

# Release Notes for X11R7.5

## The X.Org Foundation

(<http://www.x.org/wiki/XorgFoundation>)

October 2009

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

## 1. 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.

Unlike X11R1 through X11R6.9, X11R7.x releases are not built from one monolithic source tree, but many individual modules. These modules are distributed as individual source code releases, and each one is released when it is ready, instead of only when the overall window system is ready for release. The X11R7.x releases are made by “rolling up” the individual module releases into a collection that is often affectionately called the “*katamari*” by the developers.

The X11R7.5 release does not include all of the software formerly included in the previous X Window System releases. It is designed to be a reasonable baseline from which to start when building the window system for the first time for a new installation, distribution, or package set. It does not provide a full desktop environment, expecting a more feature rich set of applications to be installed from one of the several excellent desktop environments available for the X Window System. The X.Org developers continue to maintain and produce new releases of much of the software that was formerly in the main window system releases but is no longer included in the katamari releases, including many of the Athena Widgets desktop applications that were provided as samples in previous window system versions.

Once their window system build is established, most builders watch for announcements of individual module updates on the xorg-announce mailing list (<http://lists.freedesktop.org/mailman/listinfo/xorg-announce>) and update to those as needed. The X.Org Foundation currently releases the X Window System katamari releases approximately once a year, but many modules, especially the X servers and drivers, are updated more frequently between those releases.

For help with how to build and develop in the modular tree see the Modular Developer's Guide (<http://wiki.x.org/wiki/ModularDevelopersGuide>) in the X.Org wiki.

We encourage you to submit bug fixes and enhancements to [freedesktop.org's](https://bugs.freedesktop.org/) bug tracking system (<https://bugs.freedesktop.org/>) using the xorg product, and to discuss them on [<xorg@lists.freedesktop.org>](mailto:xorg@lists.freedesktop.org). More details on patch submission and review process are available on the SubmittingPatches (<http://www.x.org/wiki/Development/Documentation/SubmittingPatches>) 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).

## 2. 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 fundamentally 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 essentially a helper extension to support implementation of direct rendering drivers/libraries/technologies. The first consumer of this extension is a direct rendering OpenGL driver, but the DRI2 extension is not designed to be OpenGL specific. Work is underway to utilize DRI2 for the Video Decode and Presentation API for Unix (VPDAU) as well. 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.

## 3. 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 a “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.

## **4. Details of X11R7.5 components**

### **4.1. Video Drivers**

X11R7.5 includes the following video drivers:

Driver Name	Description	Further Information
apm	Alliance Pro Motion	README.apm (apm.html)
ark	Ark Logic	
ast	ASPEED Technology	
chips	Chips & Technologies	README.chips (chips.html), chips(4) (chips.4.html)
cirrus	Cirrus Logic	
fbdev	Linux framebuffer device	fbdev(4) (fbdev.4.html)
geode (*)	AMD Geode GX and LX	
glint	3Dlabs, TI	glint(4) (glint.4.html)
i128	Number Nine	README.I128 (I128.html), i128(4) (i128.4.html)
i740	Intel i740	README.i740 (i740.html)
imstt	Integrated Micro Solns	
intel	Intel i8xx/i9xx	README.intel (intel.html), intel(4) (intel.4.html)
mach64	ATI Mach64	README.ati (ati.html)
mga	Matrox	mga(4) (mga.4.html)
neomagic	NeoMagic	neomagic(4) (neomagic.4.html)
newport (-)	SGI Newport	README.newport (newport.html), newport(4) (newport.4.html)
nsc	National Semiconductor	nsc(4) (nsc.4.html)
nv	NVIDIA	nv(4) (nv.4.html)
r128	ATI Rage128	README.r128 (r128.html), r128(4) (r128.4.html)
radeon	ATI Radeon	radeon(4) (radeon.4.html)
rendition	Rendition	README.rendition (rendition.html), rendition(4) (rendition.4.html)
s3	S3 (not ViRGE or Savage)	
s3virge	S3 ViRGE	README.s3virge (s3virge.html), s3virge(4) (s3virge.4.html)
savage	S3 Savage	savage(4) (savage.4.html)
siliconmotion	Silicon Motion	siliconmotion(4) (siliconmotion.4.html)
sis	SiS	README.SiS (SiS.html), sis(4) (sis.4.html)
sisusb	SiS USB	sisusb(4) (sisusb.4.html)
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 Voodoo Banshee, 3, 4 & 5	tdfx(4) (tdfx.4.html)
tga	DEC TGA	README.DECtga (DECTga.html)
trident	Trident	trident(4) (trident.4.html)
tseng	Tseng Labs	
v4l	Video4Linux	v4l(4) (v4l.4.html)
vesa	VESA	vesa(4) (vesa.4.html)
vmware	VMware guest OS	vmware(4) (vmware.4.html)
voodoo	3Dfx Voodoo 1 & 2	voodoo(4) (voodoo.4.html)
wsfb	Workstation Framebuffer	wsfb(4) (wsfb.4.html)
xgi	XGI	xgi(4) (xgi.4.html)
xgixp	XGI XP	xgixp(4) (xgixp.4.html)

