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# Release Notes for X11R7.7

The X.Org Foundation [<http://www.x.org/wiki/XorgFoundation>]

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## Abstract

These release notes contain information about features and their status in the X.Org Foundation X11R7.7 release.

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## Introduction to the X11R7.7 Release

This release is the eighth modular release of the X Window System™. The next full release will be X11R7.8 and is expected in 2013.

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 X11R7.7 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.x.org/mailman/listinfo/xorg-announce) [http://lists.x.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) [http://wiki.x.org/wiki/ModularDevelopersGuide] in the X.Org wiki.

We encourage you to report bugs using freedesktop.org's [bug tracking system](https://bugs.freedesktop.org/) [https://bugs.freedesktop.org/] using the xorg product, and to submit bug fixes and enhancements to <xorg-devel@lists.x.org>. More details on patch submission and review process are available on the [SubmittingPatches](http://www.x.org/wiki/Development/Documentation/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 nearly 25 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 7.7.

The next section describes what is new in the latest full release (7.7) compared with the previous full release (7.6).

## Summary of new features in X11R7.7

This is a sampling of the new features in X11R7.7. A more complete list of changes can be found in the ChangeLog files that are part of the source of each X module.

- *Multi-touch* events are now supported for touchpads and touchscreens which can report position information on more than one finger providing input at the same time, such as found on many tablets and recent laptops. These are exposed by Xorg server 1.12 and later via the Xinput extension version 2.2.
- Additional *Xinput extension* features were introduced in version 2.1, as supported in Xorg server 1.11, including allowing clients to track raw events from input devices, additional detail in scrolling events so that clients may perform smoother scrolling, and additional constants in the Xlib-based libXi API.
- More progress has been made on the X.Org Documentation modernization - the rest of the library and protocol specifications have been converted to DocBook XML from the variety of formats they were previously in, and support for cross-linking between documents has been added. On most systems these documents will be installed under `/usr/share/doc/`. They are also posted on the X.Org website at <http://www.x.org/releases/X11R7.7/>.
- *Fence* objects are now available in Version 3.1 of the **Synchronization (“Sync”) extension**. These allow clients to create a object that is either in “triggered” or “not-triggered” state, and to perform actions when the object becomes triggered. When a client requests a fence be triggered, the X server will first complete all rendering from previous requests that affects resources owned by the fence's screen before changing the state, so that clients may synchronize with such rendering. Support for these has been added to both the `libxcb-sync` and `libXext` API's.
- *Pointer barriers* were added by X Fixes extension Version 5.0. Compositing managers and desktop environments may have UI elements in particular screen locations such that for a single-headed display they correspond to easy targets, for example, the top left corner. For a multi-headed environment these corners should still be semi-impermeable. Pointer barriers allow the application to define additional constraint on cursor motion so that these areas behave as expected even in the face of multiple displays.
- The XCB libraries have begun adding support for the GLX and XKB extensions. This work is not yet complete in this release, and not all of the functionality available through these extensions is accessible via the XCB APIs. Some of this effort was funded by past Google Summer of Code projects.
- *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.

## Overview of X11R7.7

On most platforms, X11R7.7 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:

|                |  |
|----------------|--|
| <b>Xdmx</b>    | 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.   |
| <b>Xnest</b>   | is a nested X server, that operates as both an X client and X server. <b>Xnest</b> is a client of the real server which manages windows and graphics requests on its behalf. <b>Xnest</b> 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. |
| <b>Xephyr</b>  | is a X server that outputs to a window on a pre-existing “host” X display. Unlike <b>Xnest</b> which is an X proxy, and thus limited to the capabilities of the host X server, <b>Xephyr</b> is a full X server which uses the host X server window as a “framebuffer” via fast SHM XImages.   |
| <b>Xvfb</b>    | 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.  |
| <b>Xquartz</b> | 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.   |
| <b>Xwin</b>    | 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.   |

