GNO Overview and Installation

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Chapter 1

Credits

> *Always listen to experts. They'll tell you what can't be done, and why. Then do it.* — **Lazarus Long**

The **GNO** **M**ultitasking **E**nvironment for the Apple IIgs.

The following people and organizations have contributed to the GNO base distribution; many other people have contributed stand-alone packages and their efforts are also appreciated:

Kernel Jawaid Bazyar; Derek Taubert.

GNO Shell Tim Meekins; Dave Tribby.

Documentation Jawaid Bazyar; Albert Chin; Tim Meekins; Devin Reade; Andrew Roughan.

Utilities Matt Ackeret; Leslie Barstow; Soenke Behrens; James Brookes; Evan Day; Tilghman Lesher; Devin Reade; Ian Schmidt; Derek Taubert; Greg Thompson; Dave Tribby; Philip Vandry.

Libraries Jawaid Bazyar; Soenke Behrens; James Brookes; Douglas Gwyn; Tilghman Lesher; Devin Reade; Henry Spencer; Derek Taubert; Dave Tribby; Phillip Vandry; Mike Westerfield; Procyon, Inc.; The Byte Works, Inc.; University of California, Berkeley.

The libraries contain other contributions that are necessarily anonymous, as they are derived from code fragments for which no author information was available.

With many thanks to:

- Bill Gulstad, Rob Knauerhase, and everyone on the gno-devel and GNO-BETA Internet mailing lists.
- Dave Lyons, for tolerating Jawaid's endless questions since the beginning of time, for getting Jawaid started in IIgs programming, and for calling GNO "cool".
- Mike Westerfield, for your technical assistance and all your work in making great development tools for the IIgs.

Special thanks to:

- Matt Deatherage, for egging Jawaid on to complete the project; also, for your most helpful technical support through DEVSUPPORT — you guys made this thing possible!
- Randy Hyde, for telling Jawaid it couldn't be done.

Chapter 2

Preface

Computers are tools. The flexibility of a tool determines how useful it is. Early computers were much like the one this software was written for: the Apple IIgs. They could only run one program at a time, and their usefulness was limited to what the particular program the user was executing offered. In the late 1960's, a team of researchers at AT&T began developing the UNIX operating system. The UNIX design was partially based on the premise that most programs are I/O bound, that is, most of the time the program executes is spent waiting for user input or other I/O operations. While one program is waiting for I/O, why not allow another program to execute? This is what they did, and the result was one of the most successful computer operating systems ever created.

The Apple IIgs, like the Macintosh it is modelled after, provides very limited multitasking abilities in the form of desk accessories (NDAs). The programs in the NDA menu are available in whatever application you use as long as it follows Apple's guidelines. However, there are many graphics based programs that don't support NDAs, and in addition there is a wealth of software that has been developed for the Byte Works' ORCA environment. This environment is mainly text-based, and thus makes access to NDAs impossible. As if that wasn't enough, it's very difficult to write an NDA to allow the application to keep running concurrently. So the benefits are lost, and we're back at ground zero.

Enter the GNO Multitasking Environment. What was once just dreamed about is now a reality. GNO/ME provides an environment that is almost entirely compatible with software developed for the ORCA environment. But GNO/ME also provides a wealth of new abilities, lots of new ground for developers and users alike.

Before we begin describing GNO, we'd like to respond to those who say such a multitasking system isn't possible on the Apple IIgs. Obviously it is: you hold it in your hands. Some say the Apple IIgs isn't powerful enough to make multitasking useful. We point out that the Apple IIgs is much more powerful than the first computers UNIX was designed to run on; they only had 64K of real memory, and were 16 bit machines. Some ask why you'd ever need to run more than one program at once. These are the same people who asked why we'd ever need more than 64K of memory, or more than 140K of storage on disks (end soapbox).

Chapter 3

Overview

3.1 Introduction

The GNO Multitasking Environment provides pre-emptive multitasking. Many programs can be executing at the same time; each is called a “process”. Each process is allowed to run for a short period of time (1/20th of a second on average). When its time runs out, the current process is set aside and another one chosen to run next. This cycle continues until there are no more processes left (i.e. when you exit GNO/ME). Starting up processes to run 'in the background' is a simple matter of adding a few characters to the shell commands.

GNO/ME provides a shell that takes full advantage of the multitasking ability provided. The most important feature of the shell is job control (starting, terminating, and suspending processes). But the shell also provides power never before seen on the Apple IIgs. The ability to choose files by “wildcard” has been around for a while, but the GNO Shell takes this to a new level with “regular expressions”, a very powerful yet simple programming language. Other benefits of the GNO shell are too numerous to mention. (see the **GNO Shell User's Manual** for details).

In addition to being compatible with the ORCA system, GNO/ME is a very powerful programming environment. Available to the programmer are all the calls needed to control processes, support Inter-Process Communication, and other tools needed in a multitasking environment. In fact, a large portion of the libraries in GNO v2.0.6 and later are based upon code from FreeBSD UNIX (see `http://www.freebsd.org`). The version of FreeBSD on which the GNO libraries are based is also available at `ftp://ftp.gno.org/cdrom/usr/src`.

GNO/ME also boasts the first completely consistent method for accessing serial and console I/O. The IIgs TextTools have been incredibly enhanced to provide a truly all-encompassing interface for serial, console, and IPC applications. Imagine being able to attach terminals to your GS, and have a useful shell in each one. Multiuser BBSs, remote dial-ups, UUCP or SLIP that doesn't take over your computer- the applications are endless!

With all this talk of shell utilities, have desktop users (users of programs like AppleWorks GS) been left behind? Absolutely not. GNO/ME doesn't allow more than one desktop program to run concurrently, but it DOES let you run a desktop program with as many text applications as you like. In other words, no functionality is lost from the IIgs by using GNO/ME.

Finally, the GNO Multitasking Environment comes with a large number of free utilities that bring some of the power of a UNIX system to the Apple IIgs. Also, a number of programming libraries are included that make it easy to port programs from UNIX or MS-DOS systems to the Apple IIgs.

3.2 Documentation Roadmap

There are many pieces to the GNO documentation. The primary ones are listed below. They are available at the GNO Documentation Page[1] and via anonymous ftp from `ftp.gno.org`.

