Release Notes for X11R7.5

The X.Org Foundation[1]

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These release notes contains information about features and their status in the X.Org Foundation X11R7.5 release.

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Introduction to the X11R7.5 Release

This release is the sixth modular release of the X Window System. The next full release will be X11R7.6 and is expected in 2010.

For help with how to build and develop in the modular tree see the Modular Developer's Guide[2] in the X.Org wiki.

We encourage you to submit bug fixes and enhancements to freedesktop.org's bug tracking system[3] using the xorg product, and to discuss them on <xorg@lists.freedesktop.org>. More details on patch submission and review process are available on the SubmittingPatches[4] page of the X.Org wiki.

The release numbering is based on the original MIT X numbering system. X11 refers to the version of the network protocol that the X Window system is based on: Version 11 was first released in 1988 and has been stable for 21 years, with only upward compatible additions to the core X protocol, a record of stability envied in computing. Formal releases of X started with X version 9 from MIT; the first commercial X products were based on X version 10. The MIT X Consortium and its successors, the X Consortium, the Open Group X Project Team, and the X.Org Group released versions X11R3 through X11R6.6. Since the founding of the X.Org Foundation in early 2004, many further releases have been issued, from X11R6.7 to the current 7.5.

The next section describes what is new in the latest version (7.5) compared with the previous full release (7.4).

Summary of new features in X11R7.5

This is a sampling of the new features in X11R7.5. A more complete list of changes can be found in the ChangeLog files that are part of the source of each X module.

- *Multi-Pointer X (MPX)* provides the user with multiple independent mouse cursors and multiple independent keyboard foci. Each cursor is a true system cursor and different pointers can operate in multiple applications simultaneously.
- *Input device properties* allow you to attach properties to a device. These properties can be of arbitrary type and can be changed without the server having to know their details.
- The *X Input Extension version 2.0 (XI2)* is designed to replace both core input processing and prior versions of the X Input Extension. Besides MPX, it provides a number of other enhancements over version 1.5, including:
  - use of XGE and GenericEvents.
  - explicit device hierarchy of master and slave devices.
  - the ability for devices to change capabilities at runtime.
  - raw device events
- *Resize, Rotate and Reflect Extension (RANDR) version 1.3* builds on the changes made with version 1.2 and adds some new capabilities without fundmentally changing the extension again. The following features are added in this version:

  Projective Transforms

  The implementation work for general rotation support made it trivial to add full projective transformations. These can be used to scale the screen up/down as well as perform projector keystone correct or other effects.

  Panning

  Panning was removed with RandR 1.2 because the old semantics didn't fit any longer. With RandR 1.3 panning can be specified per crtc.

- The *DRI2 extension* is designed to associate and access auxillary rendering buffers with an X drawable. It is a essentially a helper extension to support implementation of direct rendering drivers/libraries/technologies. The main consumer of this extension will be a direct rendering OpenGL driver, but the DRI2 extension is not designed to be OpenGL specific. Direct rendering implementations of OpenVG, Xv, cairo and other graphics APIs should find the functionality exposed by this extension helpful and hopefully sufficient.
- *Video and input driver enhancements*. Please see the ChangeLog files for individual drivers; there are far too many updates to list here.
- ... and the usual assortment of correctness and crash fixes.

Drivers

Video Drivers

X11R7.5 includes the following video drivers:

Driver Name	Description	Further Information
`apm`	Alliance Pro Motion	README.apm[5]
`ark`	Ark Logic	
`ast`	ASPEED Technology	
`ati`	ATI Mach64	README.ati[5]
`chips`	Chips & Technologies	README.chips[5], chips(4)[5]
`cirrus`	Cirrus Logic	
`cyrix` (*)	Cyrix MediaGX	README.cyrix[5]
`fbdev`	Linux framebuffer device	fbdev(4)[5]
`glint`	3Dlabs, TI	glint(4)[5]
`i128`	Number Nine	README.I128[5], i128(4)[5]
`i740`	Intel i740	README.i740[5]
`intel`	Intel i8xx/i9xx	README.intel[5], intel(4)[5]
`impact`	SGI Indigo Impact	impact(4)[5]
`imstt`	Integrated Micro Solns	
`mga`	Matrox	mga(4)[5]
`neomagic`	NeoMagic	neomagic(4)[5]
`newport` (-)	SGI Newport	README.newport[5], newport(4)[5]
`nsc`	National Semiconductor	nsc(4)[5]
`nv`	NVIDIA	nv(4)[5]
`ati`	ATI Rage128	README.r128[5], r128(4)[5]
`radeon`	ATI Radeon	radeon(4)[5]
`rendition`	Rendition	README.rendition[5], rendition(4)[5]
`s3`	S3 (not ViRGE or Savage)	

