Engineering Support Application Note
Number: 300
*Issue: ***2nd DRAFT****

Porting RISC OS Software to NetStation

This document suggests and outlines procedures and guidelines for adding RISC OS application software to start up in NetStation bootstrap sequences and via user home pages, and modifying that software accordingly to enable it to run successfully. The differences between a NetStation and the closest equivalent RISC OS machine (a discless A7000) are also described.

This document assumes that you have one or more NetStations bootstrapping NC OS 1.06 and loading applications from a UNIX server in accordance with Application Note 298 and the boot sequence on the Developer WWW site. No part of this document can be automatically assumed to apply to future versions of NC OS.

Applicable Hardware : NetStation and appropriate UNIX server

Related Application Notes: 298: Bootstrapping and Configuration of Ethernet-based NCs from UNIX Fileservers

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Assumptions

This document assumes that you have a UNIX server which is installed and configured to be able to boot one or more NetStations, using an appropriate bootpd / nfsd / pcnfsd combination as described in Application Note 298. It also assumes that your NFS-exported NetStation boot sequence is concordant with the developer release available as http://www.acorn.co.uk/SALES/DEVELOPERS/resource/reference/nc/bootstrap.tar.Z .

Introduction

Although the NetStation was originally designed with the high-level platform-independent requirements of being able to render HTML, run Macromedia Director movies and support Java, it must not be forgotten that NC OS 1.06 is based very heavily on RISC OS. To this end, it is possible to make many RISC OS applications run successfully on NC OS; it is predicted that about 70% - 75% of RISC OS apps can be made to run either "out of the box" or with only minor modifications. These applications will clearly have a RISC OS "look and feel"; it is anticipated that a separate document will describe how best to do a full port of an application so that it appears as though it was originally written for the NetStation, whereas this document will concentrate on the bare mechanics of getting the application's functionality working.

Differences between a NetStation and a Discless A7000

Hardware

The principal hardware differences between the two machines relate to the CPU; the A7000 contains a 32MHz ARM7500, whereas the NetStation contains a 40MHz CL-PS7500FE. The 7500FE incorporates the same core and most of the same cells as the 7500, however its external DRAM access system has been enhanced to allow support of 60ns EDO DRAM in addition to the fast page mode supported by the ARM7500; a single 8Mb EDO DRAM SIMM is fitted to the NetStation as standard. The 7500FE also incorporates hardware floating point; the FPA11 single- and double-precision units have been incorporated on-chip. For full details of the 7500 and 7500FE, see the relevant datasheets on ftp.acorn.co.uk:/pub/documents/ (to be submitted for upload by Cirrus Logic end April 97).

In overview, the CL-PS7500FE has the following properties:

- Applications may run more quickly than on the ARM7500 (some significantly so)
- Higher-resolution screen modes can be supported, even without VRAM (in common with ARM7500, VRAM support is not provided)
- Full instruction set and binary compatibility with ARM7500
- Ability to map EDO DRAM
- Ability to interface to an IBM PS/2 style mouse (the support for the Acorn Quadrature mouse has been removed).

The motherboard supports a single podule-style expansion card; in common with the A7000, the card interface is unable to support hardware DMA. The video system is able to support the same screen modes at the same scan rates as a Risc PC 600 fitted with 1Mb VRAM.

The 10BaseT EtherN card as shipped with the Ethernet NetStation has full DCI4 compliance, and constructs its MAC address from the Dallas Semiconductor unique machine ID chip on the motherboard - in Ethernet configuration, the only information requiring retrieval from the Smartcard is that concerned with user

authentication and the location of the user's home directory. EtherN can be separately sourced from Irlam Instruments.

The V.34 modem card as shipped with the modem NetStation is based around the National Semiconductor NS16550 chipset and supports a subset of the Hayes AT command set as detailed in Appendix D. Its on-board ROM contains:

- The PPP driver module
- The Caradon module (which handles Smartcard authentication; for hardware testing purposes, it is worth noting at this point that a modem-based Netstation with Caradon running should boot completely standalone to the "Please insert your Smartcard" splash-screen pictured in Application Note 298)
- The UART driver for the modem chipset.

Further details of the modem may be made available upon application.

The "perennial" Philips PCF8583 battery-backed CMOS / Real-time clock chip as used in all previous 32-bit Acorn systems has been replaced with an NVRAM device which does not require external power; this device has a larger capacity (1K) than the '8583. Real time clock data is provided from a time server via the network connection.

Finally, the NetStation has no floppy or hard disc support capability; the relevant pins of the SMC37665 are not tracked out. It is, however, possible to attach an IOMega Zip drive via the parallel port, using a copy of the relevant IZipFS drivers softloaded from the Netstation server. (NB. IZipFS drivers are not supplied with the server distribution; if you have a copy, you'll have to put them in yourself using an Obeyfile to rmload them, or just tack them into **`!RunEther,feb`**)

OS Software

Items Removed From NC OS compared to RISC OS 3.60

The contents of the NetStation ROM (NC OS 1.06) are fundamentally based on RISC OS 3.60; however, the ROM image differs significantly in a number of ways. A full list of the ROM-based modules is supplied in Appendix A; it should be noted that the following modules significant to the operation and networking of RISC OS 3.60 have been removed:

`AUNMsgs`
`Freeway`
`ShareFS`
`TaskManager`
`Filer`
`ResFSFiler`
`Display`
`Pinboard`
`DOSFS`

...along with all Econet / Level 4 support modules and the POST (Power-On Self Test) code.