- GNO Overview and Installation Manual[2].
- GNO Shell User's Manual[3].
- GNO Kernel Reference Manual[4].
- Online Manual Pages.
- GNO Frequently Asked Questions (and Answers) List[5].

If you are new to GNO, you should start with the Overview and Installation Manual (this document).

The GNO Shell User's Manual[6] provides information on using **gsh**, which is an ORCA-compatible shell. It is the primary user interface to GNO.

[1] `http://www.gno.org/~gno`
[2] `http://www.gno.org/~gno/intro.html`
[3] `http://www.gno.org/~gno/gsh/index.html`
[4] `http://www.gno.org/~gno/kern.html`
[5] `http://www.gno.org/~gno/FAQ.html`
[6] `http://www.gno.org/~gno/gsh/index.html`

The Kernel Reference Manual[7] gives detailed information about the kernel, which is the heart of GNO. It is intended mainly for programmers.

The "Manual Pages" are the traditional form of UNIX documentation. They are normally viewed on your GS by typing "man *subject*", where *subject* is the name of the command, library routine, file (and so forth) for which you are trying to obtain information. Man pages are provided for the base distribution[8], and are usually provided by authors of third-party programs. Type "man man" from within GNO for detailed instructions on how to use the man pages.

The FAQ[9] is a list of questions and answers that have come up many times; you should read the FAQ before posting any GNO questions to Delphi[10] or **comp.sys.apple2.gno**. Your question may already be answered.

More information, including an online GNO bugs database, status charts for on-going development, and GNO-related links are available online at http://www.gno.org/ gno'[11]. Because of the nature of this information, much of it is available only via the WWW, and not anonymous ftp.

3.3 Hardware Requirements

GNO/ME will work on any Apple IIgs with at least 2 MegaBytes of memory and a hard drive.

You should have at least 5 MegaBytes of hard disk space free for GNO v2.0.4.

GNO version 2.0.6 is *much* larger than previous versions. Even if you are only installing v2.0.4 at this time, it is recommended that you reserve at least one 32-megabyte ProDOS partition for GNO-specific files.

We recommend 4 MegaBytes of Memory and an accellerator card, especially if you will be using GNO with many background processes. A modem and access to an on-line service will greatly speed access to technical assistance and new utilities as they are made available.

[7] `http://www.gno.org/~gno/kern.html`
[8] `http://www.gno.org/~gno/manindex.html`
[9] `http://www.gno.org/~gno/FAQ.html`
[10] `http://delphi.com`
[11] `http://www.gno.org/~gno`

3.4 Obtaining GNO

GNO is a large and complex system. There are many pieces to it; too many to list in detail here. There are, however, two major catogories of pieces. The first is the base distribution, the second are all the third-party "add-ons". (Some of the second category sometimes get moved into the base distribution). Normally, one would install the base distribution, then install whichever third-party applications are desired.

Currently, there are available two versions of the base GNO distribution. The first is version 2.0.4, which is the one last version released by Jawaid. It is relatively stable and easy to install, but has no TCP/IP support, a few known bugs, and is not getting any kernel updates. (Recent library updates can, to some extent, be used with this version.)

The second available version is 2.0.6. It is undergoing active development and therefore includes bug fixes to v2.0.4, as well as TCP/IP support in the kernel (it does not currently take advantage of Marinetti). On the other hand, it is still of alpha quality; it is difficult to install, has some incompatibilities with 2.0.4, and new bugs have been introduced. Once it has stabalized more, it will completely supercede version 2.0.4.

Both base distributions are available via anonymous ftp. Version 2.0.6 is also available in source form, including via anonymous cvs. See the respective Installation chapters on downloading these files.

Third party applications are available (among other places) from `ftp://ftp.gno.org/pub/apple2/gs.spe` Because this collection has grown so large, James Brookes developed the **describe**database (later maintained by Soenke Behrens and Devin Reade), which provides a description and other information on the various GNO utilities. Online interfaces to the database may be found at `http://www.gno.org/~gno/describe/` or `http://www.servtech.com/public/phoenix/computers/gno/index.html`.

3.5 Obtaining Assistance

Since GNO was reclassified as freeware in the fall of 1997, Procyon no longer provides direct support to users, other than those that had paid the full price for GNO prior to the reclassification.

There is, however, a group of programmers and users of GNO who are able to render assistance on a volunteer basis. Some of these programmers are also actively involved in upgrading the base GNO distribution.

If you require assistance, the following two methods of contact are preferred:

- Post a message to the USENET news group, **comp.sys.apple2.gno**. Remember that messages usually take at least a few hours to propagate around the world. Answers also take time to propagate.
- Ask a question on the Delphi Apple II Programmers' Forum. There are subject areas set up for GNO under "third party technical support". Delphi is accessible via `http://delphi.com`. (Delphi is recommended for discussion of programming topics in general and has, for the most part, taken over from Genie as the center of online Apple II communication. Some packages are available free of charge. Visit Delphi for more details.)

  Unlike USENET, on Delphi you should try to continue existing threads. The current ones for GNO are:

  - Message 1045: GNO: System Installation and Configuration
  - Message 1046: GNO: References and Users' Manuals
  - Message 1047: GNO: Manual Pages
  - Message 1048: GNO: The Kernel
  - Message 1049: GNO: Shells
  - Message 1050: GNO: Libraries and System Header Files
  - Message 1051: GNO: Interfacing with ORCA
  - Message 1052: GNO: Networking and Telecommunications
  - Message 1053: GNO: General Discussion
- Also on Delphi, there is a regularly scheduled GNO Programmers' Conference on Monday and Thursday evenings from 10pm to midnight EST/EDT. Devin is usually around those evenings, although he sometimes misses the conference. If you don't catch him the first time, be sure to try again another day.

As a last resort, you can contact Devin Reade (one of the GNO development team) at gdr@trenco.gno.org. Please don't use this method unless absolutely necessary, as Devin is not always available. More importantly, asking questions in an open forum provides for peer review; if an answer is wrong, it can be corrected by other developers.

