

Technical Note TN2001

Running files from a hard drive in Open Firmware

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This Technote describes a method of editing, saving, and retrieving Open Firmware commands to/from a file on a "[New World](#)" Macintosh hard drive.

Open Firmware can be a powerful tool for developing and debugging driver code for add-on devices, but is limited in its ability to edit and maintain this code during development.

This Technote provides a single-machine solution to save and test code development files on an Apple machine's hard drive. This Note is directed at device developers who do not have access to a second machine for two-machine debugging or prefer to develop code on one machine.

Updated: [Sep 22 2000]

Introduction

Developing code for Open Firmware on a single machine is usually limited to a single session, with that code often lost once the session has ended. Other developer documents have suggested that code development uses a two-machine solution, where actual development of the code is done outside of the Open Firmware environment on a second machine. Although preferred, two-machine mode is not always practical.

File transfer can be accomplished using a single machine's hard drive as a common storage area between the OS and Open Firmware. Editing and saving code in the OS environment yields all the benefits of word processing and file management. Retrieving and running files in Open Firmware has the benefit of working from the same code, without the need for retyping that code each session.

Using this method, development becomes a cycle of developing and saving code in the OS, restarting the machine in Open Firmware, locating the code file in Open Firmware, loading the file and either viewing or "booting" the file.

For the sake of brevity, this method assumes that development system's hard drive is also the boot drive containing Mac OS. In this example, the boot drive is easily identified if the node has a device alias. This limits the need to identify the hard drive in the device tree and type lengthy node names to access the hard drive.

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Developing Open Firmware code in one-machine mode

Creating and editing Open Firmware code, as it applies to this method, is accomplished in the Mac OS environment, using any text editor or word processor that will save files in a standard text format (i.e., without font, style, or special format information).

Code can be written, using the text editor, as it would be entered in the Open Firmware environment -- with one exception. The first line of the document *MUST* be an Open Firmware comment, followed by a carriage return (<cr>).

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Creating and Editing a File in MacOS

The example text file below was created in using the SimpleText application on a PowerMac G4, in Mac OS 9.0.4.

Note that the first line is an Open Firmware comment.

This example should execute as follows in Open Firmware:

- Provide some visual formatting on the OF screen with some carriage returns
- Print a "Hello" message
- Select the root directory in the device tree
- Do some more formatting for the OF screen
- Print the current working directory
- Display the device tree
- Print a formatted header for `s`
- Display the properties of the root node

Example 1. A simple OF source code file created in SimpleText.

```
\ comment

cr
."  hello Open Firmware "
dev /

cr cr
pwd ."    = current working directory"
cr
ls
cr cr

." *** Properties ***"
cr
.properties

\ end of file comment ... so I can locate the end!
```

Although the code in Example 1 meets the criteria for Open Firmware FORTH code, it will immediately run once when

booted and has very limited ability for modification (if any) in the Open Firmware environment.

Another approach that lends itself to fewer transitions between editing cycles in the OS and testing cycles in Open Firmware would be to use colon definitions for functions in the code file.

Example 2. A simple OF source code file using colon definitions.

```
\ This is a file that contains some colon defined, formatted,
\ commonly used, basic Open Firmware functions.

." vv = hello & select root (dev /) " cr
." xx = formatted directory (pwd) " cr
." yy = key controlled dev tree list (ls) " cr
." zz = formatted property list (.properties) " cr

: hello ( -- ) cr ." Hello Open Firmware" ;
: slctroot ( -- ) " ... selecting 'root' " cr ;
: scrl-start ( -- ) cr ." press Control-Q to start scrolling" ;
: scrl-stop ( -- ) cr ." press Control-S to stop scrolling" ;
: wt-4-key ( -- ) cr ." press an key to continue... " key clear ;

: vv ( -- ) hello slctroot clear " /" find-device ;

: xx ( -- ) cr cr ." " pwd ." = current working directory" ;

: yy ( -- ) cr scrl-start scrl-stop cr wt-4-key ls ;

: zz ( -- ) cr cr ." *** Properties ***" cr .properties ;

\ end of file comment ... so I can locate the end!
```

In Example 2, the code will load but not run immediately when booted in Open Firmware. Instead, the colon definitions will be added to the dictionary and can be called as needed in the OF environment. Some level of editing can now be maintained in Open Firmware by redefining one or all of the colon definitions.