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.

## 4.2. Input Drivers

X11R7.5 includes the following input drivers:

Driver Name	Description	Further Information
acecad	Acecad Flair	acecad(4) (aiptek.4.html)
aiptek (*)	Aiptek USB tablet	aiptek(4) (aiptek.4.html)
evdev (*)	Linux kernel EvDev	evdev(4) (evdev.4.html)
joystick	Joystick	joystick(4) (joystick.4.html)
kbd	generic keyboards (non-evdev systems)	kbd(4) (kbd.4.html)

mouse	most mouse devices (non-evdev systems)	mouse(4) (mouse.4.html)
synaptics	Synaptics & ALP touchpads	synaptics(4) (synaptics.4.html)
vmmouse	VMWare virtual mouse	vmmouse(4) (vmmouse.4.html)
void	dummy device	void(4) (void.4.html)

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

## 4.3. Xorg server

### 4.3.1. 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, input device drivers, framebuffer layers, and internal components used by some drivers (like XAA & EXA).

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.

### 4.3.2. Configuration File

The Xorg 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)` (`xorg.conf.5.html`) manual page.

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

If you do need to customize the configuration file, see the `xorg.conf` manual page (`xorg.conf.5.html`) . 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.

### **4.3.3. 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)` (`Xorg.1.html`) manual page.

### **4.3.4. 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.

### **4.3.5. 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.

### **4.3.6. Multi-head**

Some multi-head configurations are supported in X11R7.5. Support for multiple PCI/AGP cards may require a kernel with changes to support VGA arbitration.

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).



### 4.3.7. 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.

### 4.3.8. DDC

The VESA® Display Data Channel (DDC™) standard allows the monitor to tell the video card (or in 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.

#### 4.3.8.1. *Changed behavior caused by DDC.*

Several drivers use 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.

### 4.3.9. 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 (<http://dri.sf.net/>). The 3D core rendering component is provided by Mesa (<http://www.mesa3d.org>).

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.

### 4.3.10. Terminate Server keystroke

The Xorg server has previously allowed users to exit the server by pressing the keys **Control + Alt + Backspace**. While this function is still enabled by default in this release, the keymap data usually used with Xorg, from the `xkeyboard-config` project, has been modified to not map that sequence by default, in order to reduce the chance that inexperienced users will accidentally destroy their work.

Users who wish to have this functionality available by default may enable it via the XKB configuration option `"terminate:ctrl_alt_bksp"`. For instance, the `setxkbmap` command can be used to enable this by running:

```
setxkbmap -option "terminate:ctrl_alt_bksp"
```

Many desktop environments include XKB configuration options in their preferences to enable this as well.

### 4.3.11. X Server startup state

The X servers in the X11R7.5 release now start by default with an empty black screen and do not draw the mouse cursor until a client sets the cursor image. To restore the classic behavior of starting with the grey weave pattern and `×` cursor, start the X server with the `-retro` option.

## 4.4. Font support

Details about the font support in X11R7.5 can be found in the `README.fonts` (`fonts/fonts.html`) document.