Finally, for those who paid for GNO before it was reclassified, Jawaid can still be contacted at bazyar@hypermall.com. Written correspondence should be directed to Procyon at:

```
Procyon, Inc.
PO Box 641
Englewood, CO 80151-0641 USA
(303) 781-3273
```

3.6 Reporting Bugs

In any large piece of computer software such as the GNO/ME system, bugs are sure to turn up, no matter how much testing is performed on the software before it goes out the door. If you discover a bug in GNO/ME, we'd like to hear about it. There are several things we require, however, to make bug reports useful to us.

First of all, we need a complete description of your computer system; how much RAM, what cards, in what slots, what type of disk storage, etc. This information is very important in tracking down hardware-dependent bugs. Also, we need to know the version numbers of the software involved; the GNO Kernel, the GNO Shell, and any utilities.

Second, we need a step-by-step description of how to duplicate the bug. If this requires writing down individual keystrokes, then we need it. Only in this way can we decide whether the bug is hardware dependent or global.

Once you have collected this information, the preferred method of submitting it is to use the online GNOBugs database at `http://www.gno.org/~gno/bugs.html`. Alternately, you could contact the GNO developers in one of the ways mentioned in the section on **Obtaining Assistance**.

3.7 User Projects

If you're working on a project which utilizes GNO/ME in some way, we'd like to know about it. Just Devin by email and tell him about your project. If possible, he'll coordinate your efforts with those of other programmers. If we really like your project and think it may be useful to others, it may be included on the next GNO/ME distribution!

It is, of course, good to not start work on something that is already being worked on or already finished. Before starting a project, you may first wish to check the Program Status List at `http://www.gno.org/gno/status-bin.html` or the Library Status List at `http://www.gno.org/gno/status-lib.html`.

3.8 Software Piracy

If you have illegally copied computer software from someone and are now reading this, take a moment to reflect on what you've done. Many computer software applications are huge projects, consuming many man-years of effort, huge amounts of money, and a lot of grief on the part of the developers. For example, the Byte Works' ORCA languages and development environment (as of November 1997) consists of over 220,000 lines of source code, *not* including the libraries, tool interface files, test programs, samples, or the 5 800k disks of source in the courses for each language. This work represents approximately 17 man-years of development, support, marketing, and management.

Is it right that you're now benefiting from developers' efforts without any just compensation to the authors?

Many programmers are born, bred, and raised in the spirit of computing. They love to write software, and probably always will. But if they cannot make enough money to make it worthwhile to continue their work, then they won't; because by worthwhile, we mean not only food on the table, but resources for expansion and continued growth. In short, support them and they'll support you.

Computer software is very inexpensive when you consider what it allows you to do.

To all you who properly pay for the software you use: Thank you.

3.9 Suggested Readings

The following are recommended readings for users:

- Learning UNIX [11]
- The UNIX Operating System [2]
- Peter Norton's Guide to UNIX [18]
- UNIX in a Nutshell [12]
- Life with UNIX — A Guide for Everyone [17]
- UNIX for the Impatient [1]
- Learning the vi Editor [16]

The following are recommended readings for programmers:

- The Design and Implementation of the 4.3 BSD UNIX Operating System [20]
- The UNIX Programming Environment [14]
- Advanced Programming in The UNIX Environment [22]
- Advanced UNIX Programming [19]
- Using C on the UNIX System [10]
- POSIX 1003.1 [13]. This would normally be considered required reading except that the POSIX standards (like most standards) are very expensive. If you can obtain a copy, you should try to do so.

The following should be considered as required readings for programmers:

- The ANSI X3.159-1989 (ANSI/C) Standard [3]. This, however, is an expensive manual and beyond the financial reach of many hobby programmers. A low-cost alternative is Schildt's Annotated ANSI/C Standard [21], provided that you ignore Schildt's annotations.
- The C Programming Language [15]
- Apple IIgs ToolBox Reference, Volume 1 [5]
- Apple IIgs ToolBox Reference, Volume 2 [6]
- Apple IIgs ToolBox Reference, Volume 3 [8]
- GS/OS Reference [9]
- Apple IIgs Firmware Reference [4]
- Apple Numerics Manual [7]
- Programmers Reference for System 6.0 [23]
- Programmers Reference for System 6.0.1 [24]

3.10 Freeware Status

The following message was distributed by Jawaid Bazyar by email and by USENET news, in the fall of 1997:

As the man behind Procyon Enterpsises Inc., a long-time Apple IIGS developer and one of the last commercial developers for the platform, I regret to announce the end to sales of my first product, the GNO Multitasking Environment (GNO/ME).

With my last distributor, EGO Systems, closing its doors, I cannot justify the time and expense of continuing to produce the software. I also didn't feel it was fair to the customers to continue to charge them for the product, when I would be unable to support them in the manner I would like, due to my intense involvement in my new ISP business.

However, instead of simply stopping sales of GNO and letting the software wander into oblivion, I am placing GNO into "freeware" status, and I am also making available all source code to the 2.0.4 version to the public and the development community.

I will still sell printed manuals to anyone who wants one, for $20 or so, but this is just to cover printing and shipping costs. Purchasing a manual will not entitle the buyer to support from me of GNO/ME.

Anyone who paid the normal $89 price to EGO Systems (or to me directly) for GNO will continue to receive support from me, and I will rely partly on the help of the "GNO-Devel" list for assistance in this support.

Speaking of that, the GNO-Devel list is headed by Devin Reade, and its members are programmers who have the time and devotion to continuing to develop the GNO system. To their capable hands I leave the software. The first task of this group is to put together a GNO distribution based on the latest ORCA/C and ORCA/C libraries. Devin will post followup info on csa2g and any inquiries should be directed to him at ¡gdr@trenco.gno.org¿ for the moment.

Thank you all for your support in the past of my company and myself, and best wishes to you all for the future!

Regards,
Jawaid Bazyar
President, Procyon Enterprises Inc.
President, Interlink Advertising Services Inc.