## Details of X11R7.7 components

### Video Drivers

X11R7.7 includes the following video drivers:

| <b>Driver Name</b> | <b>Description</b>            | <b>Further Information</b>              |
|--------------------|-------------------------------|---|
| ark                | Ark Logic                     |   |
| ast                | ASPEED Technology             |   |
| cirrus             | Cirrus Logic                  |   |
| dummy              | Virtual/offscreen framebuffer |   |
| fbdev              | Linux framebuffer device      | <a href="#">fbdev(4)</a> [fbdev.4.html] |

| <b>Driver Name</b> | <b>Description</b>                   | <b>Further Information</b>  |
|--------------------|--------------------------------------|---|
| geode (*)          | AMD Geode GX and LX                  |   |
| glide              | 3Dfx Voodoo 1, 2, Banshee, 3, 4 & 5  | <a href="#">glide(4)</a> [glide.4.html]   |
| glint              | 3Dlabs, TI                           | <a href="#">glint(4)</a> [glint.4.html]   |
| i128               | Number Nine                          | <a href="#">README.i128</a> [I128.txt],<br><a href="#">i128(4)</a> [i128.4.html]          |
| intel              | Intel Integrated Graphics Processors | <a href="#">README.intel</a> [intel.txt], <a href="#">intel(4)</a> [intel.4.html]         |
| mach64             | ATI Mach64                           | <a href="#">README.ati</a> [ati.txt]  |
| mga                | Matrox                               | <a href="#">mga(4)</a> [mga.4.html]   |
| neomagic           | NeoMagic                             | <a href="#">neomagic(4)</a> [neomagic.4.html]   |
| newport (-)        | SGI Newport                          | <a href="#">README.newport</a> [newport.txt], <a href="#">newport(4)</a> [newport.4.html] |
| nv                 | NVIDIA                               | <a href="#">nv(4)</a> [nv.4.html]   |
| r128               | ATI Rage128                          | <a href="#">README.r128</a> [r128.txt],<br><a href="#">r128(4)</a> [r128.4.html]          |
| radeon             | ATI Radeon                           | <a href="#">radeon(4)</a> [radeon.4.html]   |
| savage             | S3 Savage                            | <a href="#">savage(4)</a> [savage.4.html]   |
| siliconmotion      | Silicon Motion                       | <a href="#">siliconmotion(4)</a> [siliconmotion.4.html]                                   |
| sis                | SiS                                  | <a href="#">README.SiS</a> [SiS.txt], <a href="#">sis(4)</a> [sis.4.html]                 |
| suncg6 (+)         | Sun GX and Turbo GX                  |   |
| sunffb (+)         | Sun Creator/3D, Elite 3D             |   |
| tdfx               | 3Dfx Voodoo Banshee, 3, 4 & 5        | <a href="#">tdfx(4)</a> [tdfx.4.html]   |
| tga                | DEC TGA                              | <a href="#">README.DECTga</a> [DECTga.html]   |
| trident            | Trident                              | <a href="#">trident(4)</a> [trident.4.html]   |
| v4l                | Video4Linux                          | <a href="#">v4l(4)</a> [v4l.4.html]   |
| vesa               | VESA                                 | <a href="#">vesa(4)</a> [vesa.4.html]   |
| vmware             | VMware guest OS                      | <a href="#">vmware(4)</a> [vmware.4.html]   |
| voodoo             | 3Dfx Voodoo 1 & 2                    | <a href="#">voodoo(4)</a> [voodoo.4.html]   |
| wsfb               | Workstation Framebuffer              | <a href="#">wsfb(4)</a> [wsfb.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.

## Input Drivers

X11R7.7 includes the following input drivers:

| <b>Driver Name</b> | <b>Description</b>                     | <b>Further Information</b>                         |
|--------------------|--|--|
| evdev(*)           | Linux kernel EvDev                     | <a href="#">evdev(4)</a> [evdev.4.html]            |
| joystick           | Joystick                               | <a href="#">joystick(4)</a><br>[joystick.4.html]   |
| kbd                | generic keyboards (non-evdev systems)  | <a href="#">kbd(4)</a> [kbd.4.html]                |
| mouse              | most mouse devices (non-evdev systems) | <a href="#">mousedrv(4)</a><br>[mousedrv.4.html]   |
| synaptics          | Synaptics & ALP touch-pads             | <a href="#">synaptics(4)</a><br>[synaptics.4.html] |
| vmmouse            | VMWare virtual mouse                   | <a href="#">vmmouse(4)</a><br>[vmmouse.4.html]     |
| void               | dummy device                           | <a href="#">void(4)</a> [void.4.html]              |

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

## Xorg server

### 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 in stable releases, we cannot guarantee this. Compatibility in the other direction is explicitly not guaranteed because new modules may rely on interfaces added in new releases, nor is compatibility across stable release branches (such as between Xorg 1.11 and 1.12).