The absence of these modules implies that certain modes of operation under RISC OS are by default not feasible under NC OS; there is no concept of a filer window, for example, so all loading, saving and cataloguing of files must be done via an alternative interface (eg HTML pages built on the fly, or in future, Java applets). The possibility of applying some softloaded "glue" to intercept **`Filer_`** calls and cause them

to do something sensible is currently in discussion.

As Access can sit on top of the standard DCI4 IP stack, there is no technical reason why ShareFS and Freeway cannot be softloaded (some applications which use network-based authentication in their site licensed versions may require this).

The contents of ResourceFS have been abridged to remove those resources connected solely with applications which are ROM-based in RISC OS 3.6; thus if, for example, you attempt to run the RISC OS 3.5 version of !Draw you will need to softload relevant !Sprites, Templates and Messages files.

Items Added to NC OS Compared to RISC OS 3.60
To be written (module lists, help files for them, SWI details)

Items Modified in NC OS Compared to RISC OS 3.60
The FPEmulator module has been modified to take advantage of the presence of the FPA11 cell; its API remains unchanged, thus the only difference the programmer will see is that FP operations take place significantly faster than they do on any previous Acorn platform.

Allocation of NVRAM is subtly different in NC OS compared to RISC OS; the full allocation breakdown is supplied as Appendix C. Discerning readers may note that the allocation breakdown gives provision for holding a static IP address, netmask and mount point in ROM; this would, in theory, allow the sysadmin to dispense with bootp. In NC OS 1.06, a configuration screen to set these properties may be reached by powering the NetStation up with both Alt keys held down. I haven't tried using this facility yet, so Your Mileage May Vary.

On a Delete-power-on the NC OS kernel only resets the minimum number of CMOS locations required to produce a working machine. The rest of CMOS is initialised to 0. A CMOSReset module in main ROM then sets any remaining CMOS to specific values every time the machine is reset if the contents are found to be different to those expected eg. after a reset. In this way it is unlikely that the machine will ever suffer from corrupt CMOS.

NetStation has 1K of CMOS available, of which only the first 256 bytes are used in the NCOS 1.06 release.

Issues in Running RISC OS Applications

OS and Environment Detection

It is no longer feasible to rely on the version number of UtilityModule to reflect the version number of the OS; NC OS 1.06 uses UtilityModule 4.50, where 4.50 is an internal version number which may increment or decrement in the final production build. The OS type and version may be determined by looking for the OSVersion module; in NC OS this is a nonfuntional dummy module which has the same version number as the OS, in RISC OS the module is not present.

If your application is already known to be portable between NC OS and RISC OS without modification, you use SWI"OS_Byte",129,0,255 ; a version code of &A6 is returned in R1 for both RISC OS 3.6 and NC OS 1.06.

Note that this issue also impinges on !System (see below).

Filetyping and File Naming

As the NetStation uses NFS to mount the exported root of the server containing the !NFSBoot bootstrapping application, it is essential that the files stored on this server reflect the file typing metric expected by the NC OS NFS client.

The simplest way to ensure that files have the correct type is to upload them to the server using an NFS link from a RISC OS system, as the RISC OS NFS client uses the same filetyping convention; if this is not feasible, the files should be manually named according to the following guidelines:

- File leafnames as seen from the server console comprise a name component, a comma, and a three hex-digit filetype component. For example, **`!Run,feb`** denotes the file !Run of type &FEB (Obey).

- All characters contained within filenames must lie within the 7-bit ASCII domain (so no top-bit-set accented characters). If any top-bit-set characters are present, they should be changed to the closest corresponding 7-bit character and all references to the original filename must be amended. As with RISC OS, spaces are not permitted in UNIX filenames; as "hard space" lies above the 7-bit watershed, all whitespace characters should be removed.

- To aid portability of files across server types, the length of the component of the filename preceding the comma should be no more than 10 characters, and should not rely on case sensitivity.

- All files belonging to a RISC OS application (other than plain-ASCII text files) must be assigned filetypes.

- Files which under RISC OS contain a / character (/ is the directory separator under UNIX; as this is usually hardwired into the UNIX kernel there is no way to modify the server to change this) should under UNIX substitute a . for the / .

Be aware that there is one exception to the rules above; HTML files which are intended to be accessed and rendered directly by NCFresco (either by standard URLs if you are running an httpd, or by standard page links using **`<a href= ...>`**) should **not** be named as <*filename component*>**`,faf`** but should retain the standard UNIX convention of <*filename component*>**`.html`** . This also ensures that they may be easily viewed by browsers on other platforms.

A brief list of common filetype mappings is supplied in Appendix B.

It is worth noting that in some flavours of UNIX, particularly BSD, objects which have names beginning with ! are interpreted as event handles rather than files. If it becomes necessary to change the "working directory" of a UNIX shell session to some point within a RISC OS application, or to edit a file on the server where the editor is launched from a UNIX shell, a \ should be inserted in the pathname immediately before any occurrence of a ! . Thus a command to edit the main **`!RunEther,feb`** file would become:

```
emacs /export/home/ncd/boot/\!NFSBoot/\!RunEther,feb
```

To aid the transfer of files to the server on floppy, a utility exists which is able to uncompress Spark file archives; portable source code for this utility can be found on ftp.acorn.co.uk as /pub/riscos/releases/nspark.tar . When decompressing a Spark archive, nspark's -T option can intelligently set filetypes for you (but beware filename truncation).