s3virge	S3 ViRGE	README.s3virge[5], s3virge(4)[5]
savage	S3 Savage	savage(4)[5]
siliconmotion	Silicon Motion	siliconmotion(4)[5]
sis	SiS	README.SiS[5], sis(4)[5]
sisusb	SiS USB	sisusb(4)[5]
sunbw2 (+)	Sun bw2	
suncg14 (+)	Sun cg14	
suncg3 (+)	Sun cg3	
suncg6 (+)	Sun GX and Turbo GX	
sunffb (+)	Sun Creator/3D, Elite 3D	
sunleo (+)	Sun Leo (ZX)	
suntcx (+)	Sun TCX	
tdfx	3Dfx	tdfx(4)[5]
tga	DEC TGA	README.DECtga[5]
trident	Trident	trident(4)[5]
tseng	Tseng Labs	
v4l	Video4Linux	
vesa	VESA	vesa(4)[5]
vmware	VMware guest OS	vmware(4)[5]
voodoo	3Dfx Voodoo	
wsfb	Workstation Framebuffer	wsfb(4)[5]

Drivers marked with (*) are present in a preliminary form in this release, but are not complete and/or stable yet.

Drivers marked with (+) are for Linux/Sparc only.

Drivers marked with (-) are for Linux/mips only.

Darwin/Mac OS X uses IOKit drivers and does not use the module loader drivers listed above. Further information can be found in README.Darwin[5].

Input Drivers

X11R7.5 includes the following input drivers:

Driver Name	Description	Further Information
acecad	Acecad Flair	acecad(4)[6]
aiptek(*)	Aiptek USB tablet	aiptek(4)[6]
elographics	EloGraphics	
evdev(*)	EvDev	evdev(4)[6]
fpit	Fujitsu Stylistic Tablet PCs	fpit(4)[6]
hyperpen	Aiptek HyperPen 6000	

joystick	Joystick	
kbd	generic keyboards (non-evdev systems)	kbd(4)[6]
microtouch	MicroTouch	
mouse	most mouse devices (non-evdev systems)	mouse(4)[6]
mutouch	MicroTouch	
penmount	PenMount	
synaptics	Synaptics & ALP touchpads	
vmmouse	VMWare virtual mouse	
void	dummy device	void(4)[6]

Drivers marked with (*) are available for Linux only.

Overview of X11R7.5

On most platforms, X11R7.5 has a single hardware-driving X server binary called **Xorg**. This binary can dynamically load the video drivers, input drivers, and other modules that are needed. **Xorg** has currently has support for Linux, Solaris, and some BSD OSs on Alpha, PowerPC, IA-64, AMD64, Intel x86, Sparc, and MIPS platforms.

Additional specialized X server binaries may be found depending on the platform and build configuration, including:

Xdmx

is a proxy X server that uses one or more other X servers as its display devices. It provides multi-head X functionality for displays that might be located on different machines.

Xnest

is a nested X server, that operates as both an X client and X server. **Xnest** is a client of the real server which manages windows and graphics requests on its behalf. **Xnest** is a server to its own clients, and manages windows and graphics requests on their behalf. To these clients, it appears to be a conventional server.

Xephyr

is a X server that outputs to a window on a pre-existing "host" X display. Unlike **Xnest** which is an X proxy, and thus limited to the capabilities of the host X server, **Xephyr** is a full X server which uses the host X server window as "framebuffer" via fast SHM XImages.

Xvfb

is a virtual framebuffer X server that can run on machines with no display hardware and no physical input devices. It emulates a dumb framebuffer using virtual memory.

