

HeapTool User's Guide

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This is the user's guide for HeapTool V1.4 released December 14th, 1990.
Manual version 1.4.0, printed Thursday, December 13, 1990.

Thank you for your interest in HeapTool. I hope that this utility will serve you well. HeapTool is designed for care-free operation. Just drop the file into the system folder, and it will expand your system heap the next time you reboot. This document describes the reasons why HeapTool is necessary and gives detailed information on the operation of the HeapTool control panel device.

It will be to your advantage to read all of the information presented here so that you can take a logical approach to controlling your system heap. If you already have a good understanding of resources and the system heap, you may wish to skip to the Theory of Operation or to the HeapTool Instructions section.

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INITs and the System Heap

If you've ever installed software into your system folder and found that your Mac started crashing more often, you've experienced the difficulties of INIT conflicts or system heap problems. INITs are system software that run during the startup of your Mac. Although they perform useful functions they typically make modifications to the system that can lead to compatibility problems, but even INITs that work well often cause problems related to the size of the system heap.

The system heap is an area of Mac memory set aside for use by the Mac operating system and other system software. INITs use space in the system heap during startup, and many of them stay loaded as long as your Mac stays running. FONTS and Desk Accessories also require space in the system heap, but their use of the heap tends to be *dynamic*, meaning that the amount of space needed changes according to what the user is doing.

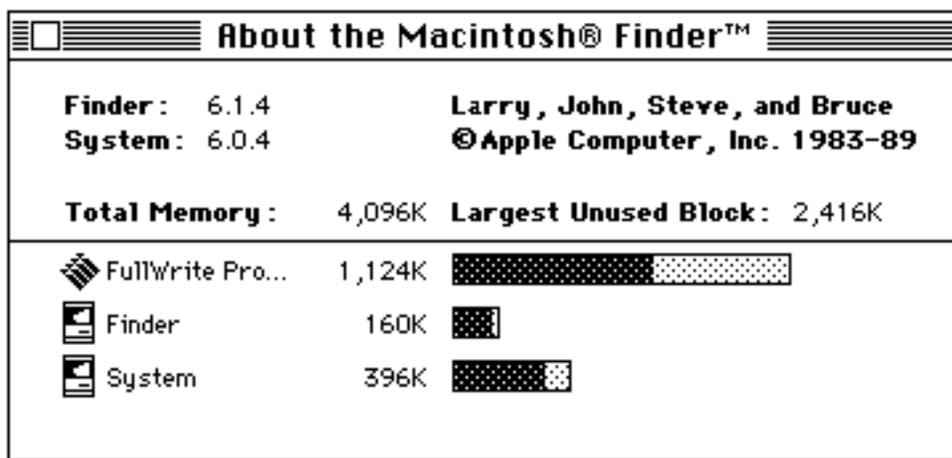


Figure 1: the "About Finder" box

To get a basic view the system heap, the user can pull down the Finder's apple menu, and choose the selection titled "About the Finder...". Something similar to Figure 1 will appear. In the figure, you see three heaps displayed: an application heap, Finder's heap, and the system heap. Each bar indicates the proportion of the specified heap which is currently used. The number to the left indicates in K bytes the size of the used portion.

If the space occupied by INITs and other resources such as FONTS exceeds the amount of space allocated for the system heap, your Mac is likely to crash. For this reason, a number of utilities have been written to allow you to adjust the size of the heap. Those utilities modify the boot blocks on your startup disk to set the *initial* size of the system heap.

While the INITs are loading, the system heap is the only heap that has been created in memory. Because no other heaps are using the memory adjacent to the system heap it is possible for the heap to expand as INITs are loaded. The Mac system software makes use

of this fact, and provides at least 16K of memory for each INIT that is loaded. If an INIT needs more space, it is possible for the software developer to make provisions so that the INIT doesn't run out of space.

The problem arises that INITs make provisions only for the space they occupy on the heap, but don't provide for the other resources which will load later. The utilities that adjust the initial heap size address the problem by letting you set the initial size beyond the requirements of the INITs, so that you again have some free space for FONTS and other dynamically loaded resources. Since this method depends on your initial setting of the heap size being just enough larger than the space needed by the INITs, it requires that you tune the size of your heap every time you add or take away an INIT.

