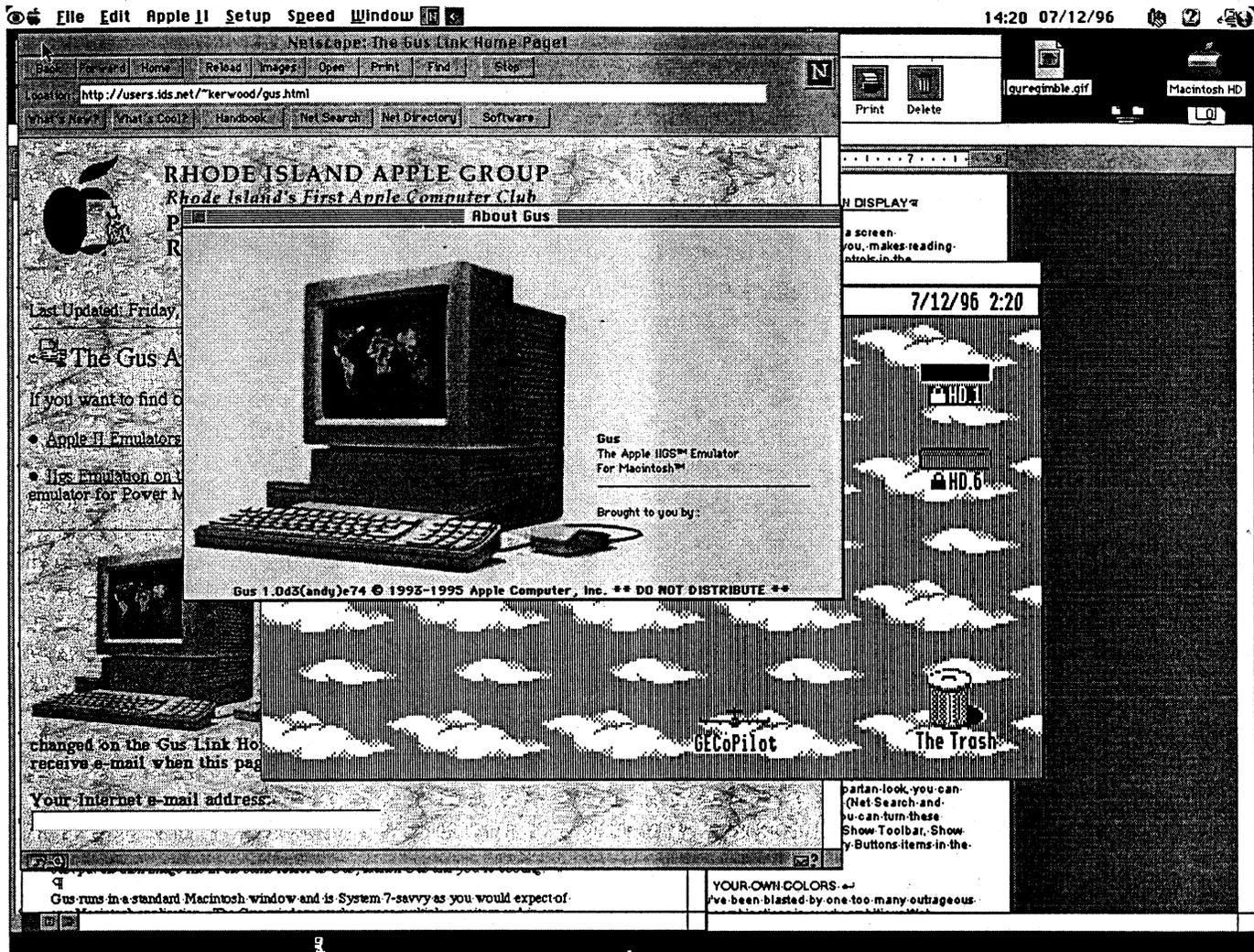


# Gus

## The Apple IIGS™ Emulator for Macintosh™

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“Gus” is the name Apple Engineers Dave Lyons, Jim Murphy, and Steve Stephenson gave to their Apple IIGS's when they first bought them in 1986 and 1987. So, we thought it was a fitting name for an Apple IIGS emulator.