The SimpleText application saves the file as a standard text file by default. Other word processors may require you to choose a "text" option under a "Save as ..." menu option. It is an obvious but important step to provide a memorable name for the file when saving the file. Providing a simple and memorable name for the file makes it easier to locate in Open Firmware.

It can save some time and typing in the Open Firmware environment if the file is saved at the root level on the primary (or boot) hard drive. (Remember, the desktop is not the root level.) Saving to the root hard drive (or a folder on the root hard drive) will make the search and path to the file simpler.

For these examples, it is also important choose a hard drive in the "Startup Disk" control panel with in MacOS prior to entry into Open Firmware. This ensures that there is a known boot-device in Open Firmware.

Once the file has been created, edited and saved, the machine should be restarted and brought up into Open Firmware (by holding down the Command-Option-O-F keys at boot time).

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Finding Files in Open Firmware

Finding files on the machine's hard drive in Open Firmware requires two steps:

1. Identify the current hard drive path in the device tree, and
2. Find the OF code file (created in the OS) on the hard drive.

Identifying the Current hard drive Path

Using the `printenv` word in Open Firmware will reveal the hard drive path for the machine's boot device.

Note that in the example below that the "boot-device" is currently "hd:", which is assumed for this type of single machine development cycle.

Example 3. A simple OF source code file created in SimpleText.

```
0 > printenv
----- Partition: common ----- Signature: 0x70 -----
little-endian?           false           false
real-mode?               false           false
auto-boot?               true            true
diag-switch?             false           false
fcode-debug?             false           false
oem-banner?              false           false
oem-logo?                false           false
use-nvramrc?             false           false
use-generic?             false           false
default-mac-address?     false           false
real-base                 -1             -1
real-size                 -1             -1
load-base                 0x800000       0x800000
virt-base                 -1             -1
virt-size                 -1             -1
pci-probe-mask            -1             -1
screen-#columns           100            100
screen-#rows              40             40
selftest-#megs            0             0
boot-device               hd:,\:\:tbxi    hd:,\:\:tbxi
boot-file
boot-screen
console-screen
diag-device               enet            enet
diag-file                 ,diags         ,diags
input-device              keyboard        keyboard
output-device             screen         screen
input-device-1            scca          scca
output-device-1           scca          scca
mouse-device              mouse         mouse
oem-banner
oem-logo
nvramrc
boot-command              mac-boot      mac-boot
```

```

default-client-ip
default-server-ip
default-gateway-ip
default-subnet-mask
default-router-ip
boot-script
aapl,pci          Use PRINT-AAPL,PCI to view
ASVP              30313037 31373030 31373030
ok

```

In Example 3 above, we obtained the path to the machine's hard drive (hd:). Clearly, "hd" is a device alias in this case. The "long hand" path name can be obtained by using the `devalias` word.

Example 4 shows the full path name for "hd".

In this case, it also shows that "ultra0" is a `devalias` for the hard drive.