### 4.4.1. Default font installation directory

Previous versions of X installed font files under the `lib/X11/fonts` subdirectory of the X installation directory (for instance, in X11R6 releases, `/usr/X11R6/lib/X11/fonts` was commonly used). This release changes the default installation path to the `fonts` subdirectory of the `datadir` setting from the GNU autoconf configuration. For instance, if the fonts are configured with `./configure --prefix=/usr`, they will be installed under subdirectories of `/usr/share/fonts/X11`. The font module configure scripts all take an option of `--with-fontrootdir=PATH` to override the default. If `--with-fontrootdir` is not specified, the `fontutil pkg-config` file will be consulted to find the `fontrootdir` specified when the `fontutil` module was installed.

#### 4.4.2. Bitmap font compression methods

The X11R7.5 release supports PCF format bitmap fonts stored uncompressed or compressed via the **compress**, **gzip**, or **bzip2** programs. To utilize bzip2 compression, the `libXfont` and **mkfontscale** modules must be built with the `--with-bzip2` — all other methods are enabled by default.

To specify which compression method to use when installing a font module from X11R7.5 the configure scripts accept an option of `--with-compression=TYPE`, where *TYPE* may be `none`, `compress`, `gzip`, or `bzip2`.

#### 4.4.3. 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.

#### 4.4.4. CID Font support

The CID-keyed font format was designed by Adobe Systems for fonts with large character sets. The CID-keyed format is obsolete, as it has been superseded by other formats such as OpenType/CFF and support for CID-keyed fonts has been removed from X11.

## 5. Build changes and issues

### 5.1. Silent build rules

Most of the modules in this release use the `AM_SILENT_RULES` option of GNU automake 1.11. When building the software, most output will show an abbreviated format for the commands being run, such as:

```
CC xmen.o
```

To enable verbose output, showing all the arguments to the commands being run, add the flag `V=1` to the **make** command line or add the flag `--disable-silent-rules` to the configure command.

### 5.2. New configure options for font modules

Several new options have been added to the configure scripts for font modules in this release. See the Font support section of this document for details of the `--with-fontrootdir=PATH` and

`--with-compression=TYPE` options.

## 5.3. Changes to extension headers

The C language header files for a number of X11 protocol extensions were refactored in this release to better split the protocol definitions and the client library definitions. Efforts were made to retain compatibility for existing software, but use of some headers may now trigger warnings suggesting including new or more appropriate headers instead.

Since these changes were made to files in both the `proto` and `lib` modules for each extension, builders upgrading individual modules will have to update these modules in unison to avoid breaking builds of software using the headers from these modules.

## 6. Miscellaneous

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

### 6.1. 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.

## 6.2. 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.

## 7. Deprecating 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](mailto:xorg@lists.freedesktop.org) to volunteer to take over maintainership, either inside or outside of the Xorg release process.

### 7.1. Future Removals

#### DGA version 2

DGA 2.0 is included in 7.5. Documentation for the client libraries can be found in the XDGA(3) (XDGA.3.man) man page. 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.

#### Input device discovery via HAL

The Xorg server currently uses the HAL framework (<http://www.freedesktop.org/wiki/Software/hal>) to discover connected input devices, receive notification of hotplug events for them, and to retrieve configuration parameters for them. The HAL maintainers have deprecated HAL, so the X.Org developers are investigating alternatives. As a result, configuration of input devices via `HAL *.fdi` files may not be supported in future Xorg server releases.

#### Xsdl server

The experimental Xsdl server has never been finished or maintained, and will be removed in future X server releases.

## 7.2. Removed in this Release

### Xprint

The Xprint server and extension have been removed in this release. The libXaw8 variant of the Athena Widgets which added Xprint widgets has been removed from this release. Xprint support in a number of client programs has also been removed.

### kdrive servers

The kdrive X servers for vesa, ati, chips, epson, i810, igs, ipaq, itsy, mach64, mga, neomagic, nvidia, pcmcia, pm2, r128, savage, sis300, sis530, smi, trident, trio, ts300, via, and vxworks have been removed in this release. Most of these have not worked or been maintained in recent releases.

### 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
- FontCache
- 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.