### Note about module security

The Xorg server runs with root privileges, so the Xorg 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 malware and contaminated code can occur and wreak havoc on your system.

### 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, or may rely on just snippets of configuration placed in the `xorg.conf.d` directory.

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.

## Command Line Options

Command line options can be used to override some default parameters and parameters provided in the configuration file. Command line options available for use with all X servers in this release are described in the [Xserver\(1\)](#) [Xserver.1.html] manual page. Command line options specific to the Xorg server are described in the [Xorg\(1\)](#) [Xorg.1.html] manual page.

## Multi-head

Some multi-head configurations are supported in X11R7.7. 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).

## Xinerama

*Xinerama* is an X server extension that allows multiple physical screens connected to multiple video devices 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. Note that enabling Xinerama may disable certain other extensions which are not compatible with Xinerama.

## 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.

## Changed behavior in handling information from DDC

The X server previously used DDC information to detect screen size and pitch, and compute DPI automatically, allowing fonts and other UI elements to automatically scale to appropriate sizes. This mechanism worked reasonably well for many single-monitor cases, but did not compute accurate DPI values for multi-monitor cases or less common single-display setups. Thus, this autodetection has been removed, and the X server no longer tries to compute an appropriate DPI value. All users wanting fonts, physical measurement units, and other UI elements scaled appropriately for their display (including users for whom autodetection previously worked) must now set DPI or some other scaling factor explicitly, either via the X server's `-dpi` option, a DPI setting in their graphical environment, or an alternate scaling mechanism provided by their environment.