Example 4. Using `devalias` to show the full name.

```

0 > devalias
pci0          /pci@f0000000
agp           /pci@f0000000
pci1          /pci@f2000000
pci2          /pci@f4000000
bridge        /pci@f2000000/@d
pci           /pci@f2000000/@d
fwx           /pci@f2000000/@d/firewire@a
enetx         /pci@f2000000/@d/ethernet@b
enet1         /pci@f2000000/@d/ethernet
fw1           /pci@f2000000/@d/firewire
cb            /pci@f2000000/@d/cardbus@1a
magma         /pci@f2000000/@d/cardbus@1a/pci-bridge/pci-bridge
usb0          /pci@f2000000/@d/usb@8
usb1          /pci@f2000000/@d/usb@9
mac-io        /pci@f2000000/@d/mac-io@7
mpic          /pci@f2000000/@d/mac-io@7/interrupt-controller
ide0          /pci@f2000000/@d/mac-io@7/ata-3@20000/disk@0
ide1          /pci@f2000000/@d/mac-io@7/ata-3@20000/disk@1
hd            /pci@f2000000/@d/mac-io@7/ata-4@1f000/disk@0
cd            /pci@f2000000/@d/mac-io@7/ata-3@20000/disk@0
zip           /pci@f2000000/@d/mac-io@7/ata-3@20000/disk@1
ultra0        /pci@f2000000/@d/mac-io@7/ata-4@1f000/disk@0
ultra1        /pci@f2000000/@d/mac-io@7/ata-4@1f000/disk@1
scca          /pci@f2000000/@d/mac-io@7/escc/ch-a
sccb          /pci@f2000000/@d/mac-io@7/escc/ch-b
ki2c          /pci@f2000000/@d/mac-io@7/i2c
ki2c-serial   /pci@f2000000/@d/mac-io@7/i2c/cereal
via-pmu       /pci@f2000000/@d/mac-io@7/via-pmu
rtc           /pci@f2000000/@d/mac-io@7/via-pmu/rtc
adb           /pci@f2000000/@d/mac-io@7/via-pmu/adb
adb-keyboard  /pci@f2000000/@d/mac-io@7/via-pmu/adb/keyboard

```

```

adb-mouse      /pci@f2000000/@d/mac-io@7/via-pmu/adb/mouse
wireless       /pci@f2000000/@d/mac-io@7/@30000
ui2c           /uni-n/i2c
ui2c-serial    /uni-n/i2c/cereal
enet           /pci@f4000000/ethernet
fw             /pci@f4000000/firewire
keyboard       /pseudo-hid/keyboard
mouse          /pseudo-hid/mouse
nvram          /nvram
last-boot      /pci@f4000000/ethernet@f
screen         /pci@f0000000/ATY,Rage128Ps@10
ok

```

Finding the OF Code File on the hard drive.

Finding the OF code file that was created in the OS environment requires the use of the word `dir` in Open Firmware.

`dir` is similar in use to the directory command in many command line, disk-based operating systems. The stack comment for `dir` is in the following form.

```
dir ( "device-specifier<eol>" -- )
```

Where the "device-specifier" is the hard drive path.

In this case the "device-specifier" requires a bit more explanation.

The exact stack input required for `dir` is as follows:

hard drive device path :hard drive directory path

`dir` returns the contents of the current working directory for the hard drive path specified.

Example 5 shows the use of the `dir` word to find the OF code file. Here, after the word `dir`, "hd" is the devalias for the device path of the hard drive determined in Examples 3 and 4.

The back slash character ("\") is the symbol for the "root" directory for the hard drive directory path. Note it that it is on the right hand side the colon (":") separator in the `dir` word example below.