!System, !Scrap and !Fonts

In its current server-based boot sequence, NC OS does not boot a !System application per se. System$Path is aliased to **NFS::NFSBoot.$.!NFSBoot** , which places the modules normally found in !System within **!NFSBoot.Modules** . As NC OS is currently only single-versioned and therefore there are no compatibility issues intrinsic to NC OS, it is envisaged that, rather than having the multilayered !System structure common to RISC OS 3.5 and above the structure should be kept fairly flat. Networking and Toolbox modules are best kept within their own subdirectories within the Modules, but otherwise all other softloadable modules can reside within the Modules directory (to be *RMLoaded with a simple Repeat ... IfThere loop).

Note that, should you decide to implement a hierarchical !System along RISC OS lines, significant surgery will need to be performed on !System to ensure that modules for incorrect versions of RISC OS are not loaded too (owing to the unusual OS version numbering).

In the current server-side boot sequence !Scrap is entirely absent, and Scrap$Dir is unset (thus RISC OS applications which require scrapfile storage will crash). Unless the **/export** partition is exported read-only, there should be no problem in inserting a standard RISC OS 3.60 !Scrap (with correct filetyping) into !NFSBoot and OBEYing its **!Boot,feb** file within **!RunEther,feb** ; thus applications which require access to !Scrap may have it. As it is often not possible to determine which application will want to write to !Scrap from which machine and with which UserID, however, it must be ensured that !Scrap.ScrapDirs is world-writable.

If you feel you must export your **/export** read-only for security reasons, there is of course no reason why in your initial UNIX setup you could not create a small (circa 10Mb) exported read-write partition purely to hold !Scrap...

As with !Scrap, it is possible to add a RISC OS 3.60 !Fonts hierarchy to !NFSBoot. The standard RISC OS distribution of Corpus, Homerton and Trinity (along with the additional Sidney font) are included as part of the resource filing system, the Font$Path macro is set to <Font$Prefix>.,Resources.:$.Fonts. as with RISC OS, and the font handling and painting modules are in ROM.

In all cases, the !Boot files for each application will need to be OBEYed within **!RunEther,feb** .

Application !Boot and !Run Files

In order to run most applications on a NetStation, as on any other RISC OS computer, both the !Boot and !Run files (where present) belonging to the application must be *OBEYed. Assuming that you have loaded your application into a suitable place on your server (eg **/export/home/ncd/boot/Apps**), copied any shared resources into the areas which correspond to !System and !Fonts, and have set the filetypes in accordance with the notes above, you should proceed as follows:

- Load **!Boot,feb** into your text editor of choice
- Look for occurrences of DOSMap; if any are present, they should be commented out. If files to be used with RISC OS applications are loaded onto the server which have DOS-style filenames, they should be renamed according to the file naming metric above.
- Look for occurrences of Filer_Boot and Filer_Run . If these are present, you need to create a new obeyfile in your application's directory for each occurrence of Filer_Boot or Filer_Run, where each file contains the equivalent Boot or Run command. The occurrence

of Filer_Boot or Filer_Run should then be replaced with an OBEY pointing to the relevant obeyfile.

For example (from my RISC OS !Boot sequence):

```
RMEnsure VProtect 0 RMRun System:Modules.VProtect
Filer_Run Boot:^.Diversions.!MemNow
Filer_Run Boot:^.Network.Vanilla2a.Apps.!Marcel
```

becomes:

```
RMEnsure VProtect 0 RMRun System:Modules.VProtect
Obey Boot:Diversions.Memhook
ObeyBoot:Network.Vanilla2a.Apps.Marcelhook
```

with extra files **/export/home/ncd/boot/Diversions/Memhook,feb** containing

```
Run Boot:Diversions.!MemNow
```

and **/export/home/ncd/boot/Network/Vanilla2a/Apps/Marcelhook,feb** containing

```
Run Boot:Network.Vanilla2a.Apps.!Marcel
```

Beware; as these files will be executed from NC OS and not UNIX, obeyfiles should be created with the **,feb** extension if created within UNIX, but referenced in !Boot,feb without this extension!

- Save the amended **!Boot,feb** file.
- Repeat the procedure with **!Run,feb**

If any other obeyfiles are used within your application, you should check these too.

Now make sure that the application does not make appeal to any ROM-based ResourceFS objects which may not be present in NC OS (eg sprite, message and template files for !Draw, !Paint, !Edit etc). If it does, you will need to create replacement files as part of your application, and have it point to these instead.

Interfacing with NCFresco

In the case of applications which require NCFresco to pass control to them when loading a known data type (eg double-clicking on a Replay movie will pass control to !ARMovie), it is necessary for the application to register its presence and the set of data types it knows with NCFresco.