Chapter 4

Installation for GNO v2.0.4

Important Note: *GNO v2.0.4 is no longer supported. New installations should be using v2.0.6 or later.*

Important Note: *This chapter is very out-of-date. It was written for GNO v2.0.1, and has had only minor updates since that time. It very much needs to be rewritten (concurrently, of course, with updates to the actual installation process). However, this is unlikely to occur since v2.0.4 has been superceded. That notwithstanding, if you have suggestions for updating this document (without making major changes to the GNO v2.0.4 distribution itself), please email your suggestions to Devin Reade.*

Before attempting to install GNO v2.0.4, you are strongly encouraged to read this entire chapter, and then consult the GNO FAQ[1] *(Frequently Asked Questions list, which is also available via ftp*[2]*) for those sections related to installation.*

GNO/ME is a very large system. Most of the system is stored on the three disks in a compressed format. For this reason we recommend that you read this section carefully and use the included automated installation program to save yourself the major headache of arranging everything. You'll need a hard drive partition with at least 5 Megabytes free to install GNO/ME. The entire installation process should take no longer than 10 minutes.

If you are upgrading from GNO 1.0 to GNO 2.0, we recommend that you install GNO 2.0 on a new area of your hard drive. This is because GNO 2.0 provides new versions of almost all the utilities and other software provided with GNO 1.0. You can then move the parts of your old system that aren't a part of the

[1] `http://www.gno.org/~gno/FAQ.html`
[2] `ftp://ftp.gno.org/pub/apple2/gs.specific/gno/doc/faq/CURRENT`

standard GNO 2.0 distribution over to the new installation.

The installer program is able to the copy the GNO libraries for use with the ORCA languages and tools. If you want to use your ORCA languages and tools, you should answer the appropriate questions during the install process. ORCA installation is covered in more detail below.

4.1 Obtaining GNO v2.0.4

The base distribution for GNO v2.0.4 is not actually available as a self-contained package. Instead, it is necessary to install GNO v2.0.1, then incrementally upgrade it to v2.0.2, v2.0.3, and finally v2.0.4.

These packages are available via anonymous ftp from `ftp://ftp.gno.org/pub/apple2/gs.specific/gno/` There is a three-disk set for GNO v2.0.1, and a single disk for each of the upgrades to versions 2.0.2, 2.0.3, and 2.0.4. You should download all of these files.

There is also a custom version of ORCALib that should be installed if you are using ORCA/C v2.0.x with GNO v2.0.4.

Remember to download these disk archives in binary mode.

4.2 Installing GNO v2.0.1

Step 1 Copy the contents of `/GNO.Disk1` to the partition where you want to install GNO/ME. The easiest way to do this is to run the IIGS Finder, insert the `/GNO.Disk1` disk, and drag the `/GNO.Disk1` icon onto the icon of the drive you want to install on. The Finder will tell you that the disks are of a different size, and ask you if you wish to place the contents of `/GNO.Disk1` in a folder on the hard drive partition. Answer "Yes", and the Finder will copy the data.

Step 2 Open the newly created `GNO.Disk1` folder on the partition and execute "Kern" by double-clicking on the `Kern` icon. `GNO.Disk1` contains a minimal GNO system which you have just started up. You'll see some copyright messages, and after a few seconds the desktop will appear.

Step 3 Install will ask you questions before the installation process begins. Questions asked by Install are boldfaced in this section. If you're uncertain of how to answer, click on the "Info" button to get more information on the question. This information is reproduced here for ease of reference.

Do you have existing Byte Works (ORCA) language products? If you use Byteworks language products such as ORCA/C, ORCA/M, ORCA/Pascal, and so forth and wish to use them from GNO/ME then answer “Yes” to this question. Otherwise, answer “No”.

Clicking on the “Info” button will display the following text:

> If you currently use products such as ORCA/C, ORCA/Pascal, ORCA/M, etc., and wish to use them from GNO/ME then you should answer “Yes” to this dialog.
> Install will then ask you to locate the file “ORCA.SYS16” (the ORCA Shell). Usually, it will be in a directory called “ORCA” on one of your hard drive partitions. On our system, it is `:software:orca`. The location of this file determines where Install puts the GNO-specific ORCA/C header files and libraries (in the ORCA LIBRARIES directory). If you have renamed ORCA.SYS16 to something else, select that instead.
> Install uses this information to correctly set the ORCA prefixes and add the EXECUTABLES directory to the $PATH variable in your gshrc file. See the GNO Shell User’s Manual, Appendix B, for more information on the ORCA prefixes.

Do you want to install the modified ORCA/C 2.0 ORCALIB library? If you have ORCA/C 2.0 installed and you answered “Yes” to the previous question, then you should answer ’Yes’ now. If you have ORCA/C 1.3 installed, or you do not have any ORCA languages or tools, then you should answer “No”.

Clicking “Info” will display the following text:

> GNO/ME 2.0 comes with a modified version of the ORCA/C ORCALIB standard library. This library adds specific support for some of GNO’s special files (pipes, terminals, etc) transparently and corrects other problems the standard ORCALIB has with GNO.
> This special ORCALIB is only for use with ORCA/C 2.0. It will NOT work with previous versions of ORCA/C.
> Note that all of GNO’s other libraries (libgno, libbsd, libc) work fine with ORCA/C 1.3.

Do you want to install the Multi-User package? If you wish to have the Multi-User package installed, answer “Yes”. It is recommended that new users do not install this package until they are familiar with the system. This package is not fully discussed in the GNO/ME manuals and may introduce many unfamiliar concepts.

Clicking “Info” will display the following text:

> The “Multi-User” package consists of a number of cooperating programs, including **init**(8) and **login**(8). MU provides

for password-protected access to the GNO Shell via the console or serial ports (modems and dedicated terminals). It also handles multiple user accounts, and a certain level of protection between users.
If you will be using a terminal with GNO, or want to be able to dial into GNO with a modem, you should install MU.
You may wish to hold off setting up the Multi-User package until you learn your way around GNO a little better, as it's simple to set up MU later.

Step 4 The Installer will now proceed to arrange the GNO Multitasking Environment on your hard drive. Initially, the contents of `/GNO.Disk1` will be moved into the proper places on the volume you have chosen. When asked by the Installer, you should place `/GNO.Disk2` and `/GNO.Disk3` into the disk drive. The contents of these disks will be extracted and decompressed into their proper places.

If the installer cannot finish it's tasks for some reason, it will abort to the shell. At this point you should study the error messages to determine the cause of the failure,

Step 5 When the Installer finishes, you will be returned to the GNO prompt. At this time you should type "exit" to return to Finder and delete the `GNO.Disk1` directory, as it is no longer needed (GNO is completely installed in a subdirectory "`GNO`" on the same partition `GNO.Disk1` is on.