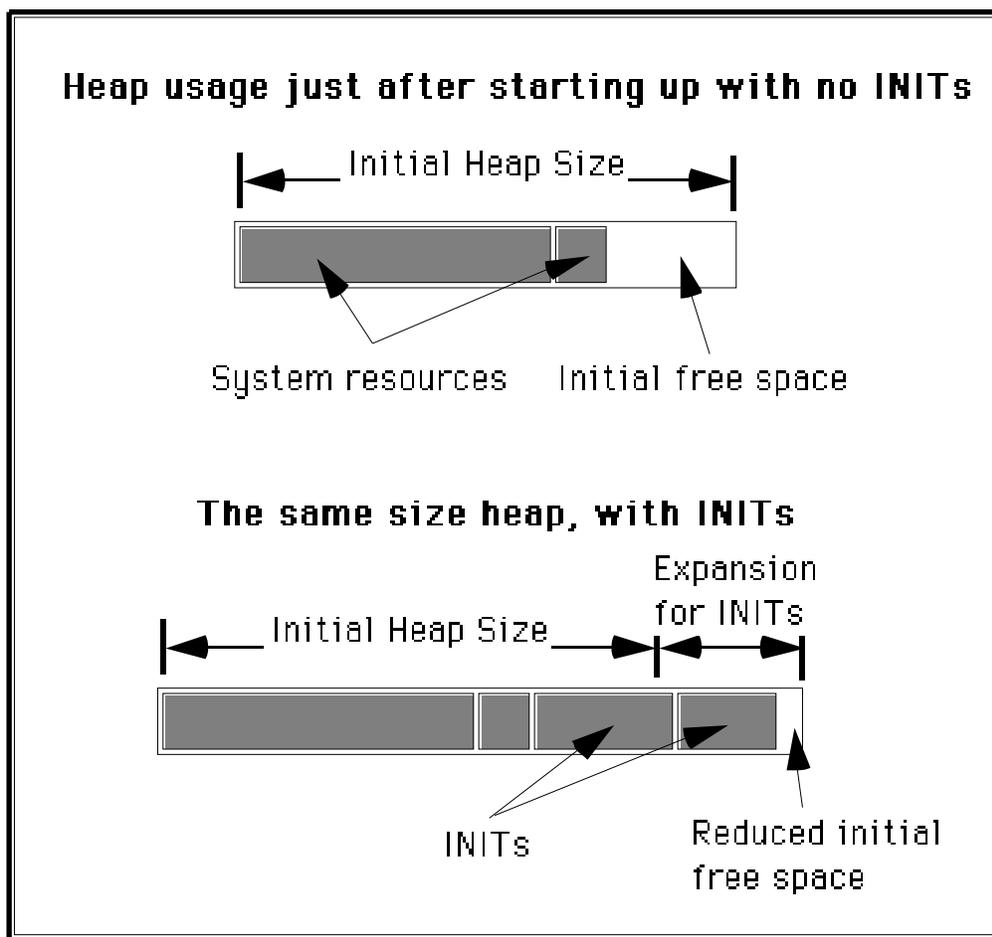


Figure 2: Heap expansion for INITs

Tuning the heap is not an easy task, since there is no simple way to look at the memory usage of the INITs, FONTS, and other resources. (Developers use programs like debuggers or utilities that dump the contents of the heap, but the information they provide is not easy to interpret.)

Some heap-adjustment utilities recommend that you use this "About Finder" display as a guideline for adjusting your heap. Unfortunately, since this display doesn't break down the heap into its component parts, called resources, it is hard to tell just how "full" the heap really is. *The system heap can be displayed as entirely full even when there is plenty of*

space for the system and your desk accessories to operate. To comprehend why the heap display is misleading you must first understand some things about the resources that comprise the heap.

Resources are “managed” pieces of memory which hold a specific type of information and have a unique identification number. The difference between computer memory and Mac resources is like the difference between molten gold and gold bars. The molten gold can be divided up any which way and there's no way to specifically identify a portion of it. Once it's solidified into gold bars of various sizes and stamped with serial numbers, you can stack it all different ways, but always get back to a specific piece.