Example 5. Examining the hard drive's directory via `dir`.

```

0 > dir hd:\
117820  4/ 7/ 0 23:43:38 1DIMM
124280  4/ 7/ 0 23:37:19 2DIMM
      6/ 2/ 0 15:10: 0 Anarchie%203.7
  3824  6/ 2/ 0 15:10: 0 Anarchie%203.7%20Installer%20Log%20File
68539   6/ 7/ 0 14:39:21 Apple%20CPU%20Plugins
      6/ 5/ 0 20:56: 2 Apple%20Extras
159744  6/24/ 0  0:30:15 AppleShare%20PDS
      6/ 5/ 0 20:31:29 Applications
      6/ 5/ 0 20:33:18 Assistants
   158   6/ 6/ 0  0:45:34 Auth.bak%0a
      8/17/ 0 22:26:24 Cleanup%20At%20Startup
      6/ 5/ 0 23:51:33 Cubase%204.1
319488  8/24/ 0 15:32:41 Desktop%20DB
1652242 8/24/ 0 15:31:58 Desktop%20DF
      8/25/ 0 18:55:36 Desktop%20Folder
   167   8/25/ 0 22:36: 2 devtree_OF
      5/ 3/ 0  0: 1: 3 Echo%20Card%20Folder
      6/ 5/ 0 16:15:18 firewire
      6/16/ 0 17:23:50 ImageMate3_A%20folder
      6/ 5/ 0 20:26: 4 Installer%20Logs
      6/ 5/ 0 20:33:18 Internet
    0    6/ 5/ 0 20:31:27 Late%20Breaking%20News
      6/15/ 0 20:50: 0 Sys%20folders
      8/24/ 0 15:49:46 Temporary%20Items
      6/ 6/ 0  7: 0:44 TheFindByContentFolder
      6/ 5/ 0 21: 4:29 TheVolumeSettingsFolder
      2/ 2/ 4 10:12:38 Trash
   287   6/ 5/ 0 23:59:30 USB%20Floppy%20Enabler%20Install%20Log
9549 10/24/99  7: 0: 0 USB%20Floppy%20Enabler%20READ%20ME
      6/ 5/ 0 20:27:30 Utilities
      6/ 5/ 0 20:33:39 Web%20Pages
      6/24/ 0  0:13:45 %uffe5%uffe5%uffe5%20HFS%20Private%20Meta%20Data ok
0 >

```

Since the OF code file was conveniently stored in the root directory of the hard drive, it appears in the 16th line of the directory as "167 8/25/ 0 22:36: 2 devtree_OF". Had the code file been in a folder on the hard drive, the search would have required longer directory path name on the right had side of the colon (containing the name of the folder) as in Example 6.

Example 6. Finding a file below the root directory of the hard drive.

```

0 > dir hd:\
117820  4/ 7/ 0 23:43:38  1DIMM
124280  4/ 7/ 0 23:37:19  2DIMM
      6/ 2/ 0 15:10: 0  Anarchie%203.7
  3824  6/ 2/ 0 15:10: 0  Anarchie%203.7%20Installer%20Log%20File
68539   6/ 7/ 0 14:39:21  Apple%20CPU%20Plugins
      6/ 5/ 0 20:56: 2  Apple%20Extras
159744  6/24/ 0  0:30:15  AppleShare%20PDS
      6/ 5/ 0 20:31:29  Applications
      6/ 5/ 0 20:33:18  Assistants
    158  6/ 6/ 0  0:45:34  Auth.bak%0a
      8/17/ 0 22:26:24  Cleanup%20At%20Startup
      6/ 5/ 0 23:51:33  Cubase%204.1
319488  8/24/ 0 15:32:41  Desktop%20DB
1652242 8/24/ 0 15:31:58  Desktop%20DF
      8/25/ 0 22:59:53  Desktop%20Folder
    210  8/25/ 0 22:49:15  devtree_OF
      5/ 3/ 0  0: 1: 3  Echo%20Card%20Folder
      6/ 5/ 0 16:15:18  firewire
      6/16/ 0 17:23:50  ImageMate3_A%20folder
      6/ 5/ 0 20:26: 4  Installer%20Logs
      6/ 5/ 0 20:33:18  Internet
    0    6/ 5/ 0 20:31:27  Late%20Breaking%20News
      8/25/ 0 18:55:44  OFFolder
      6/15/ 0 20:50: 0  Sys%20folders
      8/24/ 0 15:49:46  Temporary%20Items
      6/ 6/ 0  7: 0:44  TheFindByContentFolder
      6/ 5/ 0 21: 4:29  TheVolumeSettingsFolder
      2/ 2/ 4 10:12:38  Trash
    287  6/ 5/ 0 23:59:30  USB%20Floppy%20Enabler%20Install%20Log
9549   10/24/99  7: 0: 0  USB%20Floppy%20Enabler%20READ%20ME
      6/ 5/ 0 20:27:30  Utilities
      6/ 5/ 0 20:33:39  Web%20Pages
      6/24/ 0  0:13:45  %uffe5%uffe5%uffe5%20HFS%20Private%20Meta%20Data
ok
0 > dir hd:\OFFolder
    156  8/26/ 0  1:41:43  devtree_test ok
ok

```

In Example 6 above, searching the root directory using `dir` reveals a folder named "OFFolder." A second `dir` containing the name of this folder reveals a single test file as it's contents.