Xquartz

is an X server that interacts with the MacOS X native Aqua window system, displaying windows on the Mac desktop and accepting input from the Mac system devices, allowing X11 applications to be used in a native Mac desktop session.

Xwin

is an X server that runs under the Cygwin environment, interacting with the Microsoft Windows native window system, displaying windows on the Windows desktop and accepting input from the Windows system devices, allowing X11 applications to be used in a native Windows desktop session.

Loader and Modules

The Xorg server relies on the operating system's native module loader support for handling program modules. The X server makes use of modules for video drivers, X server extensions, font rasterisers, input device drivers, framebuffer layers, and internal components used by some drivers (like XAA).

The module interfaces (both API and ABI) used in this release are subject to change without notice. While we will attempt to provide backward compatibility for the module interfaces, we cannot guarantee this. Compatibility in the other direction is explicitly not guaranteed because new modules may rely on interfaces added in new releases.

Note about module security

The X server runs with root privileges, i.e., the X server loadable modules also run with these privileges. For this reason we recommend that all users be careful to only use loadable modules from reliable sources, otherwise the introduction of viruses and contaminated code can occur and wreak havoc on your system. We hope to have a mechanism for signing/verifying the modules that we provide available in a future release.

Configuration File

The X server uses a configuration file as the primary mechanism for providing configuration and run-time parameters. The configuration file format is described in detail in the xorg.conf(5)[6] manual page.

Note that this release features significant improvements for running the server without a configuration file, so many users may find that that they don't need a configuration file.

If you do need to customize the configuration file, see the xorg.conf manual page[7] . You can also check the driver-specific manual pages and the related documentation (found at driver tables also.

The recommended method for generating a configuration file is to use the Xorg server itself. Run as root:

```
Xorg -configure
```

and follow the instructions.

Command Line Options

Command line options can be used to override some default parameters and parameters provided in the configuration file. These command line options are described in the Xorg(1)[8] manual page.

XAA

The XFree86 Acceleration Architecture (XAA) was completely rewritten from scratch for XFree86 4.x and is used in X11R7.5. Most drivers implement acceleration by making use of the XAA module.

EXA

EXA was created as a new driver acceleration architecture to replace XAA. EXA was designed specifically to accelerate Render operations. This release features improved driver support for EXA. See the individual driver changelogs for details. Users should beware that EXA support is considered to be incomplete in X11R7.5.

Multi-head

Some multi-head configurations are supported in X11R7.5, primarily with multiple PCI/AGP cards.

One of the main problems is with drivers not sufficiently initializing cards that were not initialized at boot time. This has been improved somewhat with the INT10 support that is used by most drivers (which allows secondary card to be "soft-booted", but in some cases there are other issues that still need to be resolved. Some combinations can be made to work better by changing which card is the primary card (either by using a different PCI slot, or by changing the system BIOS's preference for the primary card).

Xinerama

Xinerama is an X server extension that allows multiple physical screens to behave as a single screen. With traditional multi-head in X11, windows cannot span or cross physical screens. Xinerama removes this limitation. Xinerama does, however, require that the physical screens all have the same root depth, so it isn't possible, for example, to use an 8-bit screen together with a 16-bit screen in Xinerama mode.

Xinerama is not enabled by default, and can be enabled with the `+xinerama` command line option for the X server.

Known problems:

- Most window managers are not Xinerama-aware, and so some operations like window placement and resizing might not behave in an ideal way. This is an issue that needs to be dealt with in the individual window managers, and isn't specifically an X server problem.

DGA version 2

DGA 2.0 is included in 7.5. Documentation for the client libraries can be found in the XDGA(3)[9] man page. A good degree of backward compatibility with version 1.0 is provided. DGA should be considered deprecated; if you are relying on it, please let us know what you need it for so we can find better solutions.

DDC

The VESA® Display Data Channel (DDC™) standard allows the monitor to tell the video card (or on some cases the computer directly) about itself; particularly the supported screen resolutions and refresh rates.