4.3 Installing GNO v2.0.2 Through v2.0.4

GNO versions 2.0.2 through 2.0.4 were distributed as sequential updates to version 2.0.1, rather than as complete distributions. Consequently, you should install each of the version 2.0.2, 2.0.3, and 2.0.4 distributions, *in sequence,* over top of your version 2.0.1 distribution.

You should also obtain and install the Multi-User Update.

4.4 What Has Been Installed?

Note: *This list of directories is somewhat out of date. You should consult the GNO FAQ*[3] *(also available via ftp*[4]*) for more current information. This section will be updated, but likely only after GNO v2.0.6 is released.*

[3] `http://www.gno.org/~gno/FAQ.html`
[4] `ftp://ftp.gno.org/pub/apple2/gs.specific/gno/doc/faq/CURRENT`

If you examine the directory that you chose for GNO/ME, you will find that the Installer has created several directories. Here is a brief rundown of thier contents:

:gno:bin:	This directory contains the executable shell utilities included with the GNO/ME package.
:gno:dev:	This directory contains device drivers. The GNO/ME package includes serial drivers for the IIgs' built-in modem and printer ports.
:gno:etc:	Various system configuration files
:gno:initrc	This a startup file for kern and must remain in this directory.
:gno:kern	This is the GNO kernel. Launch this to start GNO/ME.
:gno:lib:	This directory is provided for programming libraries that are used only occasionally. Various applications may also keep auxilliary files here. It is currently empty.
:gno:tmp:	This directory is used by various utilities as location for their temporary files. It is currently empty, and should be cleaned on periodically.
:gno:user:	This directory is created if you installed the Multi-User package. It contains a user directories for users of the system. Currently there is only one: "root".
:gno:usr:	This directory contains UNIX System Resources (USR).
:gno:usr:bin:	Miscellaneous utilities.
:gno:usr:man:	This directory contains the manual pages for the 'man' utility. There are eight categories of information as defined by UNIX standards. These eight categories are presented in either source (man) or preformatted (cat) form.
:gno:usr:games:	The classic "Hunt the Wumpus" game, and perhaps others.
:gno:usr:sbin:	System administration utilities.

Chapter 5

Installation for GNO v2.0.6

Important Note: *Before attempting to install GNO v2.0.6, you are strongly encouraged to read this entire chapter, and then consult the GNO FAQ*[1] *(Frequently Asked Questions list, which is also available via ftp*[2]*) for those sections related to installation.*

These instructions should be considered as draft quality. If you have suggestions on or corrections to these instructions, please forward them to Devin Reade.

This chapter contains information on how to install the newest version of GNO, which is version 2.0.6 or later. It explains how to install the base *binary* distribution. Installation of GNO sources such that you are able to *build* the base distribution itself are at this time beyond the scope of this document.

At this time, unfortunately, installing GNO is fairly cumbersome. Gsh's scripting abilities are crude at best, and for various reasons the Apple Installer program is not sufficient, When sh (the Bourne Shell) is finished for GNO, installation should be easier.

Information in this chapter may change significantly from release to release, so even if you have previously installed a version newer than v2.0.4, you should review this chapter prior to doing a new installation.

[1] `http://www.gno.org/~gno/FAQ.html`

[2] `ftp://ftp.gno.org/pub/apple2/gs.specific/gno/doc/faq/CURRENT`

5.1 Planning Your System

The install scripts assumes that your *new*distribution will be installed on to the two volumes **/gno** (ProDOS) and **/gno-hfs** (HFS or AppleShare). It also assumes these volumes already exist and are *empty*. You may use other volume names, but you will have to edit certain files before you run your distribution.

If you installing over an existing v2.0.6 or later distribution, ensure that you read the section on **Planning for Future Upgrades**.

You will need *at least* the following amount of disk space. It is recommended that you dedicate an entire 32Meg ProDOS partition to GNO.

boot disk (used only for installation)	800k
binary distribution (shk files)	5.3 MB
binary distribution (extracted)	12.0 MB
complete GNO source (optional)	15.0 MB

Before you start, you should also ensure that your system meets the minimum hardware requirements, as documented in **Overview**.

In order to install GNO, you will need some way to download the NuFX archive files to your GS. You will also need GS-ShrinkIt, which is available from `ftp://ftp.gno.org/pub/apple2/gs.specific/archivers/gshk11.bsc`.

Part of the GNO installation still requires use of a text editor. The GNO boot disk ships with **vi**installed; if you do not know how to use **vi**(or you need a refresher), see `http://www.jaws.umn.edu/~tobkin/vi` for a good tutorial and quick reference guide.

5.2 Upgrading from GNO v2.0.4 or Earlier

If you already have an existing GNO installation running v2.0.4 or earlier, then there is no automated upgrade mechanism. Instead, upgrades must be done manually.

Before doing such an upgrade, ensure that you have a backup of your existing system.

Although it is more disk space intensive, you should upgrade from your existing v2.0.4 system by first installing the current distribution into an otherwise unused directory hierarchy (a “from scratch” install). You should then review each component of your old distribution and move any necessary files into the new hierarchy. It is *strongly* recommended that you make maximal use of the **/usr/local** hierarchy so that future upgrades are easier. See the section in this Guide on **Planning for Future Upgrades** for details.

This method of upgrade is tedious, but in the end it makes for a cleaner GNO distribution and easier future upgrades.

5.3 Downloading and Extracting the Binary Distribution

If you have not yet read the section on *Planning Your System*, please do so now.

Your first step is of course to download the distribution. The distribution is available from `ftp://ftp.gno.org/pub/apple2/gs.specific/gno/base`. You should have the following NuFX archives:

- **gnoboot.shk** This is the GNO installation bootstrap disk. It should be extracted to a ProDOS-formatted 800k floppy disk named "/gno.boot" (the name is critical). It does not include a copy of GS/OS and is therefore not bootable; you will have to boot your system in the normal fashion.
- **gno.01.shk**, **gno.02.shk**, ... **gno.16.shk** These disk archives contain the main portion of the GNO distribution. They must be placed in a single temporary subdirectory on a hard drive, Zip disk, Appleshare volume, or other large capacity storage device. They should not yet be extracted.
- **gnohfs.shk** This archive consists of files that do not conform to ProDOS naming conventions. It should be placed into the same directory as were the files **gno.01.shk**, **gno.02.shk**, ... **gno.16.shk**. While it is possible to run GNO without any HFS partitions at all, it is recommended that you have available to GNO a small amount of space on an HFS partition. If you use the **namespace**(5) facility, it is unnecessary to dedicate an entire HFS partition to GNO. Note that Appleshare volumes may be used in lieu of HFS volumes.