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

## 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"
```

The [XKB Configuration Guide](#) also includes [an example `xorg.conf.d` file that sets the `"terminate:ctrl\_alt\_bksp"` option by default on all keyboards](#). Many desktop environments include XKB configuration options in their preferences to enable this as well.

## Grab debugging keystrokes

The Xorg server in this release provides various functions that can be mapped to keystrokes to aid in the debugging of programs with errant input grabs.

The keysyms XF86LogGrabInfo and XF86LogWindowTree are defined to print information to the Xorg log file on the current set of input grabs, and the window tree of the current display. By default, these are available for use, but not mapped to any key.

The keysym XF86Ungrab forces the X server to release all active grabs, which may leave the clients holding them in an inconsistent state. XF86ClearGrab goes further, killing the client connection of any client holding an active grab when it is pressed. These keystrokes are intended to allow developers to debug clients which are not properly releasing grabs or have problems occur while input is grabbed. Since grabs are a fundamental part of the X client security model, these keystrokes come with risks, such as the ability to bypass or kill screen locks without knowing the password, and thus are not available by default.

Users who are willing to accept the security risk and wish to enable this functionality may do so via the XKB configuration option "grab:break\_actions".

## Security issue in older xkeyboard-config releases

The xkeyboard-config data files included in this release have the grab disabling keys correctly disabled by default, but versions before xkeyboard-config 2.5 had them enabled, leading to the security risk described above. When upgrading to the X server in this release be sure to also ensure xkeyboard-config is a safe version. More details about this issue may be found in [advisories for CVE-2012-0064](http://who-t.blogspot.com/2012/01/xkb-breaking-grabs-cve-2012-0064.html) [http://who-t.blogspot.com/2012/01/xkb-breaking-grabs-cve-2012-0064.html].

## X Server startup state

The X servers in the X11R7.7 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.

## Font support

Details about the font support in X11R7.7 can be found in the "[Fonts in X11R7.7](#)" document.

## 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 uses the default installation path of 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.

## Bitmap font compression methods

The X11R7.7 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 X11R7.7 the configure scripts accept an option of `--with-compression=TYPE`, where `TYPE` may be `none`, `compress`, `gzip`, or `bzip2`.

## 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.

## 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.

# Build changes and issues

## Strict compilation flags

Most of the modules in this release use stricter compiler flags when building with the GNU `gcc`, LLVM `clang`, Oracle Solaris Studio, or Intel compilers. These flags both enable more warnings, and promote some warnings to fatal errors in the build. If these flags cause your build to fail, you can disable the flags that turn these selected warnings into errors by adding `--disable-selective-werror` to the configure command for the affected module. If that is necessary for any X.Org modules, please report a bug in the xorg product on <https://bugs.freedesktop.org/>.

Builders seeking even stricter compiler checks can instead pass `--enable-strict-compilation` to the configure command to make all warnings become errors.

## 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.

## New configure options for font modules

The bitmap font modules now accept a configure option of `--disable-all-encodings` to set the default for all encodings to off, requiring builders to then pass `--enable-<encoding>` flags for each encoding to be built.

## New configure options for documentation in modules

As many more modules now contain documentation to be converted from DocBook XML to text, HTML, PostScript, and/or PDF formats, new standard options have been added to the configure macros to control the build of these in the modules.

|   |  |
|---|--|
| <code>--with-xmlto=yes/no</code>        | Enables or disables use of the <a href="https://fedorahosted.org/xmlto/">xmlto</a> [https://fedorahosted.org/xmlto/] command to translate DocBook XML to other formats. All DocBook XML conversions require use of this command. |
| <code>--with-fop=yes/no</code>          | Enables or disables use of the <a href="http://xmlgraphics.apache.org/fop/">Apache fop</a> [http://xmlgraphics.apache.org/fop/] command to translate DocBook XML to PostScript and PDF formats.                                  |