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Viewing Files

Viewing the text in a saved file on a hard drive can be accomplished using the `load`, `load-base`, `load-size` and `dump` words.

The sequence of events is as follows:

1. Load the OF code file from the hard drive into memory

2. Get the base address of the file in memory and place it on the stack
3. Get the size of the file and place it on the stack
4. Dump the file to the OF screen.

The `load` word follows the same syntax as `dir` above except that it requires the OF code file name as well.

Example 7 below, shows the syntax and result of `load` for the file "devtree_OF".

Example 7. Loading an OF code file from the hard drive into memory.

```
0 > load hd:\devtree_OF load-size=378 Adler32=15900efd
ok
```

Note that execution of `load` displays the load (or file) size, but not the load address.

Conveniently, two words provide the functions needed for dump.

- `load-base` provides the address of last file loaded using `load` and places it on the stack.
- `load-size` provides the size (in bytes + 1) of last file loaded using `load` and places it on the stack.

The `dump` word displays the contents of the file in memory in both hex and ASCII characters.

Example 8 below, the use of `load-base` and `load-size` in preparation for `dump`. `dump` then provides a view of the "devtree_OF" file in memory.

Example 8. "dumping OF code file in memory to the OF screen.

```
0 > load-base ok
1 > load-size ok
2 > .s 800000 378
ok
2 > dump
00800000: 5c 20 54 68 69 73 20 69 73 20 61 20 66 69 6c 65 :\ This is a file:
00800010: 20 74 68 61 74 20 63 6f 6e 74 61 69 6e 73 20 73 : that contains s:
00800020: 6f 6d 65 20 63 6f 6c 6f 6e 20 64 65 66 69 6e 65 :ome colon define:
00800030: 64 2c 20 66 6f 72 6d 61 74 74 65 64 2c 20 0d 5c :d, formatted, .\:
00800040: 20 20 63 6f 6d 6d 6f 6e 6c 79 20 75 73 65 64 2c : commonly used,:
00800050: 20 62 61 73 69 63 20 4f 70 65 6e 20 46 69 72 6d : basic Open Firm:
00800060: 77 61 72 65 20 66 75 6e 63 74 69 6f 6e 73 2e 0d :ware functions..:
00800070: 0d 2e 22 20 76 76 20 3d 20 68 65 6c 6c 6f 20 26 :.." vv = hello &:
00800080: 20 73 65 6c 65 63 74 20 72 6f 6f 74 20 28 64 65 : select root (de:
00800090: 76 20 2f 29 20 22 20 63 72 0d 2e 22 20 78 78 20 :v /) " cr.." xx :
008000a0: 3d 20 66 6f 72 6d 61 74 74 65 64 20 20 64 69 72 := formatted dir:
008000b0: 65 63 74 6f 72 79 20 28 70 77 64 29 20 22 20 63 :ectory (pwd) " c:
008000c0: 72 0d 2e 22 20 79 79 20 3d 20 6b 65 79 20 63 6f :r.." yy = key co:
008000d0: 6e 74 72 6f 6c 6c 65 64 20 64 65 76 20 74 72 65 :ntrolled dev tre:
008000e0: 65 20 6c 69 73 74 20 28 6c 73 29 20 20 22 20 63 :e list (ls) " c:
008000f0: 72 0d 2e 22 20 7a 7a 20 3d 20 66 72 6f 6d 61 74 :r.." zz = format:
```

```

00800100: 74 65 64 20 70 72 6f 70 65 72 74 79 20 6c 69 73 :ted property lis:
00800110: 74 20 28 2e 70 72 6f 70 65 72 74 69 65 73 29 20 :t (.properties) :
