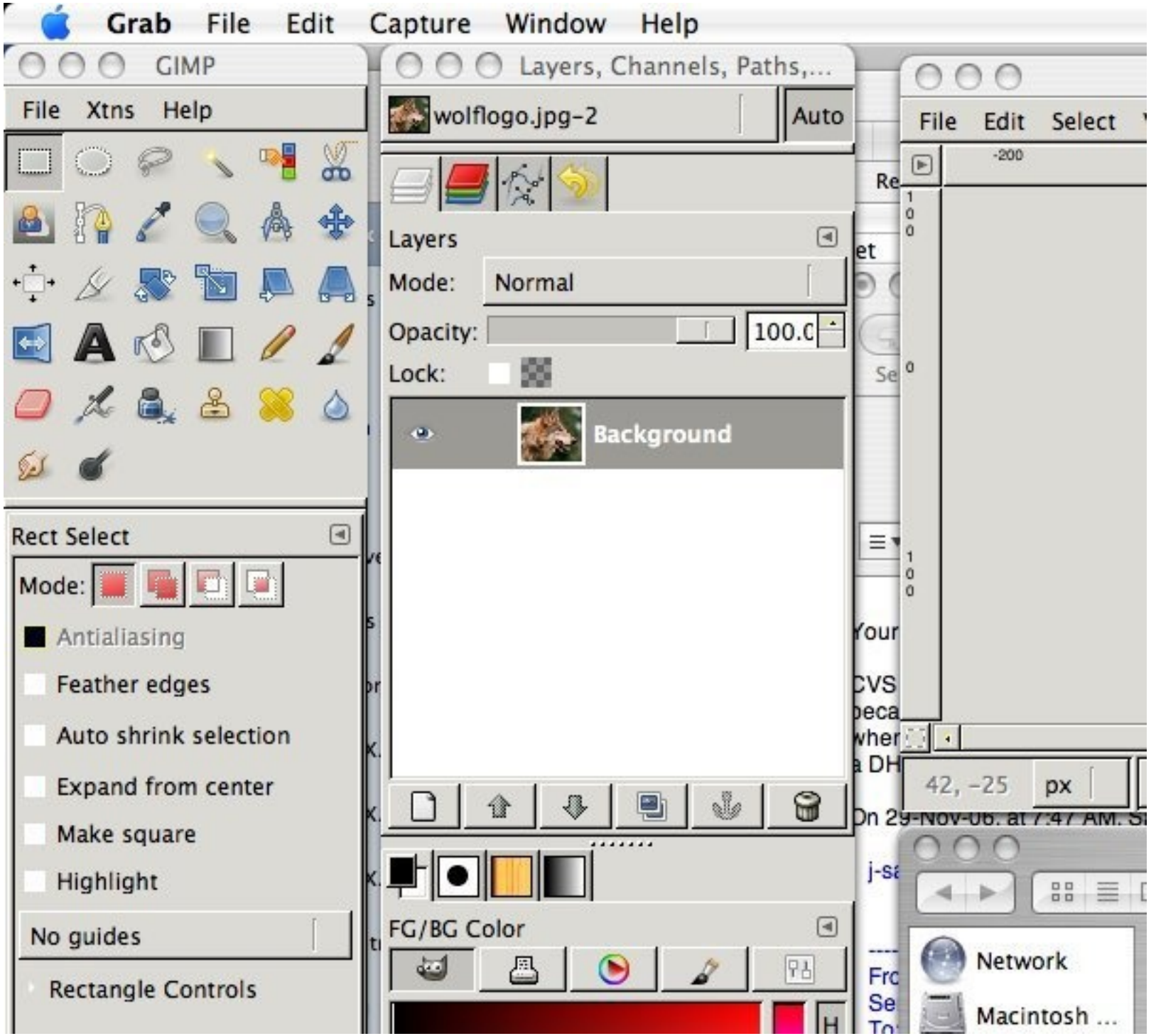
Gtk+ with a Cairo Theme Engine...



GTK

- Not an “application framework”, doesn't “take over” your app
- Real back end implementations, not wrappers
- RAD tools available (though not recommended)
- Modern and simple compared to win32, MFC, winforms, motif, AWT, ext..