| <code>--enable-docs=yes/no</code>       | Enables or disables the build and installation of all documentation except traditional man pages or those covered by the <code>--enable-devel-docs</code> and <code>--enable-specs</code> options.                               |
| <code>--enable-devel-docs=yes/no</code> | Enables or disables the build and installation of documentation for developers of the X.Org software modules.  |
| <code>--enable-specs=yes/no</code>      | Enables or disables the build and installation of the formal specification documents for protocols and APIs.   |

## Miscellaneous

This section describes other items of note for the X11R7.7 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.

## 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-devel@lists.x.org>](mailto:xorg-devel@lists.x.org) to volunteer to take over maintainership, either inside or outside of the Xorg release process.

### Future Removals

DGA version 2

DGA 2.0 is included in 7.7. 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. In this release, support has been removed for all DGA rendering and mapping code, leaving just mode setting and raw input device access.

Input device discovery via HAL

Xorg server 1.4 started using 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 since deprecated HAL, so the X.Org developers have begun replacement with alternatives. As a result, configuration of input devices via HAL `*.fdi` files is no longer supported on Linux platforms using `udev`, and may not be supported on other platforms in future Xorg server releases.

Nested and virtual X servers

As described in [the section called "Overview of X11R7.7"](#), this release contains several X servers that either display onto another X server (**Xephyr** & **Xnest**), or render into a virtual memory framebuffer (**Xvfb** & **Xfake**). These may be replaced in a future release by use of the **Xorg** server with the `xf86-video-nested` and `xf86-video-dummy` drivers which perform the same tasks.

## Removed in this Release

Unmaintained drivers    This release no longer contains the following drivers, due to lack of maintainers with relevant hardware. Existing driver versions may work with current Xorg servers, but they are not being actively updated to support Xorg driver API & ABI changes.

- xf86-input-acecad: Acecad Flair
- xf86-input-aiptek: Aiptek USB tablet
- xf86-video-apm: Alliance Pro Motion
- xf86-video-chips: Chips & Technologies
- xf86-video-i740: Intel i740
- xf86-video-rendition: Rendition Verite
- xf86-video-s3: S3 (not ViRGE or Savage)
- xf86-video-s3virge: S3 ViRGE
- xf86-video-sisusb: SiS Net2280-based USB
- xf86-video-suncg14: Sun CG14
- xf86-video-suncg3: Sun CG3
- xf86-video-sunleo: Sun Leo (ZX)
- xf86-video-suntcx: Sun TCX
- xf86-video-tseng: Tseng Labs
- xf86-video-xgi: XGI
- xf86-video-xgixp: XGI Volari 8300

## Attributions/Acknowledgements/Credits

This section lists the credits for the X11R7.7 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/) [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 X11R7.7 since the release of X11R7.6:

Aapo Rantalainen  
Aaron Culich

Lev Nezhdanov  
Linus Arver

|                             |                      |
|-----------------------------|----------------------|
| Aaron Plattner              | Luc Verhaegen        |
| Abdoulaye Walsimou Gaye     | Maarten Lankhorst    |
| Adam Jackson                | Maarten Maathuis     |
| Adam Tkac                   | Macpaul Lin          |
| Adrian Bunk                 | Magnus Kessler       |
| Alan Coopersmith            | Marcin Kościelnicki  |
| Alan Curry                  | Marcin Slusarz       |
| Alan Hourihane              | Marcin Woliński      |
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| Albert Damen                | Mario Kleiner        |
| Aldis Berjoza               | Mark Dokter          |
| Alessandro Guido            | Mark Kettenis        |
| Alex Deucher                | Mark Schreiber       |
| Alex Plotnick               | Marko Macek          |
| Alexander Polakov           | Marko Myllynen       |
| Alexandr Shadchin           | Markus Duft          |
| Alexandre Julliard          | Markus Fleschutz     |
| Alexey Shumitsky            | Mart Raudsepp        |
| Alistair Leslie-Hughes      | Martin Langhoff      |
| Ander Conselvan de Oliveira | Martin-Éric Racine   |
| Andrea Canciani             | Marton Balint        |
| Andreas Schwab              | Matěj Cepl           |
| Andreas Wettstein           | Mathias Krause       |
| Andrew Randrianasulu        | Mathieu Bérard       |
| Andrew Turner               | Mathieu Taillefumier |
| Andy Furniss                | Matt Dew             |
| Anssi Hannula               | Matt Turner          |
| Antoine Martin              | Matthew D. Fuller    |
| Arkadiusz Miśkiewicz        | matthew green        |
| Armin K                     | Matthias Clasen      |
| Arnaud Fontaine             | Matthias Hopf        |
| Arthur Taylor               | Matthieu Herrb       |
| Arvind Umrao                | Matti Hamalainen     |