Gus is a Macintosh application which emulates the 65816 microprocessor, displays, sound generation and other hardware found in an Apple IIGS. Gus has also been specially tuned to provide accelerated performance when run on any Power Macintosh.

### Quick start

Put Gus and a bootable disk image file into the same folder. Launch Gus by double-clicking or by dropping the disk image onto Gus. You can create disk image files from existing 800K or 1.4 MB disks using Apple's “Disk Copy” utility.

### What works?

We have written hardware emulations for all 13 available video modes, the Apple II memory system, the Apple Desktop Bus (ADB) KeyMicro, single-bit “Classic” Apple II sound, the Joystick, the clock, and the IWM disk hardware.

We also implement some "patches" to the image of the Apple IIGS ROM 03 image which allows us to do things like boot from an Apple "Disk Copy" disk image. There is also a simple architecture to allow us to accelerate portions of the GS ROM should we find this necessary; we have only needed to accelerate some absolutely key areas, such as IIGS Toolbox dispatching.

As for video modes, we provide: 40 column and 80 column text with all the appropriate background and text colors, Hi-Res in both B&W or Color, Double Hi-Res in both B&W or Color, Lo-Res, Double Lo-Res, Super Hi-Res 320, Super Hi-Res 640, all the "mixed" graphics and text modes, and even Super Hi-Res fill-mode. The color graphics modes for Hi-Res and Double Hi-Res are rendered using color-bleeding and match the output provided by the Apple IIe card for the Macintosh LC. Most of the graphics modes perform extremely fast updates; that is, most graphics on Gus are substantially faster than the Apple IIe card.

Gus boots from Disk Copy "disk images" or Apple II ShrinkIt-compressed "disk images". Just put the disk image file in the same folder as Gus, launch Gus and you're booting.

Gus runs in a standard Macintosh window and is System 7-savvy as you would expect of any Macintosh application. The Gus window works across multiple monitors and in any screen depth, although you will get the best performance in 256-color mode with the window entirely on a 256-color screen.

### **Apple IIGS Memory Size**

The Apple IIGS memory size is determined by the size of the Gus application size. "Get Info" on the Gus application icon and crank it up. You can have up to 14 Megs of RAM in the GS.

### **Gus Menu Items**

\* Even though menu items have Command-key ( ) equivalents, when Gus is running all keystrokes are routed to the emulator. To use a Command key for a menu item, combine the Command key with the Shift key. For instance, to use the Quit menu item instead of typing Command-Q, you need to type Command-Shift-Q. This was necessary because many Apple II and IIGS programs expect to receive key sequences such as "Command-Q". This is only necessary when the Apple IIGS window is in the front and not paused.

(\*\*\* Note: This is a problem if there are GS applications that need to see Command-Shift- keystrokes. Maybe we will have to provide a configuration dialog to choose what modifier keys allow access to the Macintosh menus. Maybe there is a better (default) modifier combination to use. What do you think? \*\*\*)

### **The Gus "File" Menu**

#### *New Disk Image...*

"New Disk Image..." allows you to create an empty disk image file. Radio buttons are used for common disk image sizes, or just type a size you would like to create.

The new disk image is immediately available to the Apple IIGS. If you're in the GS Finder, it will prompt you to format the new disk. (\*\*\*) In 1.0d2, the new image is completely blank. A future Gus will probably pre-format it as ProDOS unless you hold down the Option key. (\*\*\*)

Note: 140K disks show up in slot 6 (but there is currently no support for writing to slot 6 disks, so creating a blank one is not too useful).

All other sizes show up in slot 5, up to a maximum of 16 devices.