The Mac uses resources for a large number of purposes. Character fonts are stored in the system file as FONT resources, desk accessories and devices are DRVR resources, and applications are made up of multiple CODE resources. Icons, strings, version information, windows and dialog boxes can all be stored as resources.

Various resources are loaded in different ways and are kept around for different durations. Some always load in the system heap, while others load into a particular application's heap. Many resources are put into a heap and *locked* in place, so that an application knows where to find it. Others are allowed to move around within the heap, and only get locked into a specific location at certain times. Still others are set up to be *purgeable*, which means that they stay in the heap only so long as no other resources need their space. When a purgeable resource is removed so that more room is available for other resources, it may be called back into memory (from disk) when heap space is available so that it can be used again. In a word, the heap is *dynamic*.

Since the heap has a specific size, the organization of the resources is critical to effectively using the space. The heap may have enough space to fit a new resource, yet because the space is divided into small pieces, may not be able to accommodate it. A heap in this condition is called *fragmented*, and it needs *compacting*. As long as the resources that divide up the space are not locked, they may be moved around to make space for the new resource. When a resource of a given size can't be loaded, the Mac will start moving unlocked resources until a hole big enough for the new resource is formed, thus compacting the heap.

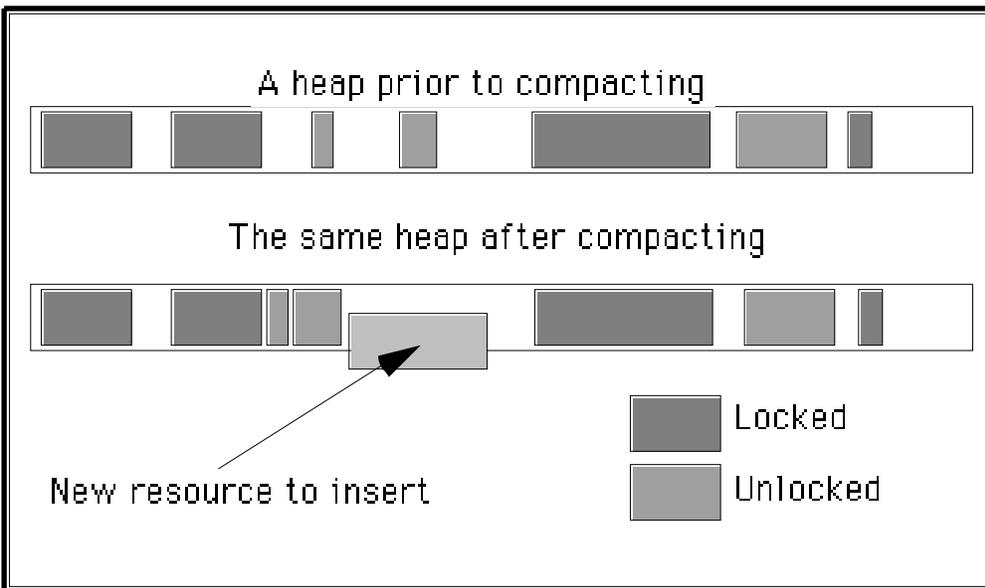


Figure 3: Heap Compaction

When compacting the heap doesn't free up enough space, the Mac may turn to removing purgeable resources to make space. Again, the operation is only performed until enough space is secured to load a specific size resource. It is important to note that the "About Finder" heap displays include purgeable resources and do not indicate how much fragmentation is present in the heaps. Since purgeable resources stay in the heap until their space is needed, and even then just enough of them are removed to make space for a specific resource, *it is perfectly normal for the display of the system heap to tend to look quite full during ordinary operation of the Mac.*

If you choose to continue using one of the heap adjustment utilities that sets the initial heap size, you may want to make it a rule to look at the "About the Finder" display only *immediately* after your machine starts up and loads the INITs. In this way, you can minimize the number of purgeable resources loaded in the system heap which contribute to an invalid indication of heap usage. HeapTool provides a way to purge the entire heap, allowing for accurate readings of heap usage. This method will be described later in the instructions.