| Avram Lyon                  | Max Schwarz          |
| Bartosz Brachaczek          | Maxim Iorsh          |
| Bartosz Kosiorek            | Mehdi Dogguy         |
| Bastian Blank               | meng                 |
| Bastien Nocera              | Michael Chang        |
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| Benjamin Otte               | Michael Thayer       |
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| Chad Versace                | Modestas Vainius     |
| Chase Douglas               | Mohammed Sameer      |

|                                |                         |
|--------------------------------|-------------------------|
| Choe Hwanjin                   | Nick Bowler             |
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| Chris Ball                     | Nicolas Cavallari       |
| Chris Halse Rogers             | Nicolas Joly            |
| Chris Wilson                   | Nicolas Kaiser          |
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| Christian Toutant              | Nicolas Peninguy        |
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| Christophe Roland              | Nobuhiro Iwamatsu       |
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| Daiki Ueno                     | Olli Vertanen           |
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| David Ronis                    | Peter Clifton           |
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| Derek Foreman                  | Peter Korsgaard         |
| Derek Wang                     | Peter Zotov             |
| Devin J. Pohly                 | Philip Langdale         |
| Diego Elio Pettenò             | Philipp Reh             |
| Dirk Wallenstein               | Phillp Haddad           |
| dtakahashi42                   | Pierre-Loup A. Griffais |
| Eamon Walsh                    | Priit Laes              |
| Ed Schouten                    | Promathesh Mandal       |
| Edward Sheldrake               | Rami Ylimäki            |
| Egbert Eich                    | Reinhard Karcher        |
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| Eoghan Sherry                  | Robert Hooker           |
| Eric Anholt                    | Robert Morell           |
| Erik Kilfoil                   | Roberto Branciforti     |



|                        |                         |
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| Frank Mariak           | Satoshi Kimura          |
| Frédéric Boiteux       | Scott James Remnant     |
| Fredrik Höglund        | Sebastian Glita         |
| Fryderyk Dziarmagowski | Sedat Dilek             |
| Gaetan Nadon           | Sergey Samokhin         |
| George Staplin         | Sergey V. Udaltsov      |
| Giuseppe Bilotta       | Servaas Vandenberghe    |
| Glenn Burkhardt        | Siddhesh Poyarekar      |
| Guillem Jover          | Simon Farnsworth        |
| György Balló           | Simon Que               |
| Hans Verkuil           | Simon Thum              |
| Hans-Juergen Mauser    | Sitsofe Wheeler         |
| Hans-Peter Budek       | Søren Sandmann Pedersen |
| Harshula Jayasuriya    | Stefan Dirsch           |
| Havoc Pennington       | Stefan Glasenhardt      |
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| Ian Osgood             | Stefan Potyra           |
| Ian Romanick           | Stephan Hilb            |
| Ilija Hadzic           | Stephane Marchesin      |
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| Javier Jardón          | Tim van der Molen       |
| Javier Pello           | Tim Yamin               |
| Jay Cotton             | Timo Aaltonen           |
| Jeetu Golani           | Tobias Droste           |
| Jeff Chua              | Tollef Fog Heen         |
| Jens Elkner            | Tom "spot" Callaway     |
| Jeremy Huddleston      | Tom Fogal               |
| Jerome Carretero       | Tomas Carnecky          |
| Jerome Glisse          | Tomas Frydrych          |
| Jesse Adkins           | Tomas Hoyer             |
| Jesse Barnes           | Tomáš Trnka             |
| Jian Zhao              | Toralf Förster          |
| JJ Ding                | Tormod Volden           |

Joe Nahmias  
Joe Shaw  
Joerg Sonnenberger  
Johannes Obermayr  
John Martin  
Jon Nettleton  
Jon TURNEY  
Jools Wills  
Jordan Hayes  
Jörn Horstmann  
Josh Triplett  
Julien Cristau  
Julien Danjou  
Justin Dou  
Justin Mattock  
Kai-Uwe Behrmann  
Kees Cook  
Keith Packard  
Kenneth Graunke  
Kent Baxley  
Kirill Elagin  
Knut Petersen  
Konstantin Belousov  
Kristian Høgsberg  
Kristof Szabo  
Krzysztof Halasa  
Kusanagi Kouichi  
Lennart Poettering

Trevor Woerner  
U. Artie Eoff  
Uli Schlachter  
Ulrich Müller  
Van de Bugger  
Vasily Khoruzhick  
Vasyl V. Vercynskyj  
Victor Machado  
Ville Skyttä  
Ville Syrjälä  
Vincent Torri  
Walter Bender  
Walter Harms  
William Jon McCann  
Xavier Bachelot  
Xiang, Haihao  
Xue Wei  
Xunx Fang  
Y.C. Chen  
Yaakov Selkowitz  
Yann Droneaud  
Yannick Heneault  