Using the Finder or a similar program, ensure that you have an empty ProDOS partition **/gno** , and an HFS or AppleShare partition online. The former *may* be named something else, but note the instructions below for handling this situation. The latter is assumed to be called **/gno-hfs** (modify the following instructions accordingly), and need not be otherwise empty. The two subdirectories **HFSinclude** and **man** will be created on **/gno-hfs** during the installation process.

Next, using GS-ShrinkIt or a similar program, extract the contents of the file gnoboot.shk onto an 800k floppy named **gno.boot**. The name of the floppy is critical. While you may use a hard drive partition for **gno.boot**, this is likely a waste of hard drive space since **gno.boot**will only be used while installing GNO, not while running it.

People have also reported that they were able to use a RAM disk for **gno.boot**without problems (thanks to Kirk Mitchell for first reporting this).

You should now do the following steps:

1. From your program launcher (typically the Finder), run the program /gno.boot/kern. This is the GNO kernel. It will come up in single user mode and you will be logged in as root running a gsh shell session.

   Note that the boot disk currently uses the version 2.0.4 GNO kernel; this is a temporary measure due to a bug with using newer kernels in single user mode. When GNO is installed on your hard drive, you will have a newer kernel.

2. As per the instructions shown on the boot screen, you should now read the file /gno.boot/README.install. The contents of that file, however, are identical to the numerated instructions below; you need only read one or the other set.

3. Set your DOWNLOAD_DIR environment variable to the directory into which you placed the base distribution NuFX archive files (gnoboot.shk, gnohfs.shk, gno.01.shk, and so forth). For example, if the NuFX files were in /download, you would type:

   ```
   setenv DOWNLOAD_DIR /download
   ```

   Ensure that you use slashes ("/") rather than colons (":") as the pathname delimiter. Do not use a trailing slash.

4. Install the majority of the GNO base distribution files by changing directory into your destination directory and running the installboot1 script. Assuming that you will be installing to the partition /gno, the commands would be:

   ```
   cd /gno
   /gno.boot/installboot1
   ```

   This step takes quite a while, even with an accelerated IIgs. Have patience.

5. There are a small number of recommended files that do not follow ProDOS naming conventions. If you wish to install these files, make sure that you have an HFS or Appleshare disk online. Change directories to that disk (or subdirectory) and run installboot2. Assuming that the HFS disk is /gno-hfs, the commands are:

   ```
   cd /gno-hfs
   /gno.boot/installboot2
   ```

   This step is optional. It is possible to use the GNO binary distribution without an HFS partition, but some information will be missing.

6. You should now edit the file /gno/etc/namespace. If your files were extracted onto a volume other than /gno, you will have to replace all the ":gno:" strings with the appropriate path. Similarily, you will have to replace ":gno-hfs:" if that is not the name of your HFS (or Appleshare) partition where you ran the installboot2 script. Note that you cannot currently use pathnames in the namespace file that contain spaces.

   The gno.boot disk includes the vi utility to do these edits. You can also edit the namespace file with any other text editor of your choosing, as long as it is done before you try to run your new GNO distribution.

   A vi tutorial and quick reference guide may be found at `http://www.jaws.umn.edu/~tobkin/vi`.

   For a description of the namespace file, see the kernel reference manual, or the namespace(5) manual page at `http://www.gno.org/~gno/man/man5/namespace.5.html`

7. During the extraction process, the following files were placed into the /gno/System directory:

   ```
   /gno/System/Desk.Accs/GNOSnooperII
   /gno/System/Desk.Accs/SuspDA
   /gno/System/Desk.Accs/TMTerm
   /gno/System/Drivers/FilePort
   /gno/System/Drivers/FilePort.Data
   /gno/System/Drivers/NullPort
   /gno/System/System.Setup/GNOBug
   /gno/System/System.Setup/SIM
   ```

   It is recommended that these files be copied into the relevent directories in the System folder of your boot partition. The GNOBug PIF is only required if you have GSBug installed. If you install GNOBug you should afterward sort the System.Setup directory so that GNOBug appears before GSBug (the latter of which is commonly called "debug.init").

8. If you are not short of disk space, you should create .so links for your manual pages. (See the mkso(8) man page for an explanation.) You can do this by executing the following commands:

```
cd /gno/usr/man
mkso -v -H /gno-hfs/man mkso.data
```

If you installed GNO somewhere other than /gno and /gno-hfs, then edit the above lines accordingly. If you did not install files onto an HFS (or Appleshare) partition at all, then execute the following commands instead:

```
cd /gno/usr/man
mkso -v mkso.data
```

9. You can now return to your program launcher (the Finder, ProSEL-16, or whatever you used to start /gno.boot/kern) by typing “exit” at the prompt. To startup up your new version of GNO, you should then launch /gno/kern. You will then see a “login:” prompt. Enter “root” as the user name; you will not yet need a password.

5.4 Planning for Future Upgrades

The information in this section is currently under review; please forward any additions, deletions, or corrections to Devin Reade.

One of the concerns for a system that is as large and as complex as GNO is how to keep it updated without losing any custom configuration that been added locally since the last installation. This section attempts to document how to minimize such conflicts and, where the conflicts can't be avoided, where they are likely to occur.

In the context of updating GNO, there are three main sets of files. The first one is anything that is in the **/usr/local** hierarchy. The subdirectories and files under **/usr/local** are intended strictly for site-specific customization. The GNO base distribution does not, and never will, add or modify files within **/usr/local**. (It may, however, ensure that certain subdirectories exist.) For this reason, it is recommended that any files (such as programs, configuration files, or manual pages) that you wish to have on your system but are not part of the GNO base distribution are placed within the **/usr/local** hierarchy. If you wish to have this customation available to another GNO installation, it would then be sufficient to copy the **/usr/local** hierarchy in its entirety.