## 8. Attributions/Acknowledgements/Credits

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 (<http://cgit.freedesktop.org/xorg/>) 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	Jordan Crouse
Aaron Zang	Joseph Adams
Adam Hoka	Josh Triplett
Adam Jackson	Juan RP
Adam Tkac	Julien Cristau
Adel Gadllah	Julien Plissonneau Duquene
Adrian Friedli	Juliusz Chroboczek
Alan Coopersmith	Kalev Lember
Alan Cox	Kazuhiro Inaoka
Alan Curry	Kees Cook
Alan Hourihane	Keith Packard
Albert Damen	Kel Modderman
Alberto Milone	Ken Thomases
Alex Deucher	Kevin E Martin
Alex Villacís Lasso	Khaled Hosny
Alexey Ten	Kim Woelders
Ander Conselvan de Oliveira	Kristian Høgsberg
Andre Herms	Krzysztof Halasa
Andreas Luik	Kshitij Kulshreshtha
Andres Salomon	Kyle McMartin
Andrew Randrianasulu	Lee Leahu
Arkadiusz Miśkiewicz	Li Peng
Arnaud Patard	Li Shao Hua
Arthur HUILLET	Lubos Lunak
Asbjørnnes	Luc Verhaegen
Barry Scott	Lukáš Hejtmánek
Bart Massey	Lukasz Kurylo
Bart Trojanowski	Ma Ling
Bastien Nocera	Maarten Maathuis
Batchy	Maciej Cencora
Ben Byer	Magnus Kessler
Ben Gamari	Magnus Vigerlöf
Ben Hutchings	Manuel Bouyer
Ben North	Marcel Dejean
Ben Skeggs	Marcin Baczyński
Benjamin Close	Marcin 'Qrczak' Kowalczyk
Benjamin Defnet	Mark Kettenis
Benjamin Herrenschmidt	Mark van Doesburg
Benjamin Tissoires	Markus Gapp
Bernhard R. Link	Markus Kuhn
Bernhard Rosenkraenzer	Mart Raudsepp
Bill Nottingham	Martin-Éric Racine
Bob Ham	Mathieu Bérard
Bob Long	Matt Helsley
Brad Smith	Matt Turner
Branden Robinson	Matthias Clasen
Brian Rogers	Matthias Hopf
Brice Goglin	Matthieu Herrb
Bryce Harrington	Mattia Dongili
Calvin Fong	Maxim Levitsky
Caolan McNamara	Micah Dowty

Carl Worth	Michael Chapman
Charlie	Michael Cree
Chris Ball	Michael Lorenz
Chris Salch	Michael Scherer
Chris Wilson	Michael Verret
Christiaan van Dijk	Michael Vogt
Christian Aistleitner	Michael Witrant
Christian Beier	Michael Witten
Christian Koenig	Michel Dänzer
Christian Schmitt	Mikhail Gusarov
Christoph Brill	Mikko Niskanen
Christoph Pfister	Milos Komarcevic
Coleman Kane	Nathael Pajani
Colin Guthrie	Nathaniel McCallum
Colin Harrison	Neale Pickett
Cooper Yuan	Nicolai Hähnle
Corbin Simpson	Nicos Gollan
Dan	Niels de Vos
Dan Nicholson	Nirbheek Chauhan
Daniel Drake	Oliver McFadden
Daniel Stone	Olivier Blin
Daniel Vetter	Olivier Fourdan
Darren Smith	Otavio Salvador
Dave Airlie	Owain Gordon Ainsworth
Dave Miller	Owen W. Taylor
David Jander	parag
David Marx	Patrick Haller
David Miller	Paul Bender
David Nolden	Paul Menzel
David Nusinow	Paul "TBBle" Hampson
David Schleef	Pauli Nieminen
Dennis Kasprzyk	Paulo César Pereira de Andrade
Derek Upham	Paulo Ricardo Zanoni
Derek Wang	Peter Alfredsen
Diego Elio 'Flameeyes' Pettenò	Peter Åstrand
Dima Kogan	Peter Breitenlohner
Dmitry Torokhov	Peter Harris
Dodji Seketeli	Peter Hutterer
Donald Kayser	Peter Korsgaard
Donnie Berkholz	Petr Salinger
Doug Chapman	Philip Langdale
Drew Parsons	Pierre Ossman
Eamon Walsh	Pierre Willenbrock
Ed Catmur	Pierre-Loup A. Griffais
Eduard Bagrov	Rafael Ávila de Espíndola
Eduard Fuchs	RALOVICH, Kristóf
edward shu	Rami Ylimaki
Egbert Eich	Ramon van der Stelt
Emilio Jesús Gallego Arias	Rémi Cardona
Eric Anholt	Richard Hughes
Eric Paris	Robert Lowery
Éric Piel	Robert Noland
Erik Andren	Roland Bär
Erkin Bahceci	Roland Scheidegger
Evgeny M. Zubok	Ross Burton
Eygene Ryabinkin	Ryan Hill
Fabio	Ryan Lortie
Federico Mena Quintero	Samuel Thibault
Fedor P. Goncharov (Fredy)	Sascha Hlusiak
Felix Kuehling	Sayamindu Dasgupta