For an application yyyy whose filetype is xxx the variable set declared in **!RunEther,feb** should include

yyyy$Dir
: the application directory containing !Boot, !Run etc. files

File$Type_xxx
: upto 8 character name describing file format

Alias$@RunType_xxx
: command to run the standalone application, taking filename as an argument

In some circumstances, particularly when the file type is commonly used on WWW pages, it may be desirable to write the application as a "plugin" for NCFresco; the plugin interface enables plugin-aware applications (such as NCFresco) to pass data they do not themselves understand (such as Macromedia Director movies) which has been embedded within data sets they do understand (such as WWW pages authored in HTML) to rendering applications (the plugins themselves) which have registered the fact that they understand and can render data of that type themselves. The full plugin specification and the plugin messaging protocol is detailed in Appendix E: !Shockwave, which is included in the server distribution, is an example of such a plugin. Java is currently being implemented as a plugin, and other useful candidates for plugin conversion would be applications such as VRML renderers, MPEG players etc.

Network-based Authentication

Some applications use network-based authentication in their site-licensed versions to ensure that a client is on the same site as that which holds the license. In the case of applications which authenticate on the basis of presence within an IP address space no further work should be necessary, provided that the address allocated to tne NetStation is within that space; however, applications which are by their nature client-server (such as !X from Gnome) will require that the NetStation has access to a DNS host.

A further class of appliation exists which requires that a cookie be transferred from a known cookie server on the local network to any copy of the application on startup; DataPower is one such application. Provided that cookies are transferred over TCP/IP there should be no problem, however trouble arises if Level4, LanMan or NetBEUI are used (unless I can get OmniClient working).

Loading and Saving of Application Data Files

For RISC OS applications which load and save using only the standard RISC OS drag-drop filer interface, this issue has yet to be resolved. Discussion is in progress regarding whether any "glue" can be softloaded to intercept **`Filer_`** calls and cause them to do something sensible, and deal with faking wimp protocols.

Where the name of the file to be loaded or saved can be specified entirely textually by the user, there should not be any problem provided that access permissions are set correctly; also if the application is hardwired to load a default template file, no problems should arise.

Starting the Application

Once you have an application which should run on NC OS, there remains the matter of attaching commands to the hooks in the server-side boot structure to start it. If the application is of the conventional sort (ie it has a !Boot file and a !Run file), you should insert the line

`Run Apps:!`<*application name*>**`.!Boot`**

in the sequence commencing on or around line 120 of **`!RunEther,feb`** and add a line to whichever HTML page you wish the application to be booted from of the form:

`<h3><img align=absbottom src="file:/Images:icons/orangeball.gif" width=14 height=14><a href="saferun:Root:Apps:`<*application name*>**`.!Run">`**<*application name*>**`</a></h3>`**

For applications such as !MPEGFast which do all the work of !Boot and !Run within !Boot and simply claim one or more filetypes, the second hook is not required. However, it will often be necessary to modify the !Boot file to ensure that NCFresco has all the data it needs to know when and how to start the application.

Other Miscellaneous Issues

Using BASIC for Debugging

For debugging purposes once the basic NC OS environment is bootstrapped and running, one of the most useful things to be able to do on a NetStation is to quit to BASIC and examine the contents of the environment variables or use ping, traceroute etc to ensure the network environment is correctly set up. Quitting to BASIC and using *<*whatever*> is preferable to attempting to quit to the CLI; in addition to the latter practice falling foul of the protection provided by the **CLIProtect** module (*qv*), which will probably result in a NetStation reboot, Other Unpredictable Things may happen if the CLIProtect module is dsabled first.

To add the hook which will enable you to quit to BASIC from the NetStation home page, create an obeyfile containing

```
basic
```

and a linefeed, and treat it as you would a !Run file for any other application when adding the hook to the home page. From the programmer's point of view, BASIC on a NetStation is directly equivalent to BASIC V on other Acorn machines.