Partial or complete DDC support is available in most of the video drivers. DDC is enabled by default, but can be disabled with a "Device" section entry: `Option "NoDDC"`. We have support for DDC versions 1 and 2; these can be disabled independently with `Option "NoDDC1"` and `Option "NoDDC2"`.

At startup the server prints out DDC information from the display, and can use this information to set the default monitor parameters, or to warn about monitor sync limits if those provided in the configuration file don't match those that are detected.

Changed behavior caused by DDC.

Several drivers uses DDC information to set the screen size and pitch. This can be overridden by explicitly resetting it to the and non-DDC default value 75 with the `-dpi 75` command line option for the X server, or by specifying appropriate screen dimensions with the "DisplaySize" keyword in the "Monitor" section of the config file.

GLX and the Direct Rendering Infrastructure (DRI)

Direct rendered OpenGL® support is provided for several hardware platforms by the Direct Rendering Infrastructure (DRI). Further information about DRI can be found at the DRI Project's web site[10]. The 3D core rendering component is provided by Mesa[11].

Of note is that this release supports building the X server using the system-wide libdrm. Previously, drm was kept in the server's tree and loaded as a module, rather than using the standard OS mechanisms for managing shared libraries of code. This requires that the server be built using a version of libdrm of 2.3.0 or newer if it is to use DRM.

Font support

Details about the font support in X11R7.5.x can be found in the README.fonts[12] document.

Type1 Font support

Previous versions of X came with two Postscript Type1 font backends. The functionality from the 'Type1' backend has been replaced by the Type1 support in the 'FreeType' backend.

Xlib Compose file support and extensions

A more flexible Compose file processing system was added to Xlib in X11R7.5. The compose file is searched for in the following order:

1. If the environment variable $XCOMPOSEFILE is set, its value is used as the name of the Compose file.
2. If the user's home directory has a file named "`.XCompose`", it is used as the Compose file.
3. The old method is used, and the compose file is "<*xlocaledir*>/<*localename*>`/Compose`".

Compose files can now use an "include" instruction. This allows local modifications to be made to existing compose files without including all of the content directly. For example, the system's iso8859-1 compose file can be included with a line like this:

```
include "/usr/X11R6/lib/X11/locale/iso8859-1/Compose"
```

There are two substitutions that can be made in the file name of the include instruction. *%H* expands to the user's home directory (the *$HOME* environment variable), and *%L* expands to the name of the locale specific Compose file (i.e., "<*xlocaledir*>/<*localename*>`/Compose`").

For example, you can include in your compose file the default Compose file by using:

```
include "%L"
```

and then rewrite only the few rules that you need to change. New compose rules can be added, and previous ones replaced.

Finally, it is no longer necessary to specify in the right part of a rule a locale encoded string in addition to the keysym name. If the string is omitted, Xlib figures it out from the keysym according to the current locale. I.e., if a rule looks like:

```
<dead_grave> <A> : "\300" Agrave
```

the result of the composition is always the letter with the "\300" code. But if the rule is:

```
<dead_grave> <A> : Agrave
```

the result depends on how Agrave is mapped in the current locale.

Luxi fonts from Bigelow and Holmes

The X distribution includes the "Luxi" family of Type 1 fonts and TrueType fonts. This family consists of the fonts "Luxi Serif", "Luxi Sans" and "Luxi Mono" in Roman, oblique, bold and bold oblique variants. The TrueType version have glyphs covering

the basic ASCII Unicode range, the Latin 1 range, as well as the *Extended Latin* range and some additional punctuation characters. In particular, these fonts include all the glyphs needed for ISO 8859 parts 1, 2, 3, 4, 9, 13 and 15, as well as all the glyphs in the Adobe Standard encoding and the Windows 3.1 character set.

The glyph coverage of the Type 1 versions is somewhat reduced, and only covers ISO 8859 parts 1, 2 and 15 as well as the Adobe Standard encoding.

The Luxi fonts are original designs by Kris Holmes and Charles Bigelow from Bigelow and Holmes Inc., who developed the Luxi typeface designs in Ikarus digital format. URW++ Design and Development GmbH converted the Ikarus format fonts to TrueType and Type 1 font programs and implemented the grid-fitting "hints" and kerning tables in the Luxi fonts.