GTK on OSX


Grab File Edit Capture Window Help
GIMP
File Xtns Help
Rect Select
Mode:
Antialiasing
Feather edges
Auto shrink selection
Expand from center
Make square
Highlight
No guides
Rectangle Controls
Layers, Channels, Paths,...
wolflogo.jpg-2
Auto
Layers
Mode: Normal
Opacity:
Lock:
Background
FG/BG Color
File Edit Select
42, -25 px
Network
Macintosh ...

Why use it?

- In a web-centric world, the case for a desktop app is hard to make with out being cross-platform
- There is almost every widget/control you need
- Once you get the concepts it's one of the easiest
- And of course.... the license

```
art9/Win32Gtk/include/cairo  /I ../../Third-party/Win32Gtk/include/glib-2.0  /I
../../Third-party/Win32Gtk/include/atk-1.0  -c src\main.c /Foobj\main.obj
main.c
        cl /nologo /D HAVE_WINDOWS_H=1 /DDEBUG /Zi /I src /I ../../Third-party/W
in32Gtk/include  /I ../../Third-party/Win32Gtk/include/gtk-2.0  /I ../../Third-p
arty/Win32Gtk/include/cairo  /I ../../Third-party/Win32Gtk/include/glib-2.0  /I
```

Service Controller

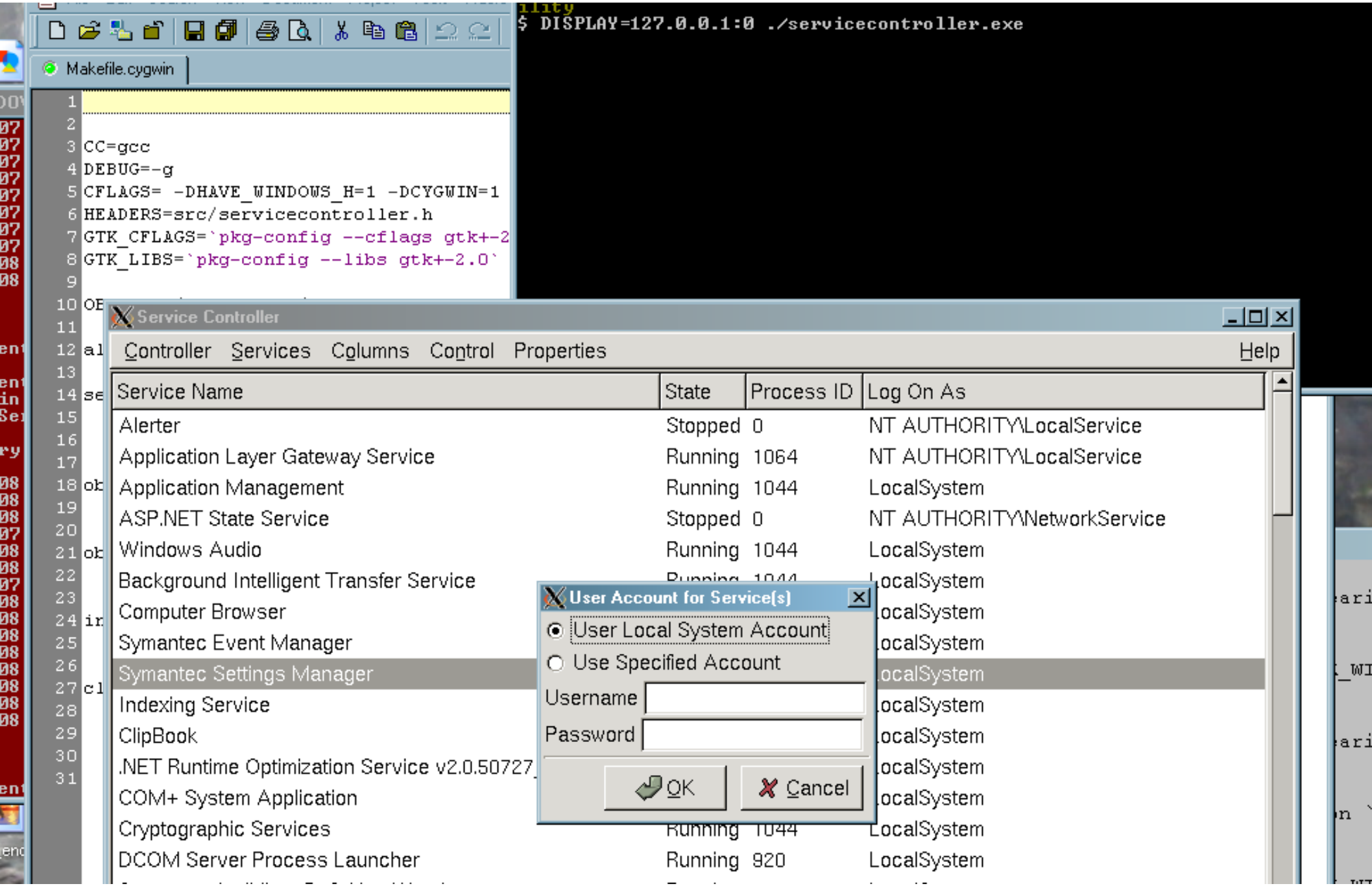
Controller Services Columns Control Properties Help