Appendix A: Contents of NC OS 1.06 ROM

```
No. Position    Module Name             Version Status

  1 System ROM  UtilityModule           4.50    Active
  2 System ROM  Podule                  1.46    Active
  3 System ROM  OSVersion               1.06    Active
  4 System ROM  CMOSreset               0.15    Active
  5 System ROM  FileSwitch              2.29    Active
  6 System ROM  ResourceFS              0.16    Active
  7 System ROM  Messages                0.79    Active
  8 System ROM  MessageTrans            0.31    Active
  9 System ROM  TerritoryManager        0.24    Active
 10 System ROM  UK                      0.22    Active
 11 System ROM  USA                     0.03    Active
 12 System ROM  WindowManager           3.85    Dormant
 13 System ROM  Desktop                 2.52    Active
 14 System ROM  PS2Driver               0.18    Active
 15 System ROM  ARM                     0.10    Active
 16 System ROM  BASIC                   1.14    Running
 17 System ROM  BASICTrans              2.00    Active
 18 System ROM  BufferManager           0.25    Active
 19 System ROM  ColourTrans             1.64    Active
 20 System ROM  Debugger                1.45    Active
 21 System ROM  DeviceFS                0.34    Active
 22 System ROM  DragASprite             0.11    Active
 23 System ROM  DragAnObject            0.02    Active
 24 System ROM  Draw                    1.09    Active
```

```
25 System ROM  FileCore                2.97    Active
 26 System ROM  FontManager             3.36    Active
 27 System ROM  FPEmulator              4.05    Active
 28 System ROM  GameModes               2.00    Active
 29 System ROM  Hourglass               2.11    Active
 30 System ROM  InverseTable            0.06    Active
 31 System ROM  International           1.28    Active
 32 System ROM  Obey                    0.34    Active
 33 System ROM  ParallelDeviceDriver    0.43    Active
 34 System ROM  InternationalKeyboard   0.37    Active
 35 System ROM  PipeFS                  0.15    Active
 36 System ROM  ROMFonts                0.19    Active
 37 System ROM  ScreenBlanker           2.24    Active
 38 System ROM  SoundDMA                1.52    Active
 39 System ROM  SoundChannels           1.30    Active
 40 System ROM  SoundScheduler          1.20    Active
 41 System ROM  SpriteExtend            0.99    Active
 42 System ROM  Squash                  0.24    Active
 43 System ROM  SuperSample             0.09    Active
 44 System ROM  SystemDevices           1.25    Active
 45 System ROM  FilterManager           0.11    Active
 46 System ROM  WaveSynth               1.13    Active
 47 System ROM  SharedCLibrary          4.79    Active
 48 System ROM  ScreenModes             0.19    Active
 49 System ROM  DrawFile                1.48    Active
 50 System ROM  BootCommands            1.15    Active
 51 System ROM  AUNMsgs                 0.07    Active
 52 System ROM  MbufManager             0.13    Active
 53 System ROM  Internet                4.08    Dormant
 54 System ROM  NFSSTB                  2.31    Dormant
 55 System ROM  MakePSFont              1.08    Dormant
 56 System ROM  PDriverDP               4.39    Dormant
 57 System ROM  PDriverPS               4.39    Dormant
 58 System ROM  PDumperSupport          1.21    Dormant
 59 System ROM  PDumperDM               1.17    Dormant
 60 System ROM  PDumperIW               1.17    Dormant
 61 System ROM  PDumperLJ               1.17    Dormant
 62 System ROM  PDumperE2               1.17    Dormant
 63 System ROM  PDriver                 3.25    Active
 64 System ROM  PPrimer                 0.09    Active
 65 System ROM  TinyStubs               0.05    Active
 66 System ROM  Toolbox                 1.36    Active
 67 System ROM  Window                  1.31    Dormant
 68 System ROM  Menu                    0.25    Active
 69 System ROM  ToolAction              0.13    Active
 70 System ROM  Interlace               0.46    Active
 71 System ROM  NHTwitter               0.07    Active
 72 System ROM  DynamicAreas            0.01    Active
 73 System ROM  ModeFiles               0.10    Active
 74 System ROM  Serial                  0.15    Active
 75 System ROM  SCTransport             0.14    Active
```

```
76 System ROM  SCInterface            0.13    Active
 77 System ROM  NCRegistry             0.11    Dormant
 78 System ROM  NCRegistrySpprt        0.04    Dormant
 79 System ROM  IRRemote               0.05    Active
 80 System ROM  SoundInput             0.04    Dormant
 81 System ROM  Standby                0.15    Active
 82 System ROM  ParallelJoystick       0.01    Active
 83 System ROM  NetTime                0.01    Active
 84 System ROM  FileWatch              0.04    Active
 85 System ROM  CacheFS                0.22    Active
 86 System ROM  TaskModule             0.04    Active
 87 System ROM  SoundFileExtMSADPCM    0.04    Active
 88 System ROM  ReplaySupport          0.37    Active
 89 System ROM  SoundFile              0.24    Active
 90 System ROM  !SoundPlay             0.04    Acive
 91 System ROM  ClipHolder             0.08    Active
 92 System ROM  NCConfig               0.17    Active
 93 System ROM  NCFiler                0.16    Active
 94 System ROM  !NCWriter              1.01    Active
 95 System ROM  SoakTest               0.20    Active
 96 System ROM  EnsureLine             0.02    Active
 97 System ROM  HTTP                   0.60    Dormant
 98 System ROM  WebFTP                 0.15    Active
 99 System ROM  WebGopher              0.08    Active
100 System ROM  Resolver               0.43    Active
101 System ROM  !NCFresco              1.06    Active
  1 Podule 0    EtherN                 1.01    Active
  2 Podule 0    Internet               4.09    Active
  3 Podule 0    NFSSTB                 2.32    Active
  4 Podule 0    DoBootP                0.08    Dormant
  5 Podule 0    StaticIP               0.01    Dormant
  6 Podule 0    NCEthernet             0.28    Active
  7 Podule 0    CLIProtect             0.01    Active
```

