

# X Multiple Arcade Machine Emulator

## INTRODUCTION

Hello. My name is Andrew Howlett. I've been using Linux since 1997. About a year ago I did a presentation on Linux Games. But I left out one of my favourite video game genres – arcade machines. This presentation will demonstrate how to play arcade machines on your linux PC.

### Platform

Before I get started, a little bit about my setup so you can compare this to whatever you are running. Obviously my PC is a custom job, but it isn't really that powerful. It has a 1 Ghz VIA C3 processor (which is about the same as a 1 Ghz Pentium 3). It has an on-board VIA 8235 sound chip and a 4x AGP VIA CastleRock graphics adapter. I am using the unaccelerated VESA drivers.

On the software side, this computer runs Debian with a custom 2.6.6 kernel, XFree86 4.3.0.1 and the fluxbox window manager.

## MAME

### Arcade Machines

You have seen arcade machines. Big boxes, controls on the front, a computer screen, and somewhere to put money. Somewhere inside that box is a computer. Arcade machine companies use special purpose computers. Typically one computer will support many different games – just change the ROM chips (more recent machines might have flash memory) and change some DIP switches. Old machines used old computers. For instance, an old machines might have a 1MHz Z80 CPU and a 320x256 16 colour video adapter. These devices are well documented. Arcade sound is much more complicated. Arcade companies designed their own analog audio circuits and d/a converters, and these designs were poorly documented. Newer games use more modern computers, video and audio devices.

### Arcade Machine Emulation

The instruction sets for these CPUs are well known, so the idea of emulating these old machines is fairly obvious. Nevertheless, it wasn't until 1997 that Nicola Salmoria wrote and distributed the first few arcade machine emulators. Others joined the project, and the many emulation engines were merged into a single binary called a "multiple arcade machine emulator". Thus the [MAME project](#) was born.



MAME is written for DOS. XMAME is a port of MAME to the X Window system. This presentation will use XMAME version 0.74.1 which is based on MAME 0.74.

## INSTALLING XMAME

If you use a debian based distribution, then installation is super easy. Just make sure that your internet connection is up and that you have a testing non-free entry in your `/etc/sources.list` file. Then:

```
bash# apt-get install xmame
```

That's it, apt-get will install and configure xmame on debian systems.

If you use an rpm-based system, then you can download Red Hat packages from the xmame website: <http://x.mame.net/xmame-doc-7.html#ss7.2>

You could even compile it from source if you want to, but I haven't bothered.

When you install mame the binary will either be in the `/usr/games` directory or the `/usr/local/games` directory. So you should add these directories to your path.

## ROMS

### Getting ROMs

Inside the original arcade machines the game code and data is stored on ROM chips. (In later generation machines it might have been stored on flash or hard drives, but we will call them all ROMs.) So to play a game on the emulator you have to copy the data from the ROM chips to your hard drive. If you have the right equipment, you can remove the ROM chips from the arcade machine and copy their data. But most people get the ROM files from different sources.

You can download three copyright-free ROMs from the mame.net miscellaneous downloads page.

You can buy ROM files on-line from <http://starroms.com>. StarROMs sells old Atari ROMs, such as centipede and missile command. But StarROMs sells only 50 games, and there are over 4000 games in total. I bought a few games from starroms just to show that I would buy them if someone sold them, but in fact they don't sell any games that I like.

The [Hotrod Joystick controller](#) (more on controllers later) comes with some CapCom ROM files. Also, the [ArcadePC](#) machine comes with a few CapCom ROMs. But that's a lot of money to spend just to get a few ROMs.

The problem is, there are over 4000 ROMs for almost 2500 different games, but you can only legally obtain about 100 ROMs. So there's a huge underground movement selling and sharing MAME ROM files. Just type mame rom file

### ROM Files and Copyright

ROM files are protected by copyright law (except for the three distributed at mame.net). In order to use a ROM file legally, you must own a set of the original ROMs or buy the right to use it through some other product or service.

into google and follow some of the links and you will see what I'm talking about. It's a shame, because many people would pay for these ROMs if they had the opportunity.