NOTE: There is a single (temporary) exception to the comments above. The current GNO base distribution will copy in the file ***/usr/local/lib/startup.mk*** *which is used by the program dmake, and which is a duplicate of* ***/usr/lib/startup.mk****. When dmake gets updated to properly use* ***/usr/lib/startup.mk*** *as it's configuration file, then* ***/usr/local/lib/startup.mk*** *will no longer be created by the*

GNO base install scripts. If you have customized ***/usr/local/lib/startup.mk*** *for your site, you first save your startup.mk file elsewhere, then merge those customizations into the new startup.mk.*

The second set of files are those which have been written such that they (or their configuration files) have pathnames which are hardcoded, and therefore must reside outside of the **/usr/local** hierarchy. Some of these programs can be forced into the first set described above by setting appropriate environment variables; see the program's documentation for details. For the remainder, you should keep track of which programs you have installed, and where they (or their configuration or data files) reside. Unless there is a name conflict with files in the GNO base distribution, these files won't be overwritten or deleted during a GNO update, but they obviously will not be copied in when doing a "from scratch" installation.

The third set of files are those are created while installing the GNO base distribution, but which almost certainly have been modified in any existing GNO site. These are all configuration files of one sort or another. (If you are doing a fresh install, you can ignore this set.) If you are using the GNO "from scratch" installation scripts rather than the update scripts (*not yet available*) then you *must* ensure that you have backups of these files so that you can restore them after the install scripts have completed. You should not merely copy your old versions over the new ones; instead compare the old files to the new to verify if there have been features added which should be propagated to your old customized files.

The files which are known to be in the third set are listed here:

```
/etc/glogin
/etc/group
/etc/hosts
/etc/inittab
/etc/motd
/etc/networks
/etc/namespace
/etc/passwd
/etc/rchost
/etc/syslog.conf
/etc/whereis.conf
/home/root/gshrc
/lib/orcacdefs/defaults.h
/var/adm/newuser/newid
/var/adm/newuser/skel/glogin
/var/adm/newuser/skel/gshrc
```

If you find that you have to modify any files outside of the **/usr/local** (or **/home**) hierarchy, you should record which files have been so modified, together with a brief description of the necessary changes.

5.5 Custom Configuration

The information in this section is currently under review; please forward any additions, deletions, or corrections to Devin Reade.

This section describes the configuration changes that are commonly done on newly installed systems.

If you have not already read the section on **Planning for Future Upgrades** , you should do so now.

5.5.1 Passwords

If you ever expect to connect your IIgs to a network (including the internet) it is recommended that you password protect all of your GNO user IDs. This is done with the passwd[3](1) command; see the manual page for details.

Because there is no inherent security features in the Apple IIgs in general (or GNO in particular), password protecting accounts on a stand-alone machine does not gain any real level of security; if someone has physical access to your IIgs, then they can get anything off of it that they want to. On the other hand, password protecting your accounts can't hurt, and it is an excellent habit to get into. (Rather, *not* password protecting accounts is a very poor habit to get into.)

5.5.2 Configuring the Namespace Facility

This section is yet to be written.

5.5.3 Configuring Host and Network

This section is yet to be written.

[3] `http://www.gno.org/~gno/man/man1/passwd.1`

5.5.4 Configuring the System Logger

This section is yet to be written.

5.5.5 Configuring the Shell

This section is yet to be written. Talk briefly on /etc/glogin, $HOME/glogin, and $HOME/gshrc. Leave real docs for the gsh manual.

5.5.6 Message of the Day

This section is yet to be written.

5.5.7 Adding Groups

This section is yet to be written.

5.5.8 Adding Users

This section is yet to be written.

5.5.9 Configuring Documentation Programs

This section is yet to be written. Discuss /etc/whereis.conf, MANPATH, etc.

5.5.10 Configuring Outbound SLIP

This section is yet to be written.

5.5.11 Configuring Inbound Serial Connections

This section is yet to be written.

5.6 Obtaining Source

Source for the base distribution is available in one of two ways: Anonymous FTP and anonymous CVS.

You can obtain the GNO source via anonymous FTP from `ftp://ftp.gno.org/pub/apple2/gs.specific/` The files in that directory hierarchy are updated daily from the master repository. Files that have been recently added or modified will be listed in one or more of the `NEW.today`, `NEW.this.week`, or `NEW.this.month` files.

Please download only what you need. Sites that attempt to download all or large portions of the sources on a regular and frequent basis without first requesting mirror status will be disabled. This is done to keep a reasonable load level on Trenco.

For those sites which are able to make use of CVS (Concurrent Versions System), the GNO sources can also be obtained by anonymous CVS in pserver mode. As there is as yet no CVS port to the GS, this implies that you have another (probably UNIX) machine to which you are downloading the sources. Because of the size of the archive, you should also have a reasonable speed of interconnect between your machine and `ftp.gno.org`.

The first time you obtain GNO sources via CVS, you must log in to the repository, then check it out:

```
cvs -d :pserver:cvs@ftp.gno.org:/usr/local/repository login
Password: cvs
cd /your/source/tree
cvs -d :pserver:cvs@ftp.gno.org:/usr/local/repository checkout gno
```

After this is done, you can update your sources to match the most recent version by doing the following:

```
cd /your/source/tree/gno
cvs update -PAd
```

Because doing updates by CVS does not use up as much bandwidth as does downloading the entire source tree, feel free to do cvs updates on a regular basis. It usually doesn't make sense to do them more than once per day, though.

Chapter 6

Desk Accessories

The following is a description of the desk accessories that are shipped with GNO/ME.

6.1 GSI NDA

The *Graphical Shell Interface New Desk Accessory* allows you to access the shell from a window inside a desktop application. Selecting "GSI" from the Apple menu opens a window and brings up a shell in it. You can use the shell in this window just as you would in text mode.

At this time, GSI doesn't support any terminal emulations — it's a "dumb" interface. As a result, full screen programs like **less**(1) and **vi**(1) will not work properly in GSI.

6.2 Suspend NDA

The Suspend New Desk Accessory allows you to temporarily stop a desktop program and return to the text shell. To return to the desktop program, simply type the foreground command, "`fg`".

You may put desktop programs in the background (through the "`bg`" command) at your own risk. This is not guaranteed to work for all programs, and putting a desktop program in the background will not put the Apple IIgs in text mode.