Appendix B: Common Filetype Mappings

```
Filetype  Description        Hex Filetype    Owner   Text alias      Comments
Text                        FileType  FFF, Acorn                  ; ASCII text file
Command                     FileType  FFE, Acorn                  ; Command (Exec) file
Data                        FileType  FFD, Acorn
Utility                     FileType  FFC, Acorn                  ; Transient program
BASIC                       FileType  FFB, Acorn                  ; Tokenised BASIC program
Module                      FileType  FFA, Acorn                  ; Relocatable module
Sprite                      FileType  FF9, Acorn                  ; Sprite or saved screen
Application                 FileType  FF8, Acorn, "Absolute"      ; Absolute app. loaded at &8000
BBCFont                     FileType  FF7, Acorn  "BBC Font"      ; BBC font file sequence of VDU
Font                        FileType  FF6, Acorn,                 ; Fancy font (4bpp bitmap only)
PostScript                  FileType  FF5, Acorn, "PoScript"      ; A PostScript program
DMData                      FileType  FF4, Acorn, "DM data"       ; Dot Matrix data file
```

```
LaserJet                FileType  FF3, Acorn              ; HP LaserJet data file
TaggedImageFileFormat   FileType  FF0, Acorn, "TIFF"      ;
Template                FileType  FEC, Acorn              ; Used by Arthur 1.20
Obey                    FileType  FEB, Acorn              ; Sequence of OS_CLIs
Desktop                 FileType  FEA, Acorn              ;
UNIXExecutable          FileType  FE6, Acorn, "UNIX Ex"
MSDOS                   FileType  FE4, Acorn              ; For DOSFS
Atari                   FileType  FE3, Acorn              ; MultiFS
Amiga                   FileType  FE2, Acorn              ; MultiFS
Make                    FileType  FE1, Acorn
VTScript                FileType  FDF, Acorn
VTSetup                 FileType  FDE, Acorn
MasterUtl               FileType  FDD, Acorn              ; Master utilities,
SoftLink                FileType  FDC, Acorn
MSDOSbat                FileType  FDA, Acorn
MSDOSexe                FileType  FD9, Acorn
MSDOScom                FileType  FD8, Acorn
TaskObey                FileType  FD7, Acorn              ; Obey file in a task window
TaskExec                FileType  FD6, Acorn              ; Exec file in a task window
Pict                    FileType  FD5, Acorn              ; MSDOS Pict
MIDI                    FileType  FD4, Acorn          ; Int. MIDI assn. MIDIFiles standard
DebImage                FileType  FD3, Acorn              ; DDE Debugable image
PCEmConf                FileType  FD0, Acorn              ; PC emulator configuration
Squash                  FileType  FCA, Acorn              ; Single compressed file
SunRaster               FileType  FC9, Acorn,  "SunRastr"  ; A Sun (computer) Raster image
MSDOSDisc               FileType  FC8, Acorn              ; MS-DOS MultiFS disc images
AppleMacintoshType1     FileType  FC7, Acorn,  "MacType1"  ; Mac Format Type 1 font
PrinterDefinition       FileType  FC6, Acorn,  "PrintDfn"  ; Printer defn file
PatchDefinition         FileType  FC3, Acorn,   "Patch"    ; !Patch patch defn file
AudioInterchangeFileFormat FileType FC2, Acorn, "AIFF"
PocketBookCards         FileType  FBE, Acorn,   "PBCards"
PocketBookWrite         FileType  FBD, Acorn,   "PBWrite"
PocketBookAbacus        FileType  FBC, Acorn,   "PBAbacus"
PocketBookLotusWK1      FileType  FBB, Acorn,   "LotusWK1"
PSPrinterDescription    FileType  FBA, Acorn,   "PPD"
Schedule                FileType  FB8, Acorn,   "Schedule"
Plotter                 FileType  FB7, Acorn,   "Plotter"
Agenda                  FileType  FB6, Acorn,   "Agenda"
AVI                     FileType  FB2, Acorn,   "AVI"
WaveForm                FileType  FB1, Acorn,   "WaveForm"
Allocate                FileType  FB0, Acorn,   "Allocate"
HTML                    FileType  FAF, Acorn,   "HTML"
TabSeparatedVariables   FileType  F0D, Acorn,   "TSV"
CommaSeparatedVariables FileType  DFE, Acorn,   "CSV"
DataExchangeFormat      FileType  DEA, Acorn,   "DXF"
TeX                     FileType  CE5, Unknown
DVI                     FileType  CE4, Unknown
HPGLPlot                FileType  CAE, Acorn
JPEG                    FileType  C85
RichText                FileType  C32
AdvanceWordProcessor    FileType  C28, Acorn,   "AWord"
```

```
AdvanceDataBase          FileType  C27, Acorn,   "ADBase"
AdvanceSpreadSheet       FileType  C26, Acorn,   "ASheet"
AdvanceGraph             FileType  C25, Acorn,   "AGraph"
MPEGMovie                FileType  BF8           "MPEG"
FLIPlay                  FileType  B9F           "FLI"
Draw                     FileType  AFF, Acorn,   "DrawFile"
Alarms                   FileType  AE9, Acorn
AcornReplayMovie         FileType  AE7, Acorn,   "ARMovie"
PortableDocumentFormat   FileType  ADF, Acorn,   "PDF"
```

Appendix C: NC OS 1.06 NVRAM Allocations

The locations listed below are logical locations, as used by the OS_Byte SWIs. For NCOS 1.06 the following mapping is applied between logical locations and physical locations.