The license terms for the Luxi fonts are included in the file '`COPYRIGHT.BH`', as well as in the License document[13]. For further information, please contact <`design@bigelowandholmes.com`> or <`info@urwpp.de`>, or consult the URW++ web site[14].

Miscellaneous

This section describes other items of note for the X11R7.5 release.

Socket directory ownership and permissions

The socket directories created in `/tmp` are now required to be owned by root and have their sticky-bit set. If the permissions are not set correctly, the component using this directory will print an error message and fail to start. Common socket directories that are known to be affected include:

```
/tmp/.font-unix
/tmp/.ICE-unix
/tmp/.X11-unix
```

These directories are used by the font server, **xfs**, applications using the Inter-Client Exchange protocol (ICE) and the X server, respectively.

There are several solutions to the problem of when to create these directories. They could be created at install time by the system's installer if the `/tmp` dir is persistent. They could be created at boot time by the system's boot scripts (e.g., the `init.d` scripts). Or, they could be created by PAM modules at service startup or user login time.

The solution chosen is platform dependent, and the system administrator should be able to handle creating those directories on any systems that do not have the correct ownership or permissions.

Composite exposes extra visuals

When the Composite extension is enabled, a new visual is created. This visual is different from the other visuals used by X applications in that it includes an alpha component. It is used by the compositing manager and other Composite aware applications.

Most X applications ignore this visual since it is not useful to them; however some applications mistakenly try to use it, which will cause them to fail. An environment variable, XLIB_SKIP_ARGB_VISUALS, was added to the X11 library to hide this visual from applications that mistakenly try to use it. If an application fails only when

the Composite is enabled, try setting this environment variable before starting the application.

Deprecated components and removal plans

This section lists current plans for removal of obsolete or deprecated components in the X.Org releases. As our releases are open source, users who continue to require these can find the source in previous releases and continue to use these, but the X.Org Foundation and its volunteers have decided the burden of continued maintenance and distribution in the core X11 releases outweighs the benefits of doing so. In some cases, this is simply because no one has volunteered to do continued maintenance, so if software is listed here that you need, you can contact <xorg@lists.freedesktop.org> to volunteer to take over maintainership, either inside or outside of the Xorg release process.

Xprint

The Xprint server and extension have been removed in this release. Xprint support in a number of client programs has also been removed.

Unmaintained extensions

Support has been removed from the X servers for the following extensions, which were obsolete, not widely used, or not working:

- AppGroup
- EVI
- MIT-SUNDRY-NONSTANDARD
- TOG-CUP
- XTrap
- XFree86-Misc
- XEvIE

Xorg configuration utilities

The **xorgcfg** GUI and **xorgconfig** CLI utilities have been removed in this release. See the Configuration File section for alternative methods of Xorg configuration.

ioport

The ioport utility and its aliases (inb, inw, inl, outb, outw, and outl) for manipulating I/O space addresses directly have been removed in this release.

Attributions/Acknowledgements/Credits

THIS IS A DRAFT OF THE X11R7.5 CREDITS SECTION.: If you find missing credits, incorrect attributions, or other errors, please send details to <xorg@lists.freedesktop.org>.

This section lists the credits for the X11R7.5 release. For a more detailed breakdown, refer to the ChangeLog file in the source tree for each module, the history in the

xorg product in freedesktop.org's git repositories[15] or the '`git log`' information for individual source files.

The X Window System has been a collaborative effort from its inception. Our apologies for anyone or organization inadvertently overlooked. Many individuals (including major contributors) who worked on X are represented by their employers in this list. If you feel we have left anyone out, please let us know.