00800120: 22 20 63 72 0d 0d 3a 20 68 65 6c 6c 6f 20 28 20 : " cr.: hello ( :
00800130: 2d 2d 20 29 20 20 63 72 20 2e 22 20 20 48 65 6c :-- ) cr ." Hel:
00800140: 6c 6f 20 4f 70 65 6e 20 46 69 72 6d 77 61 72 65 :lo Open Firmware:
00800150: 22 20 3b 0d 3a 20 73 6c 63 74 72 6f 6f 74 20 28 : " ;.: slctroot ( :
00800160: 20 2d 2d 20 29 20 20 22 20 20 2e 2e 2e 20 73 65 : -- ) " ... se:
00800170: 6c 65 63 74 69 6e 67 20 27 72 6f 6f 74 27 20 22 :lecting 'root' ":
00800180: 20 20 63 72 20 3b 0d 3a 20 73 63 72 6c 2d 73 74 : cr ;.: scl-st:
00800190: 61 72 74 20 28 20 2d 2d 20 29 20 20 63 72 20 20 :art ( -- ) cr :
008001a0: 2e 22 20 70 72 65 73 73 20 63 6f 6e 74 72 6f 6c :." press control:
008001b0: 2d 71 20 74 6f 20 73 74 61 72 74 20 73 63 72 6f :-q to start scro:
008001c0: 6c 6c 69 6e 67 22 20 3b 0d 3a 20 73 63 72 6c 2d :lling" ;.: scl-:
008001d0: 73 74 6f 70 20 28 20 2d 2d 20 29 20 20 63 72 20 :stop ( -- ) cr :
008001e0: 2e 22 20 70 72 65 73 73 20 63 6f 6e 74 72 6f 6c :." press control:
008001f0: 2d 73 20 74 6f 20 73 74 6f 70 20 73 63 72 6f 6c : -s to stop scrol:
00800200: 6c 69 6e 67 22 20 3b 0d 3a 20 77 74 2d 34 2d 6b :ling" ;.: wt-4-k:
00800210: 65 79 20 28 20 2d 2d 20 29 20 20 63 72 20 2e 22 :ey ( -- ) cr .":
00800220: 20 70 72 65 73 73 20 61 6e 20 6b 65 79 20 74 6f : press an key to:
00800230: 20 63 6f 6e 74 69 6e 75 65 20 2e 2e 2e 20 22 20 : continue ... " :
00800240: 20 6b 65 79 20 20 63 6c 65 61 72 20 3b 0d 0d 3a : key clear ;...:
00800250: 20 76 76 20 28 20 2d 2d 20 29 20 68 65 6c 6c 6f : vv ( -- ) hello:
00800260: 20 73 6c 63 74 72 6f 6f 74 20 63 6c 65 61 72 20 : slctroot clear :
00800270: 22 20 2f 22 20 66 69 6e 64 2d 64 65 76 69 63 65 : " /" find-device:
00800280: 20 20 3b 20 20 0d 0d 3a 20 78 78 20 28 20 2d 2d : ; ..: xx ( --:
00800290: 20 29 20 20 63 72 20 63 72 20 2e 22 20 20 22 20 : ) cr cr ." " :
008002a0: 70 77 64 20 2e 22 20 20 20 3d 20 63 75 72 72 65 :pwd ." = curre:
008002b0: 6e 74 20 77 6f 72 6b 69 6e 67 20 64 69 72 65 63 :nt working direc:
008002c0: 74 6f 72 79 22 20 3b 0d 0d 3a 20 79 79 20 28 20 :tory" ;...: yy ( :
008002d0: 2d 2d 20 29 20 63 72 20 73 63 72 6c 2d 73 74 61 :-- ) cr scl-sta:
008002e0: 72 74 20 73 63 72 6c 2d 73 74 6f 70 20 63 72 20 :rt scl-stop cr :
008002f0: 77 74 2d 34 2d 6b 65 79 20 6c 73 20 20 20 3b 0d :wt-4-key ls ;.:
00800300: 0d 3a 20 7a 7a 20 28 20 2d 2d 20 29 20 63 72 20 :.: zz ( -- ) cr :
00800310: 63 72 20 2e 22 20 2a 2a 2a 20 50 72 6f 70 65 72 :cr ." *** Proper:
00800320: 74 69 65 73 20 2a 2a 2a 22 20 63 72 20 2e 70 72 :ties ***" cr .pr:
00800330: 6f 70 65 72 74 69 65 73 20 3b 0d 0d 5c 20 65 6e :operties ;..\ en:
00800340: 64 20 6f 66 20 66 69 6c 65 20 63 6f 6d 6d 65 6e :d of file commen:
00800350: 74 20 2e 2e 2e 20 73 6f 20 49 20 6b 6e 6f 77 20 :t ... so I know :
00800360: 49 20 68 61 76 65 20 65 6e 6f 75 67 68 20 3c 63 :I have enough <c:
00800370: 72 3e 27 73 20 21 0d 0d :r>'s !...: ok
0 >