Theory of Operation

HeapTool's fundamental purpose is simple: give the Mac enough system heap to operate properly. It is meant to improve upon the utilities which set the initial heap size by giving the Mac a specific amount of system heap *after* all other INITs have loaded. In this way, the Mac should operate well, regardless of how many INITs are added or taken away from one day to the next. In short, you should never have to adjust your heap to account for the space used by INITs.

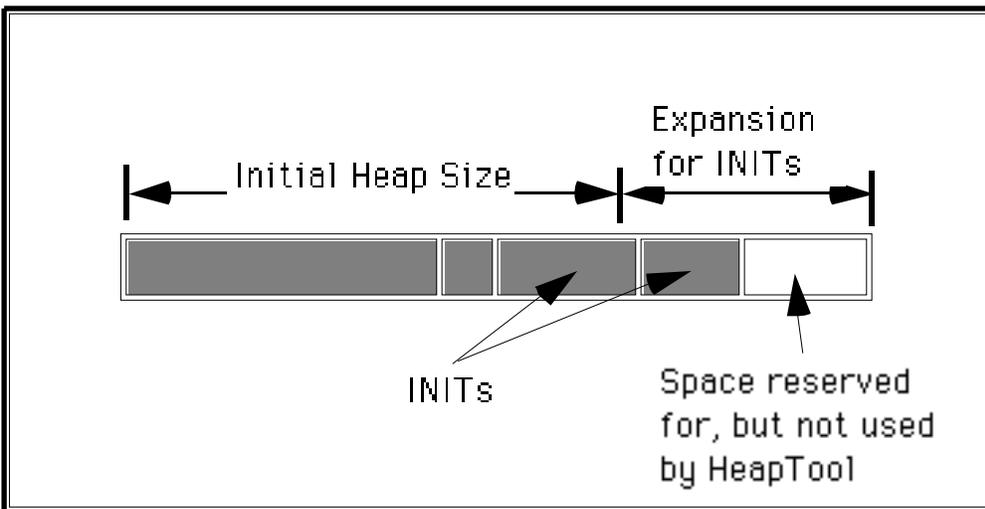


Figure 4: Operation of HeapTool

Tuning the heap by setting the initial size depended upon two factors: the static needs of INITs during load time, and the various dynamic needs of FONTS, Desk Accessories, etc. With HeapTool, you only specify the amount of dynamic heap space you need, since it provides this in addition to INIT's needs. It is up to you to determine what the normal dynamic heap needs are for your system, but some guidelines are given in the instructions that follow.

HeapTool Instructions

To use HeapTool, you must first put the HeapTool file in the system folder. You can go immediately to the control panel where you will find the HeapTool icon in your list of control panel devices. Click on the the icon, and you will see the controls for setting your heap size.

As Figure 5 shows, there is a field entitled "Initial Free Space," and two arrows to adjust the heap. Set the amount of system heap, in K bytes, that you want HeapTool to maintain for you. The next time you restart your Mac, HeapTool will begin doing its job, so that you will have a well-adjusted heap.

If you have no idea how much dynamic heap space you need, you should try starting with 64K. If you have desk accessories or other utilities which you know require a great deal of memory in the system heap, you may wish to try a value as high as 200K. *Be sure that you do not allocate such a large amount of memory to your system heap that Finder will be unable to load.* It's doubtful that you'd ever need to adjust the setting higher than 500K. Remember, you are setting space which is allocated *in addition to* the space used when INITs load.

If you have previously adjusted your heap with a utility which sets the initial heap size, you may want to change that setting back to normal, so that HeapTool has full control to adjust the size of the heap. If your initial heap size is so large that HeapTool doesn't cause the heap to expand when it loads, then should you ever remove some other INITs, you will have extra heap space allocated that HeapTool is unable to remove. (It is rumored that the Mac supports shrinking heaps, but to date, there have been no confirmed sightings.)