Also, do not run another desktop program when one is currently suspended. The GNO kernel tries to cleanly terminate the second program, but may not always be able to accomplish this.

6.3 GNO Snooper CDA

The GNO Snooper CDA is a utility that is very helpful in debugging software, and reporting system crashes. Snooper has access to information inside the kernel that is not generally available to processes.

When you enter the control panel and choose "GNO Snooper" a process list is displayed, which is very similar to the **ps**(1) shell command, and a menu is presented with the following options, each of which is invoked by typing it's first letter:

D)etails Get detailed information on a process. Snooper asks you for the process ID number of the process you want to investigate. Snooper then dumps the state of the 65816 registers and shows various other information about the process.

K)ill This option sends a SIGKILL to a process. Just type in the process ID of the process you want to kill.

P)rocess Group Dump Dumps the system process group tables, which is very useful for debugging code which manipulates process groups. The first table, "pgrp", is the process group reference count table. This table lists how many processes (and TTYs) belong to that process group. Process group ids start at 2, so the first pgrp listed is 2.

The second listing is the ttyStruct table. This table shows to which process group each TTY belongs. The TTYs start with .null (0), then move on to .ttyb, .ttya, .ttyco, etc.

F)ile Table Dump Lists all open files known to GNO. The information is presented in tuples. The first element is the real GS/OS refNum or device driver ID. The second is the type of file (GSOS, ttyXX, or PIPE). The third is how many references to that file are open. This information is global, so if two processes have .NULL opened, the refcount for .tty00 will be 2.

Bibliography

[1] Paul Abrahams and Bruce Larson. *UNIX for the Impatient.* Addison Wesley, 1992. ISBN: 0-201-55703-7
Highly recommended. A new, comprehensive, in-depth reference to UNIX. “a handbook you can use both as a manual to learn UNIX and as a ready reference for fast answers to specific UNIX questions.”.

[2] Kaare Christian. *The UNIX Operating System.* Wiley, second edition, 1988. ISBN: 0-471-84781-X
A classic overview of UNIX commands. Good in coverage.

[3] ANSI X3.159 Committee. *ANSI X3.159-1989: Programming Language – C.* American National Standards Institute, 1989.

[4] Apple Computer. *Apple IIgs Firmware Reference.* Addison-Wesley, 1987. ISBN 0-201-17744-7.

[5] Apple Computer. *Apple IIgs ToolBox Reference, Volume 1.* Addison-Wesley, 1988. ISBN 0-201-17746-3
This book is now published by the Byte Works.

[6] Apple Computer. *Apple IIgs ToolBox Reference, Volume 2.* Addison-Wesley, 1988. ISBN 0-201-17747-1
This book is now published by the Byte Works.

[7] Apple Computer. *Apple Numerics Manual.* Addison-Wesley, second edition, 1988. ISBN 0-201-17738-2.

[8] Apple Computer. *Apple IIgs ToolBox Reference, Volume 3.* Addison-Wesley, 1990. ISBN 0-201-55019-9
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[10] David Curry. *Using C on the UNIX System.* O’Reilly, 1990. ISBN: 0-937175-23-4
This book is directed to (would-be) system programmers.

[11] James Gardner. *Learning UNIX*. Sams, 1991. ISBN: 0-672-30001-X
Comes with disks containing an MSDOS simulation of UNIX. A good tutorial or reference book for those without constant access to UNIX.

[12] Daniel Gilly. *UNIX in a Nutshell*. O'Reilly, second edition, 1992. ISBN: 1-56592-001-5
Highly recommended. An excellent desktop reference to almost all UNIX commands "a complete reference containing all commands and options, plus generous descriptions and examples that put the commands in context.".

[13] ISO/ANSI. *POSIX 1003.1: System Application Program Interface*. ISO/ANSI, second edition, 1996. ISO/IEC 9945-1, ANSI/IEEE Std 1003.1.

[14] Brian Kernighan and Rob Pike. *The UNIX Programming Environment*. Prentice-Hall, 1984. ISBN: 0-13-937681-X
A true classic on UNIX programming.

[15] Brian Kernighan and Dennis Ritchie. *The C Programming Language*. Prentice Hall, second edition, 1988. ISBN 0-13-110362-8.

[16] Linda Lamb. *Learning the vi Editor*. O'Reilly, 1990. ISBN: 0-937175-67-6
A very good guide to vi and ex commands. With a quick reference card.

[17] Don Libes and Sandy Ressler. *Life with UNIX — A Guide for Everyone*. Prentice Hall, 1990. ISBN: 0-13-536657-7
Highly recommended. An "everything you want to know about UNIX" book. It includes info you might not find elsewhere. "This book is the 'other' book about UNIX, a study in reading between the lines - which is very much what learning UNIX is like.".

[18] Peter Norton and Harley Hahn. *Peter Norton's Guide to UNIX*. Bantam Computer, 1991. ISBN: 0-553-35260-1
Good coverage. A good introduction for beginners (especially those accustomed to DOS).

[19] Marc Rochkind. *Advanced UNIX Programming*. Prentice Hall, 1985. ISBN: 0-13-011818-4
A superb book covering all system calls in detail.

[20] et al Samuel Leffler. *The Design and Implementation of the 4.3 BSD UNIX Operating System*. Addison-Wesley, 1990. ISBN: 0-201-06196-1
An authoritative description of the design of BSD UNIX. "It covers the internal structure of the 4.3BSD system and the concepts, data structures, and algorithms used in implementing the system facilities.".

[21] Herbert Schildt. *The Annotated ANSI C Standard*. McGraw Hill, 1990. ISBN: 0-07-881952-0
This book should only be used if the annotations (the right-hand pages) are ignored, as they contain many errors.

[22] Richard Stevens. *Advanced Programming in The UNIX Environment.* Addison-Wesley, 1992. ISBN: 0-201-56317-7
Highly recommended. A going-to-be classic on how programs work under UNIX. The source codes and errata list are obtainable by anonymous ftp from ftp.uu.net (in /published/books).

[23] Mike Westerfield. *Programmers Reference for System 6.0.* Byte Works, Inc, 1992.

[24] Mike Westerfield. *Programmers Reference for System 6.0.1.* Byte Works, Inc, 1993.