Fernando Carrijo	Shaohua Li
Filippo Giunchedi	Shelley Gong
Francis Giraldeau	Shuang He
Francisco Jerez	Shunichi Fuji
Fredrik Höglund	Simon Farnsworth
Gaetan Nadon	Simon Munton
George Peter Staplin	Simon Thum
George Sapountzis	Søren Hauberg
George Staplin	Søren Sandmann Pedersen
Giuseppe Bilotta	Stefan Dirsch
Goneri Le Boudier	Stijn van Drongelen
Guillem Jover	Stuart Bennett
Hans de Goede	Stuart Kreitman
Hasso Tepper	Tero Saarni
Havoc Pennington	Theppitak Karoonboonyanan
Helge Bahmann	Thomas Bodzar
Henrik Rydberg	Thomas Jaeger
Henry unbongo	Thomas Klausner
Hong Liu	Thomas Petazzoni
Hugo Jacques	Thorvald Natvig
Ian Romanick	Tiago Vignatti
Imranullah Syed	Tibi Nagy
Ivaylo Boyadzhiev	Tilman Sauerbeck
Jakob Bornecrantz	Timo Aaltonen
Jakub Bogusz	Tom Jaeger
James Cloos	Tomas Carnecky
Jamey Sharp	Tomas Janousek
Jamie Lentin	Topi Kanerva
Jason Vas Dias	Tormod Volden
Jasper Lievisse Adriaanse	vehemens
Jay Cotton	Vincent Mussard
Jeff Smith	walter
Jens Granseuer	Werner LEMBERG
Jens Herden	Will Thompson
Jeremy C. Reed	William Grant
Jeremy Huddleston	Winfried Grünewald
Jeremy Jay	Wolke Liu
Jeremy Lainé	Wu Fengguang
Jeremy Uejio	Xake
Jerome Glisse	Xavier Bestel
Jerome Pinot	Xiang, Haihao
Jesse Adkins	Xue Wei
Jesse Barnes	Y.C. Chen
Jesse Ruffin	Yaakov Selkowitz
Jie Luo	Yan Li
Jim Huang	Yang Zhao
Jochen Voss	Yann Droneaud
Joe Krahn	Yannick Heneault
Joel Bosveld	Yinan Shen
John Hein	<50724><50976><50672>(Yu-yeon Oh)
John McKernan	Zdenek Kabelac
John Nielsen	Zhao Yakui
John Tapsell	Zhenyu Wang
Jon TURNEY	Zou Nan hai

This product includes software developed by:

2d3d Inc.