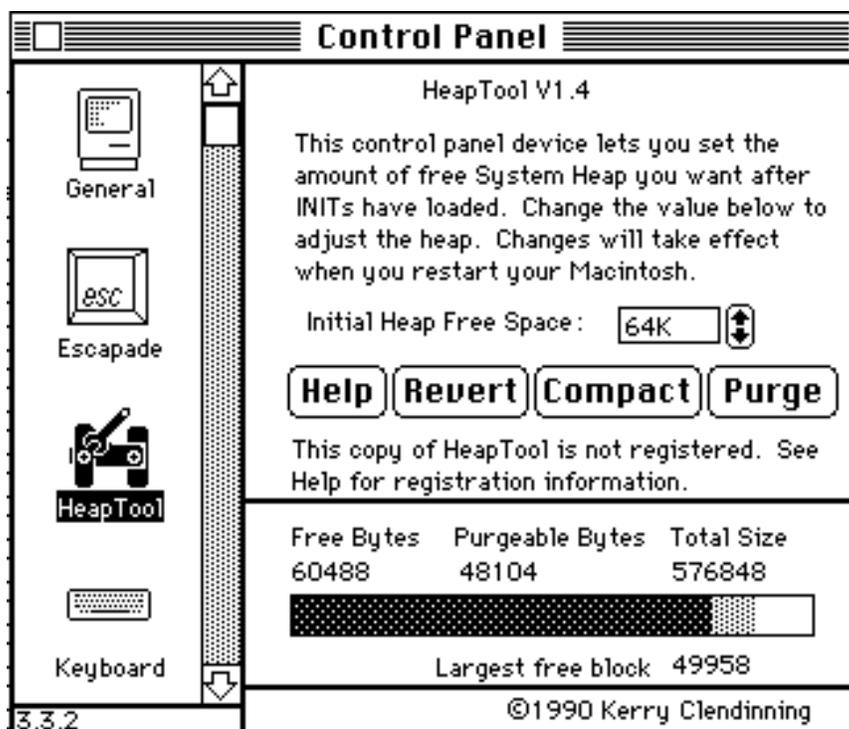


Figure 5: The HeapTool control panel Device

If you experience difficulties getting HeapTool to take effect, be sure that the HeapTool file is unlocked. (Use Finder's "Get Info" under the "File" menu to check this.)

HeapTool has buttons and displays that help you analyze your system heap usage. It makes it easy for you to purge and compact your heap prior to looking at the "About the Finder" display, and also provides more detailed information about your system heap.

The "Compact" and "Purge" buttons perform the operations described earlier in this document. See text, page 4. Unlike the normal compact and purge operations, though, the buttons compact and purge the *entire* heap.

The "Free Bytes" display indicates the current number of free bytes available in your system heap, regardless of fragmentation and unused purgeable resources. Purgeable resources displays the number of bytes which can be freed by purging the heap. HeapTool also displays the total size of the system heap and the largest contiguous space which could be made by compacting the heap.

The "Purge" button will remove all unused resources, leading to a more accurate display of heap usage. You may find it useful to press the "Purge" button prior to checking the available system heap space either here or in the "About the Finder" utility.

Compacting and purging the heap can cause some programs that crash occasionally to crash more often. If you experience problems, refrain from using them except before restarting. Most applications and desk accessories should work just fine even when you purge the heap often, but errors in programming can cause a program to expect a resource

to stay in memory, even though it is purgeable.

Registering HeapTool

To pay for and register your copy of HeapTool, mail a check or money order for \$13.50 to me, at the address given below. Please include your return address, and indicate whether you'd like to be on a mailing list for products I may market in the future.

If you are ordering from out of the U.S. and cannot send a check drawn on a U.S. bank, please add an additional \$10 for check processing fees.

Once you have sent in your fees, use the button titled "I have paid" on HeapTools third help screen to disable the registration warnings on the control panel and startup icon. If your validated copy of HeapTool is installed on a different machine, it will become unregistered and the warnings will return. Use this mechanism to help track how many copies you've paid for.

An unfortunate side-effect of the validation feature is that reformatting your hard disk will also cause HeapTool to think its been moved to another system. If you are a registered user and find the warnings are showing up on a paid copy of HeapTool, use the "I have paid" button to revalidate it.