Logical locations	Physical locations
&00 to &BF	&40 to &FF
&C0 to &EF	&10 to &3F

a,b Numbers a and b
a-b Numbers a to b
XX Do not care, contents liable to change
?? Do not care, contents unknown
(D) Default location sub-bit option

```
Loc     Value   Description

00      XX      Econet station number
01      XX      Econet file server station id
02      XX      Econet file server net number
03      XX      Econet printer server station id
04      XX      Econet printer server net number
05      2E      Filesystem number (ResourceFS)
06,07   00      UNPLUG bytes 1 and 2
08      XX      Twin CMOS
09      00      UNPLUG byte 3
0A      10      TV vertical adjust
                Bits 0-3        Not used
                Bit    4        Not used
                Bits 5-7        TV vertical adjust
0B      50      Miscellaneous configuration
                Bits 0-2        ADFS drive (D=0)
                Bits 3-5        Caps mode
                                001 = Shift caps
                                010 = No caps (D)
                                100 = Caps
                Bit    6        loads directory on switch on
```

```
0 = Directory
                                        1 = No Directory (D)
                        Bit    7        Not used
        0C      20      Keyboard auto-repeat delay
        0D      08      Keyboard auto-repeat rate
        0E      0A      Printer ignore character
        0F      2C      Printer information
                        Bit    0        Printer colour status
                                        0 = monochrome
                                        1 = colour
                        Bit    1        Status of ignore character
                                        0 = Use the ignore character (D)
                                        1 = No ignore character
                        Bits 2-4        Baud rate (D=3)
                        Bits 5-7        Printer destination (D=1)
                                        Print is sent to PrinterType$n
        10      90      Miscellaneous flags
                        Bit    0        Not used
                        Bit    1        Speaker volume
                                        0 = Quiet (D)
                                        1 = Loud
                        Bit    2        Not used
                        Bit    3        Scroll on/off
                                        0 = Scroll (D)
                                        1 = No scroll
                        Bit    4        Boot/NoBoot
                                        0 = No Boot
                                        1 = Boot (D)
                        Bits 5-7        Serial Data Format (D=4)
                                        (8 bits, no parity)
        11      XX      Net Filer flags
                        Bit    0        FS List sorting mode
                                        0 = By name
                                        1 = By number
                        Bit    1        Library type
                                        0 = Returned by file server
                                        1 = Use $.ArthurLib
                        Bits 2,3        FS List display mode
                                        00 = Large icons
                                        01 = Small icons
                                        10 = Full info
                                        11 = Reserved
                        Bits 4-7        Not used
        12-13   00      UNPLUG bytes 4 and 5
        14-15   00      Extension ROM unplug bytes 1 & 2
        16      00      Wimp Double - Click - Move - Time
        17      00      Wimp Auto - Sub Menu - Time
        18      2F      Territory (D=47 (USA))
        19      00      Printer buffer size
                        0 =1k in usual area
                        >0 = 4K * n (claimed from RMA)
```

```
1A      00      ADFS Spin down (IDE disc auto spin-down
                        delay in n*5 seconds)
        1B      00      Wimp Menu - Drag - Delay
        1C      03      FileSwitch CMOS
                        Bit     0       Truncate name bit
                                        0 = Give error if name too big
                                        1 = Truncate name (D)
                        Bit     1       DragASprite bit
                                        0 = Do not use DragASprite
                                        1 = Do use DragASprite (D)
                        Bit     2       Interactive filer operations
                                        0 = Use interactive filer ops (D)
                                        1 = Don't use interactive filer ops
                        Bit     3       WIMP use dither patterns
                                        0 = Do not use dither patterns (D)
                                        1 = Do use dither patterns
                        Bit     4       WIMP shift toggle
                                        0 = Normal toggle action (D)
                                        1 = Never obscure icon bar
                        Bit     5       Reserved
                        Bits 6,7        State of last shutdown
                                        00 = Don't care (D)
                                        01 = Failed
                                        10 = Due to power loss
                                        11 = Undefined
        1D      03      Mouse type CMOS
                        0 = standard quadrature mouse
                        1 = Microsoft compatible serial mouse
                        2 = Mouse Systems Corporation serial mouse
                        3 = PS/2 mouse (D)
                        4-255 = Reserved
        1E-21   00      NC static IP address (was User CMOS)
        22-25   00      NC boot server IP address (was User CMOS)
        26-29   00      NC gateway IP address (was user CMOS)
        2A-2D   00      NC sub-net mask (was User CMOS)
        2E-3B   00      Third party software CMOS
        3C-4F   00      Podule extra CMOS (podules 4-7 and network slot)
        50-6A   00      NC boot mount path (was ShareFS CMOS)
        50      XX      ShareFS net number
        51      XX      ShareFS marker
        52-69   XX      ShareFS remote disc names
        6A      XX      ShareFS modified ADFSFiler bits
        6B      XX      Printer ID CMOS
        6C      00      Configured monitor mode CMOS
                        Bits 0-4        Resolution
                                        0 = 640x480
                                        1 = 800x600
                                        2 = 1024x768
                                        all other values reserved
                        Bits 5,6        Pixel depth
                                        0 = 8bpp
```

```
                                1 = 16bpp
                                2 = 32bpp
                                3 = reserved
                        Bit 7   High frame rate bit
                                0 = use standard frame rates
                                1 = use high frame rates
6D      00              Miscellaneous NC flags
                        Bits 0,1        Printer paper size
                                0 = A4
                                1 = US letter
                                2 = US legal
                                3 = Use general PaperSizes file
                        Bit 2           Static IP enable/disable
                                0 = disabled
                                1 = enabled
                        Bits 3-7        Not used
6E-6F   00              Not used
70-73   00              Podule 0 CMOS
74-77   00              Podule 1 CMOS