### Installing ROMs

ROM files come in a zip package. DO NOT UNZIP THEM! XMAME reads zip files, if you unzip them yourself then XMAME won't be able to read them.

Create a /roms directory off the root directory and move your zipped ROM files to this /roms directory.

## RUNNING XMAME

### Command Line Interface

Launching xmame is easy, just type in xmame followed by an option specifying our rompath, then the name of the rom:

```
bash# xmame -rompath /roms galaga
```

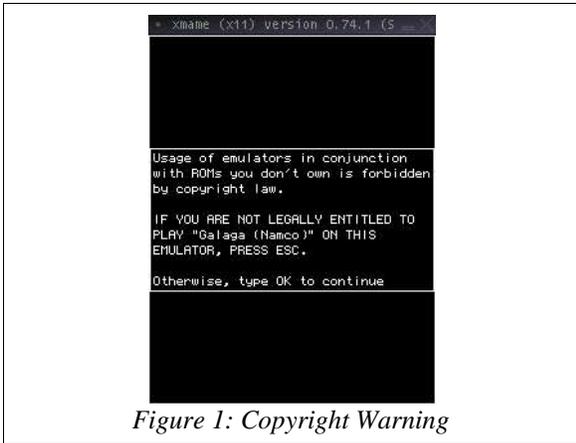


Figure 1: Copyright Warning

First, XMAME will advise you that it is illegal to use ROMs that you don't own (Figure 1). Type "OK" to continue. Then XMAME will warn you of any known bugs (Figure 2). Again, type OK to continue. Next XMAME will show you the game information (figure 3). Press any key and the game starts. As you can see, the emulator goes through the exact same diagnostic screens that the real arcade machine would go through, then you get to the familiar game (Figure 4). This isn't a PC version of galaga.

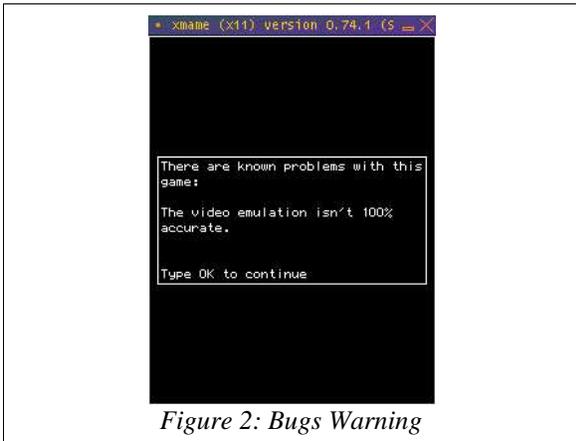


Figure 2: Bugs Warning

This is the real thing. Press the escape key ("Esc") to exit the game.

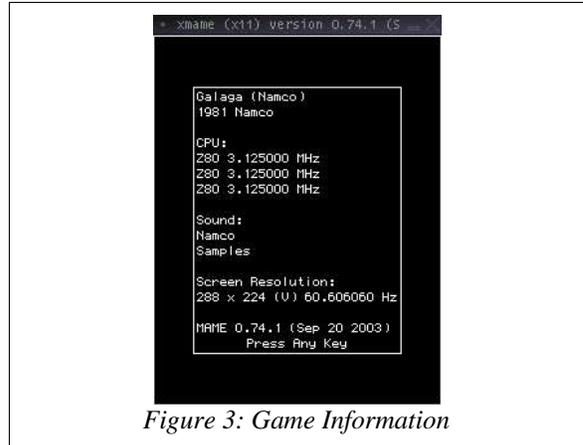


Figure 3: Game Information

### Configuring XMAME

Like all GNU/Linux software, XMAME can be customized using configuration files. Some of the customization is personal, but there are some things you should know. First, on my system the global configuration file is stored at /etc/xmame/xmame.rc. The format is self-explanatory, here is a snippet:

```
### X11-window Related ###
cursor          1
mitshm          1
xsync           1
privatecmap     0
xil             1
mtxil           0
run-in-root-window 0
root_window_id  0
geometry        640x480
```

For a description of the options, read the xmame man page. Some options that you might want to set are rompath, skip\_disclaimer, and skip\_gameinfo.



