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] 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.


We encourage you to report bugs using freedesktop.org's bug tracking system [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] 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.

- Version 1.2 of the X Resource extension provides new requests that allow clients to query for additional identification information about other clients, such as their process id, and to request size information about the resources clients have allocated in the X server, to allow better observability and easier debugging of client resource allocations in the server.

- 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 accessibile 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:

**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.

Details of X11R7.7 components

Video Drivers

X11R7.7 includes the following video drivers:
<table>
<thead>
<tr>
<th>Driver Name</th>
<th>Description</th>
<th>Further Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>ark</td>
<td>Ark Logic</td>
<td></td>
</tr>
<tr>
<td>ast</td>
<td>ASPEED Technology</td>
<td></td>
</tr>
<tr>
<td>cirrus</td>
<td>Cirrus Logic</td>
<td></td>
</tr>
<tr>
<td>fbdev</td>
<td>Linux framebuffer device</td>
<td>fbdev(4) [fbdev.4.html]</td>
</tr>
<tr>
<td>geode (*)</td>
<td>AMD Geode GX and LX</td>
<td></td>
</tr>
<tr>
<td>glint</td>
<td>3Dlabs, TI</td>
<td>glint(4) [glint.4.html]</td>
</tr>
<tr>
<td>i128</td>
<td>Number Nine</td>
<td></td>
</tr>
<tr>
<td>intel</td>
<td>Intel Integrated Graphics Processors</td>
<td>README.intel [intel.txt], intel(4) [intel.4.html]</td>
</tr>
<tr>
<td>mach64</td>
<td>ATI Mach64</td>
<td>README.ati [ati.txt]</td>
</tr>
<tr>
<td>mga</td>
<td>Matrox</td>
<td>mga(4) [mga.4.html]</td>
</tr>
<tr>
<td>neomagic</td>
<td>NeoMagic</td>
<td>neomagic(4) [neomagic.4.html]</td>
</tr>
<tr>
<td>newport (-)</td>
<td>SGI Newport</td>
<td>README.newport [newport.txt], newport(4) [newport.4.html]</td>
</tr>
<tr>
<td>nv</td>
<td>NVIDIA</td>
<td>nv(4) [nv.4.html]</td>
</tr>
<tr>
<td>r128</td>
<td>ATI Rage128</td>
<td>README.r128 [r128.txt], r128(4) [r128.4.html]</td>
</tr>
<tr>
<td>radeon</td>
<td>ATI Radeon</td>
<td>radeon(4) [radeon.4.html]</td>
</tr>
<tr>
<td>savage</td>
<td>S3 Savage</td>
<td>savage(4) [savage.4.html]</td>
</tr>
<tr>
<td>siliconmotion</td>
<td>Silicon Motion</td>
<td>siliconmotion(4) [siliconmotion.4.html]</td>
</tr>
<tr>
<td>sis</td>
<td>SiS</td>
<td>README.SiS [SiS.txt], sis(4) [sis.4.html]</td>
</tr>
<tr>
<td>suncg6 (+)</td>
<td>Sun GX and Turbo GX</td>
<td></td>
</tr>
<tr>
<td>sunffb (+)</td>
<td>Sun Creator/3D, Elite 3D</td>
<td></td>
</tr>
<tr>
<td>tdfx</td>
<td>3Dfx Voodoo Banshee, 3, 4 &amp; 5</td>
<td>tdfx(4) [tdfx.4.html]</td>
</tr>
<tr>
<td>tga</td>
<td>DEC TGA</td>
<td>README.DECtga [DEDtga.html]</td>
</tr>
<tr>
<td>trident</td>
<td>Trident</td>
<td>trident(4) [trident.4.html]</td>
</tr>
<tr>
<td>v4l</td>
<td>Video4Linux</td>
<td>v4l(4) [v4l.4.html]</td>
</tr>
<tr>
<td>vesa</td>
<td>VESA</td>
<td>vesa(4) [vesa.4.html]</td>
</tr>
<tr>
<td>vmware</td>
<td>VMware guest OS</td>
<td>vmware(4) [vmware.4.html]</td>
</tr>
<tr>
<td>voodoo</td>
<td>3Dfx Voodoo 1 &amp; 2</td>
<td>voodoo(4) [voodoo.4.html]</td>
</tr>
<tr>
<td>wsfb</td>
<td>Workstation Framebuffer</td>
<td>wsfb(4) [wsfb.4.html]</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Driver Name</th>
<th>Description</th>
<th>Further Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>evdev(*)</td>
<td>Linux kernel EvDev</td>
<td>evdev(4) [evdev.4.html]</td>
</tr>
<tr>
<td>joystick</td>
<td>Joystick</td>
<td>joystick(4)</td>
</tr>
<tr>
<td>kbd</td>
<td>generic keyboards (non-evdev systems)</td>
<td>kbd(4) [kbd.4.html]</td>
</tr>
<tr>
<td>mouse</td>
<td>most mouse devices (non-evdev systems)</td>
<td>mousedrv(4) [mousedrv.4.html]</td>
</tr>
<tr>
<td>synaptics</td>
<td>Synaptics &amp; ALP touchpads</td>
<td>synaptics(4) [synaptics.4.html]</td>
</tr>
<tr>
<td>vmmouse</td>
<td>VMWare virtual mouse</td>
<td>vmmouse(4)</td>
</tr>
<tr>
<td>void</td>
<td>dummy device</td>
<td>void(4) [void.4.html]</td>
</tr>
</tbody>
</table>