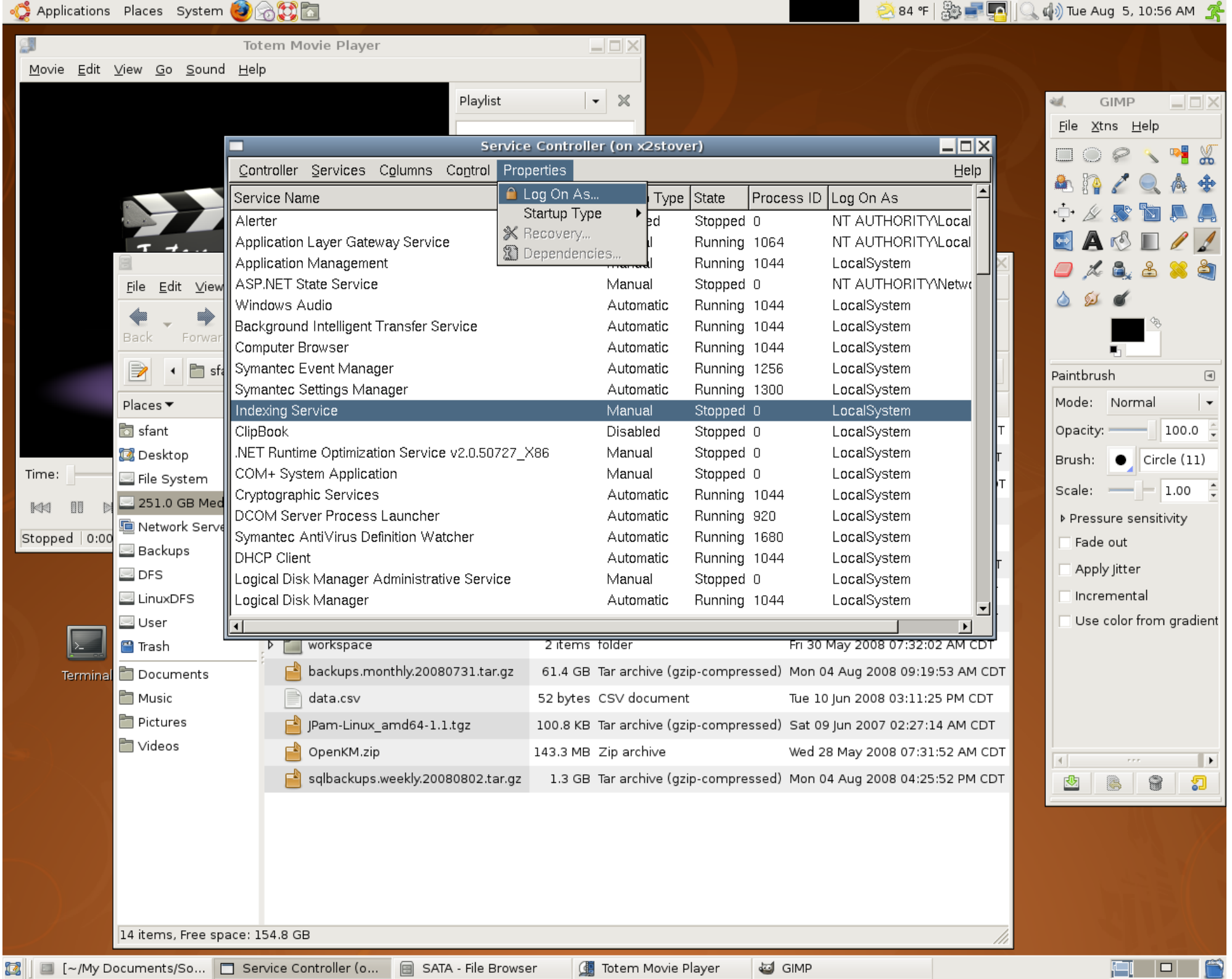
Columns menu: ✔ Name, ✔ Description, ✔ Startup Type, ✔ State, PID, Log on as