Figure 4: Play the Game!

## Configuring X for XMAME

You might have noticed that the galaga window was very small. You might also have noticed that the Game Information stated that galaga uses a screen resolution of 288x224 pixels. By default, XMAME will use a one to one mapping of X Window pixels to emulated pixels. If the X Desktop is 1024x768, then galaga appears very small. You can use the "--scale 2" or "--scale 3" arguments to double or triple the size of the window, but you might noticed that at triple size moving pixels appear a bit choppy. A better choice is to set up some low resolutions display modes in your `/etc/x11/XF86Config-4` file. For instance, my minimum mode is 640x480. Some people can get 320x256, which is even better.

```
SubSection "Display"
    Depth 16
    Modes "1280x1024" "1024x768" "800x600" "640x480" "320x256"
EndSubSection
```

You can switch to fullscreen mode by pressing the left Alt key and the Home key at the same time (or by starting xmame with the "-x11 1" switch). XMAME will use whichever video resolution is closest to the game's resolution, but it can only use the resolutions defined in the `XF86Config-4` file.

Some games require a certain bit depth. For instance, space invaders requires 32 bits per pixel, which is a bit bizarre since Space Invaders was a black and white game. But nevertheless, if you are running X at a colour depth of 16, then you can't play Space Invaders under XMAME.

Some video drivers work better than others. For instance, my via driver doesn't do fullscreen. I have to change to the VESA driver to do fullscreen. Fortunately the VESA driver works very well with XMAME, and almost all graphics cards work OK with the VESA driver.

## GXMAME

GXMAME is a front end for XMAME. You can download rpms or debs from <http://gxgame.sourceforge.net/downloads.php>. The first time you run gxgame you will see a blank screen. You need to build a game list – select the "Build Game List" menuitem from the Options menu. It will take a few minutes to build the game list. Next, go to the "Options" menu, select the "Directories" menuitem, click the

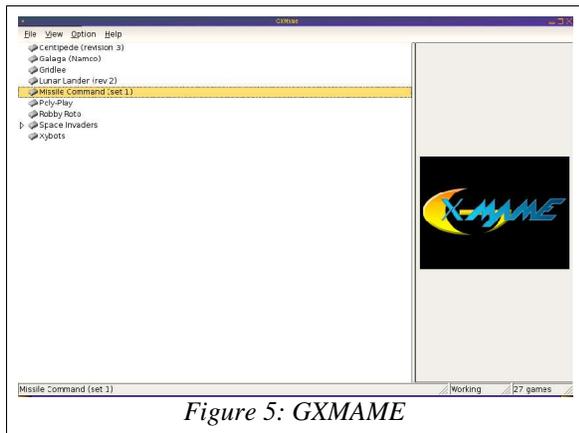


Figure 5: GXMAME

"XMAME Basic Paths" tab, and add the `/roms` directory to the rompath. Click "Apply" and "Ok". Now go to the "File" menu and select the "Audit All Games" menuitem. It will take several minutes to audit all your games. You will have to do a new audit whenever you add ROMs to your `/roms` directory.

The default GXMAME view is a bit crowded. You should click on the "Available" folder in the left pane, then use the View menu to remove the folder view, remove the toolbar and the folder pane, and switch to List mode.

## XMAME CONTROLLERS

### Keyboard

Different arcade machines have different controllers: pacman has a single joystick. SmashTV has two joysticks. Space Invaders has three buttons. Missile Command has a trackball and three buttons. All games have at least one, and usually more start buttons. And of course, every machine had a coin slot.