Conclusion

I hope that you find HeapTool useful, and that it serves you well. I am interested in your experiences using HeapTool, so please feel free to send me your comments. I make no warranty of the performance of this utility, expressed or implied. In no event will I be held responsible for any damages or loss as a result of using HeapTool. In states where this disclaimer does not apply, my liability will be limited to the amount paid for the product.

You can contact me on Compuserve as Kerry Clendinning 76424,2214, or you may write me at PO Box 26061 Austin, TX 78755.

Appendix A: For users of prior HeapTool versions

Here is a brief description of the changes between version 1.0 and 1.2:

1. The control panel interface is enhanced, providing arrows to adjust your heap size, and a Revert button to recall the previous setting.
2. There is no longer a dialog box during startup when HeapTool isn't registered. This had caused some incompatibilities.
3. HeapTool no longer has to load last. It reserves the amount of memory you choose, regardless of it's ordering with other INITs. You may also notice a slight difference in the amount of space your system heap has available right after booting. To account for this difference, you may want to adjust HeapTool 1.2's setting either 16K or 32K higher than you did using 1.0.
4. No more validation numbers! Once you have paid for HeapTool, you just click on a button, and it will remember that copy is paid for.
5. Best of all, it is a free upgrade for all registered 1.0 users.

Little changed between version 1.2 and 1.4:

1. An incompatibility with SuperSpool and SuperLaserSpool was fixed. It is no longer necessary to alter the loading order between HeapTool and those INITs.
2. My new PO Box number is listed in the help screen.
3. The largest available block is displayed constantly, even without compacting the heap.
4. A bar graph display now shows used, purgeable, and free space in the system heap.



HeapTool Application notes INTRODUCTION

This section contains application notes which apply to some users. If you have problems with HeapTool or just want to further understand its operation, look through the application notes for additional help.



HeapTool Application notes 1-2

Application Note #1

I'm often asked to suggest a HeapTool setting for a user's system. This is a difficult problem, since the best heap setting for your situation depends as much on the way you use your Mac as how it's configured. The more applications and desk accessories you use at once, the more system heap space you'll need. Also documents that have many fonts take additional space.

Here's the best way I know to fine tune your system heap setting: Install and enable all the INITs that you expect to run, and boot your machine. Use the "About the Finder" display, or HeapTool's control panel to determine whether there's at least 64K free at this point. If not, you already need to adjust HeapTool's setting higher.

Next, open up as many DA's and applications as you'd ever expect to use concurrently. As you open each one, monitor the system heap usage. If it gets close to full, try clicking

HeapTool's "Purge Heap" button. If the heap is still mostly full, you will need to increase the setting of HeapTool and reboot. Be sure to open typical documents (with average to large size, and a representative number of fonts) in each application. Continue this process until you are satisfied with the DA's and Applications you can open without filling up the system heap.

Application Note #2

*Users who have set their heap with other programs (SUM, HeapFixer, Inflator, or BootMan) may want to set it back to normal (see application note 3). These programs all affect the heap setting in your disk's *boot blocks*, which means the change stays in effect even if you dispose of the program. In HeapFixer, the normal setting is 80K, under system 6.0.4 (and will probably stay the same for all 6.X.X releases).*



HeapTool Application note 3

Application Note #3

*Many vendors suggest that you set your heap to maintain some percentage or particular amount of space free in the "About the Finder" display of your system heap. In short, this is nonsense. Purgeable resources, described earlier in this document, will tend to fill up your system heap, even when it's plenty big for your configuration. Having a healthy amount of free system heap *on startup*, or just after pressing HeapTool's "Purge" button when there are no applications or DAs open, *is* important.*

To see the effect of purgeable resources, try this exercise on a freshly-rebooted system: Open up "About the Finder" and the "Key Caps" desk accessory provided by apple. Arrange the two windows so you can see them both. Now, select each font in order from the Font menu in the DA, and watch how the system heap space is used up. If you have enough fonts to fill up your system heap, you will either see it expand, or more likely, a font that's not in use will be purged every time you select another new font.

Once you're done, leave the "About the Finder" window open, and go to HeapTool to press the "Purge" button. You will see that the space used by all the fonts you accessed will quickly be freed.