#### *Open Disk Image...*

"Open Disk Image..." allows you to open and mount a new disk image file even if Gus has already started running. If Gus has been booted from an empty folder and is idling at the "sliding apple" screen when you open a new disk

image file Gus will attempt to boot from that disk image. If Gus has already been booted the additional disk image will be available in either Slot 6 (140K images) or Slot 5 (all other disk image sizes).

As you might expect, drag & dropping a disk image onto Gus will launch Gus and boot from the disk which was dropped.

If Gus is already running and you drop a disk image onto Gus, it will be added to the list of available disk images. If no disk images have yet been opened by Gus, then Gus attempts to boot from the disk image which was dropped.

### *Page Setup...*

"Page Setup..." shows the standard Page Setup dialog for the currently chosen printer.

### *Print Window...*

"Print Window..." allows you to print the contents of the "Apple IIGS" window.

### *Quit*

Exit Gus. Command-Shift-Q and Command-Option-Q are key equivalents for Quitting Gus.

## **The Gus "Edit" Menu**

### *Copy*

"Copy" copies the contents of the current Apple IIGS screen onto the Macintosh clipboard. If a graphics mode is being shown on the IIGS, then the contents of the clipboard will be a Macintosh picture. If a text mode (40 or 80 columns) is being shown, then the contents of the clipboard will be text.

In a mixed text-and-graphics mode, only the four lines of text at the bottom of the screen are copied.

If you want a picture of a text or mixed-text-and-graphics display, use the next menu item, "Copy Picture."

### *Copy Picture*

Regardless of the Apple IIGS display mode, "Copy Picture" puts a picture of the Apple IIGS screen onto the Macintosh clipboard. This is useful for saving, printing, or possibly editing the picture later in a Macintosh painting program.

### *Paste*

When there is text on the Macintosh clipboard, Paste types the letters one at a time on the Apple IIGS keyboard. (Use "Clear Keyboard Buffer" in the Apple II menu, or type Command-Control-Delete, to abort the operation.)

Some special Macintosh characters in the text are converted into ASCII characters during the Paste. For example, "™" becomes "(TM)".

### *Clear*

When the Clipboard window is in front, "Clear" clears the Macintosh clipboard.

### *Import Macintosh Clipboard*

(\*\*\* Not implemented in Gus 1.0d2 \*\*\*) "Import Macintosh Clipboard" transfers a copy of the contents of the Macintosh clipboard to the Apple IIGS clipboard.

### *Export Apple IIGS Clipboard*

"Export Apple IIGS Clipboard" transfers a copy of the contents of the Apple IIGS clipboard to the Macintosh clipboard.

(\*\*\* As of 1.0d2, only text is transferred. More data types coming later. \*\*\*)

## The Gus "Apple II" Menu

### *Ctrl-Reset*

"Ctrl-Reset" performs the same action that pressing the Control and "Reset" keys on the Apple IIGS. Usually this resets the machine, possibly rebooting it. It may also cause the IIGS to start running its low-level "Monitor" program.

### *Restart Apple IIGS*

"Restart Apple IIGS" simulates pressing "Command-Control-Reset" on a real Apple IIGS. The emulated machine reboots much the same as you would expect of a real Apple IIGS.

### *Restart from Slot 5*

"Restart from Slot 5" restarts the Apple IIGS and acts like the StartUp Slot is set to 5 in the control panel. (The actual setting is not changed, it's just temporarily ignored.)

Use this menu item to start up from a disk in slot 5 even when a 140K disk image is present in slot 6.

### *Restart from Slot 6*

"Restart from Slot 6" restarts the Apple IIGS and acts like the StartUp Slot is set to 6 in the control panel. (The actual setting is not changed, it's just temporarily ignored.)

### *Pause*

"Pause" pauses or resumes the Apple IIGS.

### *Classic Desk Accessories*

"Classic Desk Accessories" simulates pressing "Command-Ctrl-Esc" on a real Apple IIGS. The Classic Desk Accessories which are currently installed are shown.