```

Note two things in Example 8 above.

1. Using `load-base` and `load-size` do not require you to ever know what values were loaded on the stack. ".s" was used in this example to show the stack contents prior to using `dump`. The number on the top of the stack {provided by `load-size`} matches the `load-size` value displayed in Example 7.
2. The ASCII text, displayed to the right of the colon on each line, matches the text from the file in Example 1 (although no formatting is shown).

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Running Files

The primary goal of this session is to be able to run the code created in the OS from the Open Firmware environment.

Running a file from the hard drive can be accomplished using the `boot` word.

The `boot` word follows the same syntax as `load` above and requires the hard drive paths as well as the OF code file name.

Example 9 below, shows the syntax and result of `boot` for the file "devtree_OF" from Example 2.

Example 9. Running an OF code file from the hard drive.

```
0 > boot hd:\devtree_OF load-size=378 Adler32=15900efd

evaluating Forth source
vv = hello & select root (dev /)
xx = formatted directory (pwd)
yy = key controlled dev tree list (ls)
zz = formatted property list (.properties)
ok
0 > vv
Hello Open Firmware ... selecting 'root'
ok
0 > xx

/ = current working directory ok
0 > zz

*** Properties ***

model                PowerMac3,1
compatible            PowerMac3,1
                     MacRISC
                     Power Macintosh
serial-number         HNZM7824LL/B
                     XB002027

customer-sw-config
color-code            ffff
scb#                  00000000
name                  device-tree
copyright              Copyright 1983-1999 Apple Computer, Inc. All Rights Reserved
device_type           bootrom
system-id             0000000000000
#address-cells        00000001
#size-cells           00000001
clock-frequency       05f03e4d
AAPL,add-fcode-file   ff81cfe0

ok
0 > xx
```

```
/ = current working directory ok
0 > yy

press Control-Q to start scrolling
press Control-S to stop scrolling

press an key to continue ...
ff83b630: /cpus
ff83b860:   /PowerPC,G4@0
ff83bbd8:     /l2-cache
ff83c6f8: /chosen
ff83c888: /memory@0
ff83caa0: /openprom
ff83cbd0:   /client-services
ff83dd70: /rom@ff800000
ff83def8:   /boot-rom@fff00000
```

The Control-S keys were pressed to abbreviate the device tree listing example above.

Note that if the file name and path are known and the file does not need to be viewed in Open firmware, then the `boot` word (with the path/filename) becomes the only word needed to run the file in the Open Firmware session.

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Summary

Open Firmware code development can be accomplished on a single machine by alternately creating, editing, and saving a standard text file in Mac OS to the hard drive, then locating, loading, viewing, and booting the same file on the hard drive from Open Firmware.

Figure 1 below demonstrates a typical Open Firmware debugging session in one-machine mode.