Service Name	Startup Type	State	Description
Alerter	Disabled	Stopped	Notifies selected users and computers of administrative ale
Application Layer Gatev	Manual	Running	Provides support for 3rd party protocol plug-ins for Internet
Application Managemer	Manual	Running	Provides software installation services such as Assign, Pul
ASP.NET State Service	Manual	Stopped	Provides support for out-of-process session states for ASP
Windows Audio	Automatic	Running	Manages audio devices for Windows-based programs. If tl
Background Intelligent Transfer Service	Automatic	Running	Transfers data between clients and servers in the backgrc
Computer Browser	Automatic	Running	Maintains an updated list of computers on the network and
Symantec Event Manager	Automatic	Running	Event propagation and logging service
Symantec Settings Manager	Automatic	Running	Settings storage and management service
Indexing Service	Manual	Stopped	Indexes contents and properties of files on local and remot
ClipBook	Disabled	Stopped	Enables ClipBook Viewer to store information and share it
.NET Runtime Optimization Service v2.0.50727_X86	Manual	Stopped	Microsoft .NET Framework NGEN
COM+ System Application	Manual	Stopped	Manages the configuration and tracking of Component Ob
Cryptographic Services	Automatic	Running	Provides three management services: Catalog Database S
DCOM Server Process Launcher	Automatic	Running	Provides launch functionality for DCOM services.
Symantec AntiVirus Definition Watcher	Automatic	Running	Monitors and maintains virus definitions.
DHCP Client	Automatic	Running	Manages network configuration by registering and updatin
Logical Disk Manager Administrative Service	Manual	Stopped	Configures hard disk drives and volumes. The service only
Logical Disk Manager	Automatic	Running	Detects and monitors new hard disk drives and sends disk
DNS Client	Automatic	Running	Resolves and caches Domain Name System (DNS) name:
Error Reporting Service	Automatic	Running	Allows error reporting for services and applictions running i

Just for fun...

Since, GTK has a xlib (soon to be xcfb) back end for X11....
... and cygwin gives us a X11 dev environment ...


$ DISPLAY=127.0.0.1:0 ./servicecontroller.exe
Makefile.cygwin
CC=gcc
DEBUG=-g
CFLAGS= -DHAVE_WINDOWS_H=1 -DCYGWIN=1
HEADERS=src/servicecontroller.h
GTK_CFLAGS=`pkg-config --cflags gtk+-2
GTK_LIBS=`pkg-config --libs gtk+-2.0`
Service Controller
Controller Services Columns Control Properties Help
Service Name State Process ID Log On As
Alerter Stopped 0 NT AUTHORITY\LocalService
Application Layer Gateway Service Running 1064 NT AUTHORITY\LocalService
Application Management Running 1044 LocalSystem
ASP.NET State Service Stopped 0 NT AUTHORITY\NetworkService
Windows Audio Running 1044 LocalSystem
Background Intelligent Transfer Service
Computer Browser
Symantec Event Manager
Symantec Settings Manager
Indexing Service
ClipBook
.NET Runtime Optimization Service v2.0.50727_
COM+ System Application
Cryptographic Services
DCOM Server Process Launcher Running 920 LocalSystem
User Account for Service(s)
User Local System Account
Use Specified Account
Username
Password
OK
Cancel