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 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 \texttt{-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/]. 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.

**Terminate Server keystroke**

The Xorg server has previously allowed users to exit the server by pressing the keys \texttt{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 \texttt{"terminate:ctrl_alt_bksp"}. For instance, the \texttt{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 \texttt{"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].

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/](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.

- `--with-xmlto=yes|no` Enables or disables use of the xmlto [https://fedorahosted.org/xmlto/] command to translate DocBook XML to other formats. All DocBook XML conversions require use of this command.
- `--with-fop=yes|no` Enables or disables use of the Apache fop [http://xmlgraphics.apache.org/fop/] command to translate DocBook XML to PostScript and PDF formats.
- `--enable-docs=yes|no` Enables or disables the build and installation of all documentation except traditional man pages or those covered by the `--enable-devel-docs` and `--enable-specs` options.
- `--enable-devel-docs=yes|no` Enables or disables the build and installation of documentation for developers of the X.Org software modules.
- `--enable-specs=yes|no` 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> to volunteer to take over maintainership, either inside or outside of the Xorg release process.

### Future Removals

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DGA version 2</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Input device discovery via HAL</strong></td>
<td>Xorg server 1.4 started using the HAL framework [<a href="http://www.freedesktop.org/wiki/Software/hal">http://www.freedesktop.org/wiki/Software/hal</a>] 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.</td>
</tr>
<tr>
<td><strong>Nested and virtual X servers</strong></td>
<td>As described in the section called “Overview of X11R7.7”, this release contains several X servers that either display onto another X server (Xephyr &amp; Xnest), or render into a virtual memory framebuffer (Xvfb &amp; 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.</td>
</tr>
</tbody>
</table>
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/] 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  Lev Nezhdanov
Aaron Culich  Linus Arver
Release Notes for X11R7.7

Joe Nahmias
Joe Shaw
Joerg Sonnenberger
Johannes Obermayr
John Martin
Jon Nettleton
Jon TURNLEY
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
and the members of the Translation Project [http://translationproject.org/].

This product includes software developed by:

2d3d Inc. 3Dlabs Inc. Ltd.
Kevin E. Martin Kim woelders
Aaron Plattner Kristian Høgsberg
Adam de Boor Larry Wall
Adam Jackson Lars Knoll
Lawrence Berkeley Laboratory Leif Delgass
After X-TT Project Lennart Augustsson
AGE Logic Inc. Leon Shiman
Alan Coopersmith Lexmark International Inc.
Alan Cox Linus Torvalds
Alan Hourihane Linuxcare Inc.
Alexander Gottwald Lorens Younes
Alex Deucher Luc Verhaegen
Alex Williamson Machine Vision Holdings Inc.
Alexei Gilchrist Mandriva Linux
Anders Carlsson Manfred Brands
Andreas Luik Manish Singh
Andreas Monitzer Marc Aurele La France
Andreas Robinson Mark Adler
Andrei Barbu Mark J. Kilgad
Andrew C Aitchison Mark Kettenis
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Andrey A. Chernov  Mark Leisher
Andy Ritger      Mark Smulders
Angus Lees       Mark Vojkovich
Ani Joshi        Martin Husemann
Anton Zioviev     Marvin Solomon
Apollo Computer Inc. Massachusetts Inst. Of Technology
Apple Computer Inc. Matrox Graphics
Apple Inc.        Matt Dew
Ares Software Corp. Matthew Grossman
Arnaud LE HORS    Matthias Hopf
Arne Schwabe      Matthias Ihmig
ASPEED Technology Inc. Matthieu Herrb
AT&T Inc.         Metro Link Inc.
ATI Technologies Inc. Michal Rehacek
Bart Massey       Michael Bax
Bart Trojanowski, Symbio Technologies,Michael H. Schimek
LLC
BEAM Ltd.         Michael P. Marking
Benjamin Herrenschmidt Michael Schimek
Benjamin Rienfenstahl Michael Smith
Ben Skeggs        Michel Dänzer
Beth Mardutho: The Syriac Institute Mike A. Harris
Bigelow and Holmes Mike Harris
Bill Reynolds      Ming Yu
Bitstream Inc.    MIPS Computer Systems Inc.
Bogdan Diaconescu  MontaVista Software Inc.
Branden Robinson   National Security Agency
Brian Fundakowski Feldman National Semiconductor
Brian Goines      NCR Corporation Inc.
Bogdan D.         Neil Brown
Brian Paul        NetBSD Foundation
Bruce Kalk        Netscape Communications Corp.
Bruno Haible      Network Computing Devices Inc.
Bryan Stine       New Mexico State University
Bryan W. Headley. Nicholas Joly
C. Scott Ananian  Nicholas Miell
Carl Switzky      Nicholas Wourms
Catharon Productions Inc. Nicolai Haehnle
Charles Murcko    Noah Levitt
Chen Xiangyang   Nolan Leake
Chisato Yamauchi  Nokia Corporation
Chris Constello   Nokia Home Communications
Chris Salch       Novell Inc.
Christian Thaeter Nozomi YTOW
Christian Zietz   NTT Software Corporation
Cognition Corp.   Number Nine Computer Corp.
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Concurrent Computer Corporation NVIDIA Corporation
Conectiva S.A.    Oivier Danet
Corin Anderson    Oki Technosystems Laboratory Inc.
Corvin Zahn.      Olivetti Research Limited
Cronyx Ltd.       OMRON Corporation
Craig Struble     Open Software Foundation
Daewoo Electronics Co. Ltd. Open Text Corporation

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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.
Dennis De Winter
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
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
Fedor P. Goncharov
Felix Kühling
Finn Thoegersen
Francesco Zappa Nardelli
Frank C. Earl
Florian Loitsch
Francisco Jerez
Fred Hucht
OpenedHand Ltd.
Oracle Corp.
Orest Zborowski
Owen Taylor
Pablo Saratxaga
Panacea Inc.
Panagiotis Tsirigotis
Paolo Severini
Pascal Haible
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Patrick Lerda
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Paul Elliott
Paul Mackerras
Peter Breitenlohner
Peter Hutterer
Peter Kunzmann
Peter Osterlund
Peter Trattler
Philip Blundell
Philip Homburg
Philip Langdale
Precision Insight Inc.
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Radek Doulik
Ralf Habacker
Randy Hendry
Ranier Keller
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Regis Cridlig
Rene Cougnenc
Richard A. Hecker
Richard Burdick
Rich Murphey
Rickard E. Faith
Rik Faith
Robert Chesler
Robert Millan
Robert V. Baron
Robert W. Scheifler
Robin Cutshaw
Roland Mainz
Roland Scheidegger
Ronnny Vindenes
Russ Blaine
Ryan Breen
Ryan Lortie
Ryan Underwood
S. Lehner
S3 Graphics Inc.
Sam Leffler
Santa Cruz Operation Inc.
Release Notes for X11R7.7

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
Hartwig Felger
Henry A. Worth
Henry Davies
Hewlett-Packard Company
Hideki Hiura
Hitachi Ltd.
Holger Veit
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Hummingbird Communications Ltd.
Ian Romanick
IBM Corporation
Inst. of Software Academia Sinica
Intel Corporation
INTERACTIVE Systems Corporation
Itai Nahshon
Itronix Inc.
Ivan Kokshaysky
Ivan Pascal
Jakub Jelinek
James Tsillas
Jamey Sharp
Jason Bacon
Jaymz Julian
Jean-loup Gailly

Sascha Hlusiak.
SciTech Software
Scott Laird
Sebastien Marineau
Serge Winitzki
Sergey Vovk
Shigehiro Nomura
ShoGraphics Inc.
Shunsuke Akiyama
Silicon Graphics Computer Systems
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Simon P. Cooper
Simon Thum
Snitily Graphics Consulting Services
Sony Corporation
Søren Sandmann
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Stefan Bethge
Stefan Dirsch
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Thomas Roell
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Thomas Winischhofer
Thomas Wolfram
Thorsten.Ohl
Tiago Gons
Tilman Sauerbeck
Todd C. Miller
Tomohiro KUBOTA

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