Lars Knoll

3Dlabs Inc. Ltd.	Lawrence Berkeley Laboratory
Aaron Plattner	Leif Delgass
Adam de Boor	Lennart Augustsson
Adam Jackson	Leon Shiman
Adobe Systems Inc.	Lexmark International Inc.
After X-TT Project	Linus Torvalds
AGE Logic Inc.	Luc Verhaegen
Alan Coopersmith	Machine Vision Holdings Inc.
Alan Cox	Manfred Brands
Alan Hourihane	Marc Aurele La France
Alexander Gottwald	Mark Adler
Alex Deucher	Mark J. Kilgard
Alex Williamson	Mark Leisher
Anders Carlsson	Mark Smulders
Andreas Luik	Mark Vojkovich
Andreas Monitzer	Marvin Solomon
Andreas Robinson	Massachusetts Inst. Of Technology
Andrei Barbu	Matrox Graphics
Andrew C Aitchison	Matthew Grossman
Andy Ritger	Matthias Hopf
Angus Lees	Matthieu Herrb
Ani Joshi	Metro Link Inc.
Anton Zioviev	Michael Bax
Apollo Computer Inc.	Michael H. Schimek
Apple Computer Inc.	Michael P. Marking
Ares Software Corp.	Michael Schimek
AT&T Inc.	Michael Smith
ATI Technologies Inc.	Michel Dänzer
BEAM Ltd.	Mike A. Harris
Benjamin Herrenschmidt	Mike Harris
Benjamin Rienfenstahl	Ming Yu
Ben Skeggs	MIPS Computer Systems Inc.
Bigelow and Holmes	National Semiconductor
Bill Reynolds	NCR Corporation Inc.
Bitstream Inc.	NetBSD Foundation
Bogdan Diaconescu	Netscape Communications Corp.
Branden Robinson	Network Computing Devices Inc.
Brian Fundakowski Feldman	Nicholas Joly
Brian Goines	Nicholas Miell
Brian Paul	Nicholas Wourms
Bruno Haible	Nicolai Haehnle
Bryan Stine	Noah Levitt
Carl Switzky	Nolan Leake
Catharon Productions Inc.	Nokia Corporation
Charles Murcko	Novell Inc.
Chen Xiangyang	Nozomi YTOW
Chisato Yamauchi	NTT Software Corporation
Chris Constello	Number Nine Computer Corp.
Christian Zietz	Number Nine Visual Technologies
Cognition Corp.	NVIDIA Corporation
Compaq Computer Corporation	Oivier Danet
Concurrent Computer Corporation	Oki Technosystems Laboratory Inc.
Conectiva S.A.	Olivetti Research Limited
Corin Anderson	OMRON Corporation
Craig Struble	Open Software Foundation
Daewoo Electronics Co. Ltd.	OpenedHand Ltd
Dag-Erling Smørgrav	Orest Zborowski
Dale Schumacher	Owen Taylor
Damien Miller	Pablo Saratxaga

Daniel Berrange	Panacea Inc.
Daniel Borca	Panagiotis Tsirigotis
Daniel Stone	Paolo Severini
Daniver Limited	Pascal Haible
Daryll Strauss	Patrick Lecoanet
Data General Corporation	Patrick Lerda
Dave Airlie	Paul Anderson
David Bateman	Paul Elliott
David Dawes	Paul Mackerras
David E. Wexelblat	Peter Breitenlohner
David Holland	Peter Kunzmann
David J. McKay	Peter Trattler
David McCullough	Philip Homburg
David Mosberger-Tang	Philip Langdale
David Reveman	Precision Insight Inc.
David S. Miller	Prentice Hall
David Woodhouse	Quarterdeck Office Systems
Davor Matic	Radek Doulik
Deron Johnson	Ralf Habacker
Digeo Inc.	Randy Hendry
Digital Equipment Corporation	Ranier Keller
Dirk Hohndel	Red Hat Inc.
Dmitry Golubev	Regis Cridlig
Donnie Berkholz	Rene Cougnenc
DOS-EMU-Development-Team	Richard A. Hecker
Doug Anson	Richard Burdick
Drew Parsons	Rich Murphey
Earle F. Philhower III	Rickard E. Faith
Edouard TISSERANT	Rik Faith
Eduard Fuchs	Robert Chesler
Eduardo Horvath	Robert Millan
Egbert Eich	Robert V. Baron
Egmont Koblinger	Robin Cutshaw
Elliot Lee	Roland Mainz
Eric Anholt	Roland Scheidegger
Eric Fortune	Ronny Vindenes
Eric Sunshine	Russ Blaine
Erik Fortune	Ryan Breen
Erik Nygren	Ryan Lortie
Evans & Sutherland Computer Corp.	Ryan Underwood
Fabio Massimo Di Nitto	S3 Graphics Inc.
Fabrizio Gennari	Sam Leffler
Felix Kuehling	Santa Cruz Operation Inc.
Felix Kühling	SciTech Software
Finn Thøgersen	Scott Laird
Francesco Zappa Nardelli	Sebastien Marineau
Frank C. Earl	Shigehiro Nomura
Frederic Lepied	ShoGraphics Inc.
Fredrik Höglund	Shunsuke Akiyama
Free Software Foundation	Silicon Graphics Computer Systems
Fujitsu Limited	Silicon Integrated Systems Corp
Fujitsu Open Systems Solutions Inc.	Silicon Motion Inc.
Fuji Xerox Co. Ltd.	Simon P. Cooper
Geert Uytterhoeven	Snitily Graphics Consulting Services
George Fufutos	Sony Corporation
Gerrit Jan Akkerman	Søren Sandmann
Gerry Toll	SRI
Glenn G. Lai	Stanislav Brabec
GNOME Foundation	Stefan Dirsch

