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# AMD Geode™ GX Processors

## Building a Linux Image



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## 1.0 Scope

This document discusses the materials needed and the steps involved in building a Linux image on a system based on an AMD Geode™ GX processor\*. This document is intended to augment the README files that accompany the drivers and patches provided by AMD.

## 2.0 Discussion

### 2.1 Materials

This build was performed with the following:

- 1) Redhat v9.0 standard three CD installation set.
- 2) Linux Kernel v2.4.24 source (<ftp://ftp.kernel.org/pub/linux/kernel/v2.4/linux-2.4.24.tar.bz2>).
- 3) AMD patches and drivers ([www.amd.com](http://www.amd.com)):
  - Kernel Patches ([linux-2.4.24-geode.patch](#)).
  - Audio Driver ([Audio\\_LinuxOSS\\_GX2\\_2.0.6\\_src.tar.gz](#)).
  - XFree86 Driver/Patches ([Graphics\\_LinuxXFree86\\_GX2\\_2.8.6\\_src.tar.gz](#)).
- 4) XFree86 Source XFree86-4.3.0-2.src.rpm (Redhat v9.0 Source CD1).

### 2.2 Overview

- 1) Install Linux with Redhat v9.0.
- 2) Build new kernel with kernel patches and audio:
  - a) Install kernel source.
  - b) Apply AMD kernel patches to stock linux-2.4.24 kernel.
  - c) Install AMD OSS (Open Sound System) drivers into patched kernel.
  - d) Build and install the kernel.
  - e) Verify the new kernel is executing.
- 3) Build XFree86:
  - a) Install GCC (GNU C-compiler).
  - b) Install X development RPMs (Glide3 packages).
  - c) Install AMD XFree86 source code.
  - d) Build XFree86.
  - e) Install XFree86.
  - f) Tune XFree86.

\*The AMD Geode GX 533@1.1W processor operates at 400 MHz, the AMD Geode GX 500@1.0W processor operates at 366 MHz, and the AMD Geode GX 466@0.9W processor operates at 333 MHz. Model numbers reflect performance as described here: <http://www.amd.com/connectivitysolutions/geodegxbenchmark>.

## 2.3 Details

Building the kernel can be performed on any Linux system. This saves time, as a very fast system can be selected, and additionally, the results can be saved and new Linux systems for Geode GX processors can be rebuilt quickly.

XFree86 must be built on a compatible system (i.e., the same distribution (Redhat v9.0 in this case)). Given this constraint, it is advantageous to find a good build system, as XFree86 takes up to eight times longer to build than the kernel.

### 2.3.1 Install Linux with Redhat v9.0

Install a workstation version of the system with developer tools included.

Follow the distribution instructions and install a stock Redhat system. The system should be operational, if not optimized for operation with the Geode GX processor.

Refer to the Redhat v9.0 Installation Guide if necessary: <http://www.redhat.com/docs/manuals/linux/RHL-9-Manual/install-guide/>

### 2.3.2 Build New Kernel with Kernel Patches and Audio

The kernel README is a valuable resource: <http://www.kernel.org/pub/linux/kernel/README>

- 1) Install GCC, if not already done, by installing the workstation version of Redhat:
  - This was done on the Redhat v9.0 by going to the RPM (Redhat Package Manager) (System Settings -> Add/Remove Applications), selecting "Development Tools" and updating.
- 2) Install the kernel source:
  - Decompress and restore the bz2 file containing the kernel source, *linux-2.4.24.tar.bz2*. By convention, the source is unwound at: */usr/src*.
  - `cd /usr/src`
  - `bunzip2 -cd linux2.4.24.tar.bz2 | tar -xv`

This step creates the directory: */usr/src/linux-2.4.24*

- 3) Apply AMD kernel patches to stock linux-2.4.24 kernel:
  - Change directories to the path where the kernel source was unwound:
  - `cd /usr/src/linux-2.4.24`
  - Apply the patch:
    - `cat linux-2.4.24-geode.patch | patch -p1`
  - Rename the appropriate configuration file to be the active target at build:
    - `cp gx3_2.4.config /usr/src/linux-2.4.24/.config` → Check this file

At this point, the optimized kernel could be built/installed without the OSS audio drivers.

- 4) Install AMD OSS drivers into patched kernel:
  - Change to the root of the kernel source tree and unwind the tarball, *Audio\_LinuxOSS\_GX2\_2.0.6\_src.tar.gz*:
    - Create a directory for the audio source to be unwound
    - `cd` to this new directory
    - `gunzip Audio_LinuxOSS_GX2_2.0.6_src.tar.gz`
    - `tar -xvf Audio_LinuxOSS_GX2_2.0.6_src.tar`
  - Install the drivers into the source tree:
    - `./install`
  - Augment the configuration by running the *menuconfig* routine:
    - `make menuconfig`
    - Select "Loadable module support" and uncheck "Set version information on all modules"
    - Select "Sound" Option and enable "OSS Modules" by pressing the spacebar when the option is highlighted
    - Make any other configuration changes that may be required for your system (Ethernet controllers, etc.)
    - Save and Exit
- 5) Build and install the kernel:
  - Make dependencies:
    - `make dep`

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- Make the binary compressed image:
    - make bzImage
  - Rebuild the modules:
    - make modules
  - Install the new kernel components:
    - make install
  - or
    - cp arch/i386/boot/bzImage /boot/vmlinuz-2.4.24
    - cp System.map /boot/System.map-2.4.24
    - cp .config /boot/config-2.4.24
    - Change the symbolic links for vmlinuz and System.map to point at the new files
  - Install modules:
    - make modules\_install
  - or
    - Set the environment variable for build path when building on a host and perform the same step
  - Update grub, the boot loader:
    - Change directories to /boot/grub and edit grub.conf. Add a new line to reference to the new kernel and its associated files (2.4.24)
- 6) Verify that the new kernel is executing. Reboot. After the computer reboots, execute:
- `uname -r`
- If installed correctly, the return is:
- 2.4.24-geode-1.0.6

**2.3.3 Build XFree86**

- 1) Install GCC if not already done by installing the workstation version of the Redhat.
  - This was done on the Redhat v9.0 by going to the RPM (System Settings -> Add/Remove Applications), selecting “Development Tools” and updating.
- 2) Install X development RPMs (Glide3 packages).
  - This was done on the Redhat v9.0 by going to the RPM (System Settings -> Add/Remove Applications), selecting “X Software Development” and updating.
- 3) Install AMD XFree86 source code. Be clear here that the RPM source is not installed but placed.
  - Select a build directory and unwind the AMD XFree86 tarball:
    - `cd ~`
    - `mkdir xBuild`
    - `cd xBuild`
    - `gunzip amd-x-linux-GX2_2.8.6.tgz`
    - `tar -xvf amd-x-linux-GX2_2.8.6.tar`
- 4) Build XFree86:
  - `make >& log`
- 5) Install XFree86:
  - When step 4 is complete, change directories into the top level of the current build and untar the product file:
    - `cd amd-x-linux-GX2-2.8.6`
    - `tar -C / -xzpf XFree86-4.3.0.tgz`
- 6) Tune XFree86:
  - Edit /etc/XF86Config-4 to reflect the execution environment’s monitor and mouse. Use XF86Config to tune the configuration.
- 7) Go /var/log and check the XFree86 logs to look for “AMD” or execute the command:
  - `xcpyinfo`

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