Zack Rusin  
Zhao Yakui  
Zhenyu Wang  
Zhigang Gong  
Zou Nan hai

and the members of [the Translation Project](http://translationproject.org/) [http://translationproject.org/].

This product includes software developed by:

2d3d Inc.  
3Dlabs Inc. Ltd.  
Aaron Plattner  
Adam de Boor  
Adam Jackson  
Adobe Systems Inc.  
Advanced Micro Devices, Inc.  
After X-TT Project  
AGE Logic Inc.  
Alan Coopersmith  
Alan Cox  
Alan Hourihane  
Alexander Gottwald  
Alex Deucher  
Alex Williamson  
Alexei Gilchrist  
Anders Carlsson  
Andreas Luik  
Andreas Monitzer  
Andreas Robinson  
Andrei Barbu  
Andrew C Aitchison

Kevin E. Martin  
Kim woelders  
Kristian Høgsberg  
Larry Wall  
Lars Knoll  
Lawrence Berkeley Laboratory  
Leif Delgass  
Lennart Augustsson  
Leon Shiman  
Lexmark International Inc.  
Linus Torvalds  
Linuxcare Inc.  
Lorens Younes  
Luc Verhaegen  
Machine Vision Holdings Inc.  
Mandriva Linux  
Manfred Brands  
Manish Singh  
Marc Aurele La France  
Mark Adler  
Mark J. Kilgard  
Mark Kettenis

Andrey A. Chernov  
Andy Ritger  
Angus Lees  
Ani Joshi  
Anton Zioviev  
Apollo Computer Inc.  
Apple Computer Inc.  
Apple Inc.  
Ares Software Corp.  
Arnaud LE HORS  
Arne Schwabe  
ASPEED Technology Inc.  
AT&T Inc.  
ATI Technologies Inc.  
Bart Massey  
Bart Trojanowski, Symbio Technologies, LLC  
BEAM Ltd.  
Benjamin Herrenschmidt  
Benjamin Riefenstahl  
Ben Skeggs  
Beth Mardutho: The Syriac Institute  
Bigelow and Holmes  
Bill Reynolds  
Bitstream Inc.  
Bogdan Diaconescu  
Branden Robinson  
Brian Fundakowski Feldman  
Brian Goines  
Bogdan D.  
Brian Paul  
Bruce Kalk  
Bruno Haible  
Bryan Stine  
Bryan W. Headley.  
C. Scott Ananian  
Carl Switzky  
Catharon Productions Inc.  
Charles Murcko  
Chen Xiangyang  
Chisato Yamauchi  
Chris Constello  
Chris Salch  
Christian Thaeter  
Christian Zietz  
Cognition Corp.  
Compaq Computer Corporation  
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Conectiva S.A.  
Corin Anderson  
Corvin Zahn.  
Cronyx Ltd.  
Craig Struble  
Daewoo Electronics Co. Ltd.

Mark Leisher  
Mark Smulders  
Mark Vojkovich  
Martin Husemann  
Marvin Solomon  
Massachusetts Inst. Of Technology  
Matrox Graphics  
Matt Dew  
Matthew Grossman  
Matthias Hopf  
Matthias Ihmig  
Matthieu Herrb  
Metro Link Inc.  
Michal Rehacek  
Michael Bax  
Michael H. Schimek  
Michael P. Marking  
Michael Schimek  
Michael Smith  
Michel Dänzer  
Mike A. Harris  
Mike Harris  
Ming Yu  
MIPS Computer Systems Inc.  
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National Security Agency  
National Semiconductor  
NCR Corporation Inc.  
Neil Brown  
NetBSD Foundation  
Netscape Communications Corp.  
Network Computing Devices Inc.  
New Mexico State University  
Nicholas Joly  
Nicholas Miell  
Nicholas Wourms  
Nicolai Haehnle  
Noah Levitt  
Nolan Leake  
Nokia Corporation  
Nokia Home Communications  
Novell Inc.  
Nozomi YTOW  
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Number Nine Computer Corp.  
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NVIDIA Corporation  
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| Dale Schumacher                   | Oracle Corp.               |
| Damien Miller                     | Orest Zborowski            |
| Daniel Berrange                   | Owen Taylor                |
| Daniel Borca                      | Pablo Saratxaga            |
| Daniel Stone                      | Panacea Inc.               |
| Daniver Limited                   | Panagiotis Tsirigotis      |
| Daryll Strauss                    | Paolo Severini             |
| Data General Corporation          | Pascal Haible              |
| Dave Airlie                       | Patrick Lecoanet           |
| David Bateman                     | Patrick Lerda              |
| David Dawes                       | Paul Anderson              |
| David E. Wexelblat                | Paul Elliott               |
| David Holland                     | Paul Mackerras             |
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| David McCullough                  | Peter Hutterer             |
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| Davor Matic                       | Philip Blundell            |
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| Dennis De Winter                  | Precision Insight Inc.     |
| Digital Equipment Corporation     | Prentice Hall              |
| Dirk Hohndel                      | Quarterdeck Office Systems |
| Dmitry Golubev                    | Radek Doulik               |
| Donnie Berkholz                   | Ralf Habacker              |
| DOS-EMU-Development-Team          | Randy Hendry               |
| Doug Anson                        | Ranier Keller              |
| Drew Parsons                      | Red Hat Inc.               |
| Earle F. Philhower III            | Regis Cridlig              |
| Edouard TISSERANT                 | Rene Cougnenc              |
| Eduard Fuchs                      | Richard A. Hecker          |