### *Clear Keyboard Buffer*

"Clear keyboard Buffer" clears the Apple IIGS keyboard buffer. It's the same as typing Command-Control-Delete.

This is useful when you have Pasted or dragged in a piece of text and want to stop the operation. Gus can accept drops of pieces of text from other programs which are drag & drop aware. The text is "typed" into the emulator as if you were sitting and typing.

### *Restart to Option Screen*

"Restart to Option Screen" restarts the emulated Apple IIGS and shows the standard options available:

- Enter the Control Panel
- Set system standards and 60 hertz.
- Set system standards and 50 hertz.
- Continue restarting the system.

This menu item is useful for resetting the values stored in the Apple IIGS battery ram. These battery RAM settings are stored in the "Gus Preferences" file in the Preferences folder in your System Folder.

### *Restart to Self Test*

"Restart to Self Test" simulates pressing Command-Option-Ctrl-Reset on a real Apple IIGS. The Apple IIGS self test is executed.

(\*\* As of 1.0d2, the self test fails with error 05010100. \*\*)

Speaking of Control-Reset... Do NOT press Command-Control-Reset on your Macintosh. Your Macintosh will reboot, and you will be as cranky as Jim and Andy were when they did it. (\*\* We may try to have Gus "own" the Reset key when it is the frontmost application. What would you think of this? \*\*)

## The Gus "Setup" Menu

### *Show Available Disks*

(\*\* In 1.0d2, all you get is a bunch of virtual-disk-in-use lights. The first 16 rows are for slot 5, and the last two are for slot 6. \*\*)

"Show Available Disks" shows a list of "connected" disk images. Each disk image is mapped to a particular slot and drive (ie, Slot 6, Drive 1) as you would expect of a real Apple II. There is a column of disk activity lights displayed in this window. A red light indicates writing. A green light indicates reading.

(\*\* Eventually, you'll be able to unmount disks from this window and see what's where. \*\*)

### Apple II Mouse Mode

"Apple II Mouse Mode" enters Apple II mouse mode.

(\*\* Not implemented in 1.0d2. The idea is to hide the Mac mouse entirely and keep reporting mouse-movement deltas to the Apple II softswitches. Without this mode, the mouse only works correctly with software that uses the GS Event Manager. \*\*)

### *Large Window*

### *Small Window*

These menu items toggle the size of the main Apple IIGS window.

For best speed, the window should be Large, on a 256-color monitor, and not obscured by any other windows. When these conditions aren't met, the window title shows "(Slow Video)", and Gus uses the Macintosh toolbox to draw to the window, instead of blitting directly to the screen.

As a shortcut, you can toggle the window's size by holding down Control when you click the window's Zoom box.

(Holding down the Option key when you click the window's Zoom box allows the window to move to another monitor if Gus believes that is wise. It prefers the smallest 256-color monitor that the window fits on.)

### *Enable/Disable Monochrome Graphics*

These menu items are only enabled if the emulated Apple IIGS is displaying graphics in the Hi-Res or Double Hi-Res mode. If Hi-Res or Double Hi-Res is being shown some programs assume that the color signal to the monitor could be removed to show the graphics screen in monochrome. Gus provides a monochrome switch so that those programs can work correctly and not look weird because of the color bleeding that occurs in normal Hi-Res and Double Hi-Res graphics.

### *Preferences*

"Preferences" shows a movable dialog giving detailed preference settings for Gus.

(\*\* This dialog will probably change a lot. As of Gus 1.0d2, here's the deal:

- Warn on quit if GS work may not be saved.

When checked, the only time you don't get the alert is at the sliding-Apple screen.