XMAME maps each input to a key on a standard PC keyboard. XMAME has a standard mapping, but because different games had different controllers each game can be slightly different. While XMAME is running the game, press the TAB key to access the XMAME menu. You will notice an "Input (general)" and "Input (this game)" menuitem. Select the "Input (this game)" menuitem. Now you can see all the keymappings for this game. In fact, you can redefine the key mappings, and the changes will be effective next time you start this game. Some important general keymappings are:

Key	Function
5	Insert Coin
1	Start Player 1
Left arrow	Move left
Right arrow	Move right
Left Ctrl	Button #1 (eg Fire!)
Left Alt	Button #2
Left Shift + F7	Save state

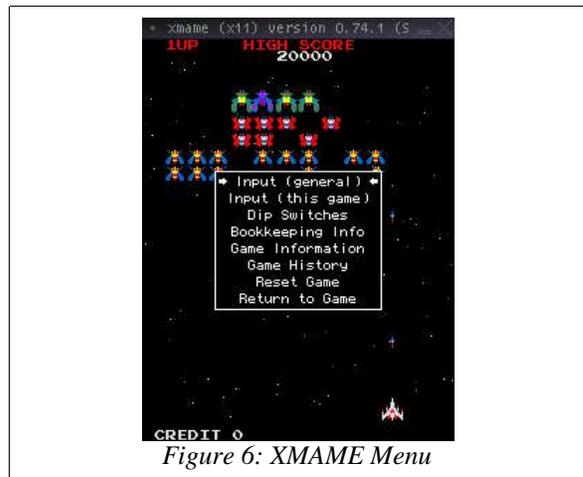


Figure 6: XMAME Menu

<i>Key</i>	<i>Function</i>
F7	Load state
P	Pause

Notice the last three entries. You can save a game and restore a game. Which is really good for those long games that have lots of levels. And you can pause a game.

Some other interesting keys are F11, which shows the frames per second at the top of the XMAME window, and F8, F9, and F10 which change parameters for the autothrottling system. Under XMAME some of these game programs can run much faster than on their original 1 Mhz CPUs. If you want to, you can try to play these games at 6 times their original speed.

### **Arcade Controllers**

You can buy arcade controllers on the Internet. For instance, the [X-Arcade controller](#), shown in Figure 6, features two joysticks and sixteen buttons, arranged so that you can play single player games that require two joysticks or two player games that each require a single joystick. These arcade controllers plug into the usb port or the PS/2 keyboard port. The operating system sees them as a keyboard, and XMAME accepts them as keyboard input.

### **Joysticks**

XMAME supports several types of PC joystick, but I recommend using the kbstick utility (see sidebar). That way the PC joystick just generates keyboard input just like the arcade style controllers.

### **Custom Built Controllers**

You can build your own controllers. Just take apart an old keyboard and solder some arcade style buttons onto the contacts. Some high school students near my house made one and it looks really ugly but if you put it inside a cabinet like they did, then no one will see the messy wires and dismembered keyboard, they just see the arcade buttons on the front of the cabinet. You can download plans describing exactly how to build a MAME cabinet. You can even download artwork to go on the sides of the cabinet. If you prefer, you can [buy prebuilt cabinets online](#).



*Figure 7: X-Arcade Controller*

## **KNOPPXMAME**

KnoppixMAME is a live-bootable CD which runs XMAME and GXMAME. You can download the 150MB iso image from <http://sourceforge.net/projects/knoppixmame>. The iso image does not have any ROM files. When you run KnoppixMAME it scans your hard drives for a /roms directory, then KnoppixMAME uses the ROM files it finds in that directory.

So what's the point of having a bootable XMAME cd if it doesn't have any ROMs? Well, reboot the computer with the KnoppixMAME cd in the drive. This time, when you get to the boot command line, enter the boot command "knoppix addroms".

KnoppixMAME will guide you through the process of building a new iso image, and the new iso image will include the ROM files. Now you can burn that new iso image to a CD and you will have a bootable CD that has its own ROMS.

### **Linux Joystick Support**

Linux supports many types of joysticks. The linux kernel has joystick/gamepad modules, and some games, like tuxracer, automatically use the joystick. But other games, like Quake3, don't recognize the linux joystick system. Fortunately there is an incredibly simple and elegant little hack called "kbstick" put together by David Fulgham. This neat little program reads the linux joystick device and uses the builtin XWindows function XTestFakeKeyEvent to translate each joystick event into a keyboard event. So if you press left on the joystick, kbstick will generate a keypad left arrow keypress. Most games let you customize the keyboard commands, so you can quickly instruct Quake or any other game to respond to these keyboard inputs. You can find kbstick at <http://www.ditch.org/kbstick/>.