These people contributed in some way to X11R7.5:

Aaron Plattner
Aaron Zang
Adam Jackson
Adam Tkac
Alan Coopersmith
Alan Hourihane
Alex Deucher
Ander Conselvan de Oliveira
Bart Trojanowski
Ben Byer
Ben Gamari
Ben Skeggs
Benjamin Close
Benjamin Defnet
Benjamin Tissoires
Bernhard R. Link
Bernhard Rosenkraenzer
Brad Smith
Brian Rogers
Carl Worth
Chris Ball
Christian Beier
Colin Guthrie
Colin Harrison
Cooper Yuan
Dan Nicholson
Daniel Drake
Daniel Stone
Dave Airlie
Dave Miller
David Jander
David Marx
David Miller
David Nolden
David Nusinow
Dodji Seketeli
Donnie Berkholz
Doug Chapman
Drew Parsons
Eamon Walsh
Egbert Eich
Eric Anholt
Eric Paris
Éric Piel
Federico Mena Quintero
Felix Kuehling
Fernando Carrijo
Francis Giraldeau
Fredrik Höglund
Gaetan Nadon
George Peter Staplin
John Hein
John Tapsell
Jon TURNEY
Jordan Crouse
Julien Cristau
Kazuhiro Inaoka
Keith Packard
Kevin E Martin
Kim Woelders
Kristian Høgsberg
Lee Leahu
Luc Verhaegen
Maarten Maathuis
Magnus Kessler
Magnus Vigerlöf
Manuel Bouyer
Mark Kettenis
Martin-Éric Racine
Mathieu Bérard
Matt Turner
Matthias Hopf
Matthieu Herrb
Michael Lorenz
Michael Vogt
Michael Witrant
Michel Dänzer
Mikhail Gusarov
Nathaniel McCallum
Nicolai Hähnle
Oliver McFadden
Olivier Blin
Owen W. Taylor
Paul Bender
Paulo César Pereira de Andrade
Paulo Ricardo Zanoni
Peter Åstrand
Peter Harris
Peter Hutterer
Pierre Willenbrock
Pierre-Loup A. Griffais
RALOVICH, Kristóf
Rémi Cardona
Richard Hughes
Robert Noland
Roland Bär
Roland Scheidegger
Ross Burton
Samuel Thibault
Sascha Hlusiak
Shunichi Fuji
Simon Farnsworth

George Sapountzis
George Staplin
Goneri Le Bouder
Hans de Goede
Hasso Tepper
Havoc Pennington
Hong Liu
Ian Romanick
Ivaylo Boyadzhiev
James Cloos
Jason Vas Dias
Jay Cotton
Jeremy Huddleston
Jeremy Uejio
Jerome Glisse
Jesse Adkins
Jesse Barnes
Jesse Ruffin
Jie Luo
Jim Huang
Joe Krahn
Joel Bosveld
Simon Thum
Søren Sandmann Pedersen
Stefan Dirsch
Stuart Bennett
Thomas Bodzar
Thomas Jaeger
Thorvald Natvig
Tiago Vignatti
Tilman Sauerbeck
Timo Aaltonen
Tom Jaeger
Tomas Carnecky
Tomas Janousek
Topi Kanerva
Tormod Volden
Werner LEMBERG
Winfried Grünewald
Xavier Bestel
Xiang, Haihao
Yaakov Selkowitz
Zhenyu Wang

This product includes software developed by:

2d3d Inc.
3Dlabs Inc. Ltd.
Aaron Plattner
Adam de Boor
Adam Jackson
Adobe Systems Inc.
After X-TT Project
AGE Logic Inc.
Alan Coopersmith
Alan Cox
Alan Hourihane
Alexander Gottwald
Alex Deucher
Alex Williamson
Anders Carlsson
Andreas Luik
Andreas Monitzer
Andreas Robinson
Andrei Barbu
Andrew C Aitchison
Andy Ritger
Angus Lees
Ani Joshi
Anton Zioviev
Apollo Computer Inc.
Apple Computer Inc.
Ares Software Corp.
AT&T Inc.
ATI Technologies Inc.
BEAM Ltd.
Benjamin Herrenschmidt
Benjamin Rienfenstahl
Kristian Høgsberg
Larry Wall
Lars Knoll
Lawrence Berkeley Laboratory
Leif Delgass
Lennart Augustsson
Leon Shiman
Lexmark International Inc.
Linus Torvalds
Luc Verhaegen
Machine Vision Holdings Inc.
Manfred Brands
Marc Aurele La France
Mark Adler
Mark J. Kilgard
Mark Leisher
Mark Smulders
Mark Vojkovich
Marvin Solomon
Massachusetts Inst. Of Technology
Matrox Graphics
Matthew Grossman
Matthias Hopf
Matthieu Herrb
Metro Link Inc.
Michael Bax
Michael H. Schimek
Michael P. Marking
Michael Schimek
Michael Smith
Michel Dänzer
Mike A. Harris