- Slow down the GS while it is idle  
Analogous to "power cycling" on certain Macintosh models. Puts an "[Idle]" indicator in the Mac menu bar after 5 seconds of GS inactivity. The idea is for Gus to take up less Mac time in this state, but currently it doesn't make any difference.
- Allow writing to DiskCopy images  
When disabled, all DiskCopy images are opened read-only
- Allow GS to set Macintosh date and time  
When enabled, the GS can change your Mac clock. Otherwise, Gus remembers the time difference between the Mac and GS clocks until you quit Gus.
- Allow GS programs to run Macintosh code  
Does not do anything. Preference will probably go away for Gus 1.0.
- Install Memory Peeker and Visit Monitor CDAs  
Works. When enabled, forces the relevant Battery RAM bit to be set.
- Accelerate GS with native code  
Currently always on. There are some ROM patches that could be optional, and this would control them.
- Allow GS to turn itself off.  
Questionable value, but there is actually a magic 65816 instruction that makes Gus quit.  
\*\*\*)

## The Gus "Speed" Menu

*Apple IIe*  
*Apple IIGS*  
*Fastest*

When set to Apple IIe speed (1 Mhz) Gus is capable of accurately reproducing "Classic" Apple II sound. Gus will also have the "feel" of a 1 Mhz Apple II. This setting is useful for playing games where some games become unplayable if the emulator goes too fast. When set to "Fastest" Gus will not produce "Classic" Apple II sound, but it goes very fast.

\* Apple IIGS speed is being worked on, as is getting "Classic" sound to work at all speeds.

## Caveats?

- Gus currently cannot run copy-protected software. We have thought about a scheme to remedy this, but it involves modifying Andy's freeware program, ShrinkIt, to include a bit-copier. That's hard and will take a while to write. Donations of free (or nearly free) source code to help us fix this problem would be welcome.
- Serial Port emulation does not exist.
- Ensoniq DOC emulation does not exist.
- A few \$Cxxx softswitches have not been implemented or are incomplete.
- AppleTalk does not yet work. It's coming.

## Bugs:

- The Mac cursor is usually not shielded properly, so you can get garbage on your screen, temporarily, by putting the Mac cursor where the GS is drawing. The Mac cursor also flickers wildly sometimes.

## How does it work?

Gus is an interpretive emulator and is a "Fat" application (containing both 68K and PowerPC code). Gus is written mostly in C and C++ with almost the entire 65816 "engine" and memory system written in 68K assembly and PowerPC assembly.

The exact performance of Gus is highly dependent on the type of IIGS code being run through the emulator. For instance, running 8-bit 6502 application code is usually slower than running 65816 code because more work is

required of the emulator. Our best-case benchmarks usually occur when running applications which were written for GS/OS.

Using those best-case benchmarks based on the Quickdraw II "Speed" benchmark:

- The PowerPC engine is approximately 2x GS speed on a 60 Mhz Power Mac.  
It is approximately 3.5x GS speed on an 80 Mhz Power Mac.  
It is approximately 7.5x GS speed on a 120 Mhz PowerPC 604 based Power Mac.

As far as we can tell, when Gus is run on any reasonably fast (80 Mhz) Power Mac it is faster than any hardware Zip GS accelerator card ever capable of being built.

(\*\*\* Gus 1.0d3 is not yet a "FAT" application. \*\*\*)

### **What can I do? What should I do?**

First and foremost we would like feedback on the work that we have done:

How good of a job do you think we have done? What might you use Gus for? What might your friends or customers use Gus for? What features are important to you that we have not yet implemented? Are there any features you consider "must-have?" Is the speed acceptable? Are there areas where we might consider additional acceleration? Are there any crucial programs which must be able to run? How important is the 68K performance of Gus to you? If we did not provide for high-fidelity reproduction of Ensoniq sound, would you be miffed? Have you found any obvious problems? What are your opinions on distribution of Gus?

Next, we need your help. We need help screening the thousands of disks which have been produced for the Apple II and IIGS over the years. We also need help documenting which disks work and which crash or which almost work. If you have a non-copy protected disk that doesn't function when you create a Disk Copy disk-image, please arrange for us to get a legal copy of the software if we don't already have it in our library.

### **One more thing...**

Gus is not done, and it's not ready for prime time.