Applications Places System
84 °F
Tue Aug 5, 10:56 AM
Totem Movie Player
Movie Edit View Go Sound Help
Playlist
Time:
Stopped 0:00
Service Controller (on x2stover)
Controller Services Columns Control Properties Help
Log On As...
Startup Type
Recovery...
Dependencies...
Service Name Type State Process ID Log On As
Alerter Stopped 0 NT AUTHORITY\Local
Application Layer Gateway Service Running 1064 NT AUTHORITY\Local
Application Management Running 1044 LocalSystem
ASP.NET State Service Manual Stopped 0 NT AUTHORITY\Netw
Windows Audio Automatic Running 1044 LocalSystem
Background Intelligent Transfer Service Automatic Running 1044 LocalSystem
Computer Browser Automatic Running 1044 LocalSystem
Symantec Event Manager Automatic Running 1256 LocalSystem
Symantec Settings Manager Automatic Running 1300 LocalSystem
Indexing Service Manual Stopped 0 LocalSystem
ClipBook Disabled Stopped 0 LocalSystem
.NET Runtime Optimization Service v2.0.50727_X86 Manual Stopped 0 LocalSystem
COM+ System Application Manual Stopped 0 LocalSystem
Cryptographic Services Automatic Running 1044 LocalSystem
DCOM Server Process Launcher Automatic Running 920 LocalSystem
Symantec AntiVirus Definition Watcher Automatic Running 1680 LocalSystem
DHCP Client Automatic Running 1044 LocalSystem
Logical Disk Manager Administrative Service Manual Stopped 0 LocalSystem
Logical Disk Manager Automatic Running 1044 LocalSystem
GIMP
File Xtns Help
Paintbrush
Mode: Normal
Opacity: 100.0
Brush: Circle (11)
Scale: 1.00
Pressure sensitivity
Fade out
Apply Jitter
Incremental
Use color from gradient
Places
sfant
Desktop
File System
Network Serve
Backups
DFS
LinuxDFS
User
Trash
Documents
Music
Pictures
Videos
Terminal
workspace 2 items folder Fri 30 May 2008 07:32:02 AM CDT
backups.monthly.20080731.tar.gz 61.4 GB Tar archive (gzip-compressed) Mon 04 Aug 2008 09:19:53 AM CDT
data.csv 52 bytes CSV document Tue 10 Jun 2008 03:11:25 PM CDT
JPam-Linux_amd64-1.1.tgz 100.8 KB Tar archive (gzip-compressed) Sat 09 Jun 2007 02:27:14 AM CDT
OpenKM.zip 143.3 MB Zip archive Wed 28 May 2008 07:31:52 AM CDT
sqlbackups.weekly.20080802.tar.gz 1.3 GB Tar archive (gzip-compressed) Mon 04 Aug 2008 04:25:52 PM CDT
14 items, Free space: 154.8 GB
[~/My Documents/So...
Service Controller (o...
SATA - File Browser
Totem Movie Player
GIMP

URL, tokyocabinet.sourceforge.net

License, L-GPL

Author, Mikio Hirabayashi

(successor to QDBM)

- Low level data storage facilities
- Hash, B+ Tree, fixed length array
- Optional “in memory only” databases
- Journaled file format
- Extremely fast
- Byte order independent, portable
- Utilizes 64bit
- In and Out of process models (server process)
- Server can use mcache clients
- Thread safe

Language Bindings

- C, native
- Java: Java API
- Perl, Perl API
- Ruby, Ruby API
- Python, PYTC
- Others, DIY import wrappers
- Some other options with mcache interface

Yes, that's right...

Language Bindings

- C, Native
- Others, DIY import wrappers

Re-Implementations

- Python, PyPy
- .NET, Iron Python
- Java, Jython

Conclusions...

- A vast array of powerful software components exist for free – right now!
- Cross Platform is doable more often than not.
- Open Source Libraries that people use are great ways to gain notoriety.
- Isn't C useful?

Questions?