Ben Skeggs
Bigelow and Holmes
Bill Reynolds
Bitstream Inc.
Bogdan Diaconescu
Branden Robinson
Brian Fundakowski Feldman
Brian Goines
Brian Paul
Bruno Haible
Bryan Stine
Carl Switzky
Catharon Productions Inc.
Charles Murcko
Chen Xiangyang
Chisato Yamauchi
Chris Constello
Christian Zietz
Cognition Corp.
Compaq Computer Corporation
Concurrent Computer Corporation
Conectiva S.A.
Corin Anderson
Craig Struble
Daewoo Electronics Co. Ltd.
Dag-Erling Smørgrav
Dale Schumacher
Damien Miller
Daniel Berrange
Daniel Borca
Daniel Stone
Daniver Limited
Daryll Strauss
Data General Corporation
Dave Airlie
David Bateman
David Dawes
David E. Wexelblat
David Holland
David J. McKay
David McCullough
David Mosberger-Tang
David Reveman
David S. Miller
David Woodhouse
Davor Matic
Deron Johnson
Digeo Inc.
Digital Equipment Corporation
Dirk Hohndel
Dmitry Golubev
Donnie Berkholz
DOS-EMU-Development-Team
Doug Anson
Drew Parsons
Earle F. Philhower III
Edouard TISSERANT
Eduard Fuchs
Eduardo Horvath
Mike Harris
Ming Yu
MIPS Computer Systems Inc.
National Semiconductor
NCR Corporation Inc.
NetBSD Foundation
Netscape Communications Corp.
Network Computing Devices Inc.
Nicholas Joly
Nicholas Miell
Nicholas Wourms
Nicolai Haehnle
Noah Levitt
Nolan Leake
Novell Inc.
Nozomi YTOW
NTT Software Corporation
Number Nine Computer Corp.
Number Nine Visual Technologies
NVIDIA Corp.
Oivier Danet
Oki Technosystems Laboratory Inc.
OMRON Corporation
Open Software Foundation
Orest Zborowski
Owen Taylor
Pablo Saratxaga
Panacea Inc.
Panagiotis Tsirigotis
Paolo Severini
Pascal Haible
Patrick Lecoanet
Patrick Lerda
Paul Anderson
Paul Elliott
Paul Mackerras
Peter Breitenlohner
Peter Kunzmann
Peter Trattler
Philip Homburg
Philip Langdale
Precision Insight Inc.
Prentice Hall
Quarterdeck Office Systems
Radek Doulik
Ralf Habacker
Randy Hendry
Ranier Keller
Red Hat Inc.
Regis Cridlig
Rene Cougnenc
Richard A. Hecker
Richard Burdick
Rich Murphey
Rickard E. Faith
Rik Faith
Robert Chesler
Robert Millan
Robert V. Baron

Egbert Eich
Egmont Koblinger
Elliot Lee
Eric Anholt
Eric Fortune
Eric Sunshine
Erik Fortune
Erik Nygren
Evans & Sutherland Computer Corp.
Fabio Massimo Di Nitto
Fabrizio Gennari
Felix Kuehling
Felix Kühling
Finn Thoegersen
Francesco Zappa Nardelli
Frank C. Earl
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Free Software Foundation
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Notes

1. http://www.x.org/wiki/XorgFoundation
2. http://wiki.x.org/wiki/ModularDevelopersGuide
3. https://bugs.freedesktop.org/

4. http://www.x.org/wiki/Development/Documentation/SubmittingPatches
5. Darwin.html
6. xorg.conf.5.html
7. xorg.conf.5.html
8. Xorg.1.html
9. XDGA.3.man
10. http://dri.sf.net/
11. http://www.mesa3d.org
12. fonts.html
13. LICENSE.html
14. http://www.urwpp.de
15. http://cgit.freedesktop.org/xorg/