| Eduardo Horvath                   | Richard Burdick            |
| Egbert Eich                       | Rich Murphey               |
| Egmont Koblinger                  | Rickard E. Faith           |
| Elliot Lee                        | Rik Faith                  |
| Eric Anholt                       | Robert Chesler             |
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| Eric Sunshine                     | Robert V. Baron            |
| Erik Fortune                      | Robert W. Scheifler        |
| Erik Nygren                       | Robin Cutshaw              |
| Evans & Sutherland Computer Corp. | Roland Mainz               |
| Fabio Massimo Di Nitto            | Roland Scheidegger         |
| Fabrizio Gennari                  | Ronny Vindenes             |
| Fedor P. Goncharov                | Russ Blaine                |
| Felix Kühling                     | Ryan Breen                 |
| Finn Thoegersen                   | Ryan Lortie                |
| Francesco Zappa Nardelli          | Ryan Underwood             |
| Frank C. Earl                     | S. Lehner                  |
| Florian Loitsch                   | S3 Graphics Inc.           |
| Francisco Jerez                   | Sam Leffler                |
| Fred Hucht                        | Santa Cruz Operation Inc.  |

Frederic Lepied  
Fredrik Höglund  
Free Software Foundation  
Fujitsu Limited  
Fujitsu Open Systems Solutions Inc.  
Fuji Xerox Co. Ltd.  
Gaetan Nadon  
Gareth Hughes  
Geert Uytterhoeven  
George Fufutos  
George Sapountzis  
Gerrit Jan Akkerman  
Gerry Toll  
Ghozlane Toumi  
Glenn G. Lai  
GNOME Foundation  
Go Watanabe  
Google Summer of Code participants  
Greg Kroah-Hartman  
Gregory Mokhin  
Greg Parker  
GROUPE BULL  
Guillem Jover  
Guy Martin  
Hans Oey  
Harald Koenig  
Harm Hanemaayer  
Harold L Hunt II  
Harry Langenbacher  
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Hewlett-Packard Company  
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IBM Corporation  
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Itai Nahshon  
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Ivan Kokshaysky  
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James Tsillas  
Jamey Sharp  
Jason Bacon  
Jaymz Julian  
Jean-loup Gailly  
Sascha Hlusiak.  
SciTech Software  
Scott Laird  
Sebastien Marineau  
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Søren Sandmann  
SRI  
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Sun Microsystems Inc.  
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Thomas E. Dickey  
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Thomas Mueller  
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Thomas Wolfram  
Thorsten.Ohl  
Tiago Gons  
Tilman Sauerbeck  
Todd C. Miller  
Tomohiro KUBOTA

|                          |                                   |
|--------------------------|-----------------------------------|
| Jeff Hartmann            | Torrey Lyons                      |
| Jeff Kirk                | Torrey T. Lyons                   |
| Jeffrey Hsu              | TOSHIBA Corp.                     |
| Jehan Bing               | Toshimitsu Tanaka                 |
| Jeremy C. Reed           | Travis Tilley                     |
| Jeremy Katz              | Trolltech AS                      |
| Jeremy Huddleston        | Troy D. Hanson                    |
| Jerome Glisse            | Tungsten Graphics Inc.            |
| Jesse Barnes             | Tuomas J. Lukka                   |
| Jim Gettys               | Ty Sarna                          |
| Jim Tsillas              | UCHIYAMA Yasushi                  |
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| John Dennis              | UniSoft Group Limited             |
| John Harper              | University of California          |
| John Heasley             | University of South Australia     |
| Jonathan Adamczewski     | University of Utah                |
| Jon Block                | University of Wisconsin           |
| Jon Smirl                | UNIX System Laboratories Inc.     |
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| Julio M. Merino Vidal    | Wyse Technology Inc.              |
| Juan Romero Pardines     | X Consortium                      |
| Juliusz Chroboczek       | XFree86 Project Inc.              |
| Jyunji Takagi            | Xi Graphics Inc.                  |
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| Kazushi (Jam) Marukawa   | X-TrueType Server Project         |
| Kazuyuki (ikko-) Okamoto | X.Org Foundation                  |
| Kazutaka YOKOTA          | XGI Technology                    |
| Kean Johnston            | Yu Shao                           |
| Keith Packard            | Zack Rusin                        |
| Keith Whitwell           | Zephaniah E. Hull                 |
| Kensuke Matsuzaki        | Zhenyu Wang                       |

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