Go Watanabe	Stephane Marchesin
Google Summer of Code participants	Stephan Lang
Greg Kroah-Hartman	Steven Lang
Gregory Mokhin	Stuart Kreitman
Greg Parker	Sun Microsystems Inc.
GROUPE BULL	SunSoft Inc.
Guy Martin	SuSE Inc
Hans Oey	Sven Luther
Harald Koenig	Takis Psarogiannakopoulos
Harm Hanemaayer	Takuma Murakami
Harold L Hunt II	Takuya SHIOZAKI
Harry Langenbacher	T. A. Phelps
Henry A. Worth	Tektronix Inc.
Hewlett-Packard Company	Theo de Raadt
Hitachi Ltd	Theodore Ts'o
Holger Veit	The Open Group
Hong Bo Peng	The Weather Channel Inc.
Howard Greenwell	Thomas E. Dickey
Hummingbird Communications Ltd.	Thomas G. Lane
Ian Romanick	Thomas Hellström
IBM Corporation	Thomas Mueller
Inst. of Software Academia Sinica	Thomas Roell
Intel Corporation	Thomas Thanner
INTERACTIVE Systems Corporation	Thomas Winischhofer
Itai Nahshon	Thomas Wolfram
Ivan Kokshaysky	Thorsten.Ohl
Ivan Pascal	Tiago Gons
Jakub Jelinek	Tilman Sauerbeck
James Tsillas	Todd C. Miller
Jason Bacon	Tomohiro KUBOTA
Jaymz Julian	Torrey Lyons
Jean-loup Gailly	Torrey T. Lyons
Jeff Hartmann	TOSHIBA Corp.
Jeff Kirk	Toshimitsu Tanaka
Jeffrey Hsu	Travis Tilley
Jehan Bing	Trolltech AS
Jeremy C. Reed	Tungsten Graphics Inc.
Jeremy Katz	Tuomas J. Lukka
Jerome Glisse	Ty Sarna
Jesse Barnes	UCHIYAMA Yasushi
Jim Gettys	Unicode Inc.
Jim Tsillas	UniSoft Group Limited
John Dennis	University of California
John Harper	University of South Australia
John Heasley	University of Utah
Jonathan Adamczewski	University of Wisconsin
Jon Block	UNIX System Laboratories Inc.
Jon Smirl	URW++ GmbH
Jon Tombs	Valery Inozemtsev
Jorge Delgado	VA Linux Systems
José Fonseca	VIA Technologies Inc.
Joseph Friedman	Video Electronics Standard Assoc.
Joseph V. Moss	VMware Inc.
Julio M. Merino Vidal	Vrije Universiteit
Juliusz Chroboczek	Wittawat Yamwong
Jyunji Takagi	Wyse Technology Inc.
Kaleb Keithley	X Consortium
Kazushi (Jam) Marukawa	XFree86 Project Inc.

Kazuyuki (ikko-) Okamoto  
Kean Johnston  
Keith Packard  
Keith Whitwell  
Kensuke Matsuzaki  
Kevin E. Martin  
Kristian Høgsberg  
Larry Wall

Xi Graphics Inc.  
X-Oz Technologies  
X-TrueType Server Project  
Yu Shao  
Zack Rusin  
Zephaniah E. Hull  
Zhenyu Wang

This product includes software developed by The XFree86 Project, Inc (<http://www.xfree86.org/>) and its contributors.

This product includes software that is based in part of the work of the FreeType Team (<http://www.freetype.org/>).

This product includes software developed by the University of California, Berkeley and its contributors.

This product includes software developed by Christopher G. Demetriou.

This product includes software developed by the NetBSD Foundation, Inc. (<http://www.netbsd.org/>) and its contributors.

This product includes software developed by X-Oz Technologies (<http://www.x-oz.com/>).