One-Machine Debug Flow

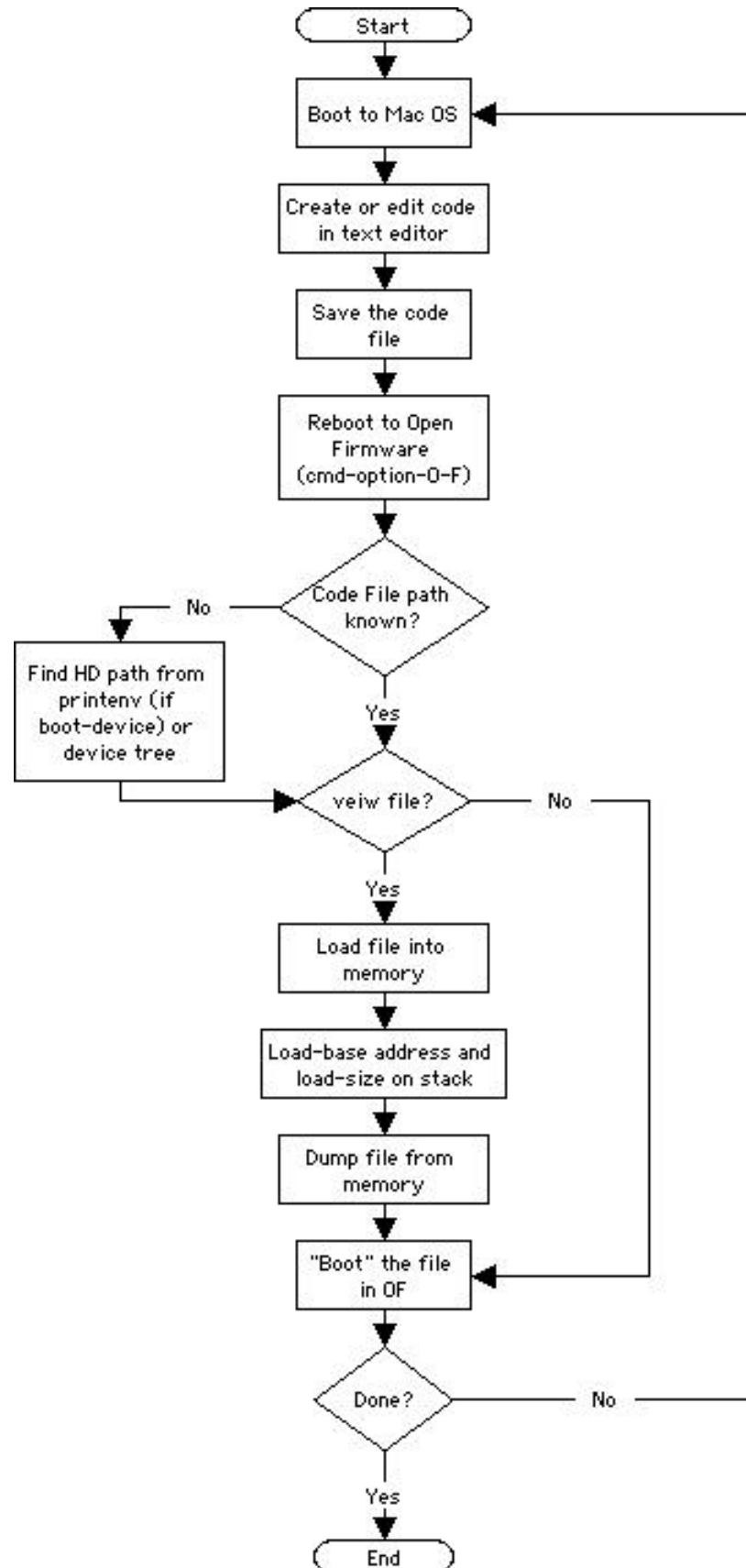


Figure 1. A typical Open Firmware debugging session in one-machine mode.

References

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