78-7B   00              Podule 2 CMOS
7C-7F   00              Podule 3 CMOS
80      60              Current year (D=96)
                        Must be set during manufacture
81      13              Current year (century)  Decimal 19
82-83   00              UNPLUG bytes 6 and 7
84      A4              DumpFormat & 16-bit sound
                        Bits 0,1        Control characters print control
                                00 = Print in GST format : |M   (D)
                                01 = Print : '.'
                                10 = Print decimal
                                11 = Print hexadecimal
                        Bit    2        Top bit set character control
                                0 = Control characters
                                1 = Valid       (D)
                        Bit    3        8/7 bit ASCII control in *Dump
                                0 = Send character unaltered    (D)
                                1 = AND character with &7F
                        Bit    4        Tab size control
                                0 = Don't treat tab as 8 spaces (D)
                                1 = Treat tab as 8 spaces
                        Bits 5,6        16-Bit sound control
                                0 = No 16-bit sound output, use mu-law
                                1 = DAC clock is slave. 11.2896MHz
                                        external clock
                                2 = DAC clock is slave. No external
                                3 = DAC clock is master. External clock
                                        must be used for 16-bit sound.
                        Bit    7        Sound quality control
                                0 = No quality adjustment
                                1 = Perform sample interpolation
```

```
85      FD      Sync, monitor and mode information
                        Bits 0,7        Sync type
                                        00 = Separate syncs
                                        01 = Composite syncs
                                        10 = Reserved
                                        11 = Auto syncs (D)
                        Bit    1        Not used - set to zero
                        Bits 2-6        Monitor type
                                        00000 = Monitor type 0 Normal
                                        00001 = Monitor type 1 Multisync
                                        00010 = Monitor type 2 Hi-Res Monochrome
                                        00011 = Monitor type 3 VGA
                                        00100 = Monitor type 4 Super VGA
                                        00101 = Monitor type 5 LCD
                                        00110 = Monitor type 6 Third party use
                                        00111 = Monitor type 7 File
                                        01000 = Monitor type 8
                                        to
                                        11110 = Monitor type 1E - Undefined
                                        11111 = Monitor type 1F Auto    (D)
        86      10      FontSize (units of 4k)  D=16 (64k)
        87      XX      New ADFS CMOS byte #1
                        Bits 0-2        Number of floppy disc drives    D=0
                        Bits 3-5        Not used
                        Bits 6,7        Number of IDE hard discs        D=0
        88      XX      New ADFS CMOS byte #2
                        Bits 0,1        Step rate - floppy disc 0       D=3
                        Bits 2,3        Step rate - floppy disc 1       D=3
                        Bits 4,5        Step rate - floppy disc 2       D=3
                        Bits 6,7        Step rate - floppy disc 3       D=3
        89      XX      New ADFS CMOS byte #3  File buffers
                        (ADFSBuffers)
                        0 = no 1k buffers
                        1 = no. of buffers depends on memory size       (D)
                        1MB = 2x 1k buffers
                        >1MB = 4x 1k buffers for each MB installed
                        >1 = n x 1k buffers
        8A      60      CDROMFS CMOS
                        Bits 0-4        Number of CD-ROM drives D=0
                        Bits 5-7        Buffer size
                                        000 = None
                                        001 = 8K
                                        010 = 16K
                                        011 = 32K       (D)
                                        100 = 64K
                                        101 = 128K
                                        110 = 256K
                                        111 = 512K
        8B      00      Time CMOS
                        Indicates the offset from UTC(GMT) to the current time
                        zone. The byte is a signed 2's complement number, this
```

```
                represents the number of 15 minute increments required.
8C      83      Desktop features CMOS
                Bit    0        Chosen RISC OS look
                                0 = 2D (RISC OS 2.00 style) look
                                1 = 3D look     (D)
                Bits 1-4        Desktop font setting:
                                0 = Use Wimp$Font and Wimp$FontSize
                                1 = Use system font
                                2-15 = use ROM font
                Bits 5-6        Reserved
                Bit    7        Window background tiling enabled
                                0 = tiled with tile_1   (D)
                                1 = not tiled, ie grey1
8D,8E   00      UNPLUG bytes 8 and 9
8F      00      Screen size (units of pagesize)
90      00      RAM Disc size (units of pagesize)
91      00      System heap size (units of page size)
92      00      RMA size (units of pagesize)
93      00      Sprite size (units of pagesize)
94      F0      Sound default parameters
                Bits 0-3        Channel voice 1-16      D=0 (Voice 1)
                Bits 4-6        Loudness        D=7 (Volume 7)
                Bit    7        Not used
95-98   00      NC DNS IP address
99-9D   XX      Printer server name bytes 2 to 6
9E      00      Modem CMOS
                Bits 0-3        Prefix digit + 1 (0 => no prefix)
                Bit    4        Wait for second dial tone
                                0 = don't wait
                                1 = wait
                Bit    5        Dial type
                                0 = tone dialling
                                1 = pulse dialling
                Bits 6,7        Not used
9F-A1           Local dialling code
                (one digit+1 per nibble, terminated by 0 nibble)
A2      05      Modem disconnection time out
                Bits 0-5        Time out in minutes (0 = disabled)
                Bits 6,7        Not used
A3-A5   00      Not used
A6-AB   00      Machine address
AC      00      Machine address check sum byte
AD-B0   00      UNPLUG bytes 10 to 13
B1-B4   00      Expn. card unplugged ROM bytes 1 to 4
B5-B8   XX      Wild cards for BASIC editor
B9      00      Configured language
BA      30      Configured country      D=48 (USA)
BB      00      Network card UNPLUG byte
BC      00      Miscellaneous flags #1
                Bits 0,1        ROMFS Opt4 status       D=0 (OPT 4,0)
```

```
                Bit    2        Cache icon enable state
                                0 = No cache icon       (D)
                                1 = Caches icon
                Bits 3-5        Screen blank time
                                000 = No screen blanking        (D)
                                001 = 30 Second blanking time
                                010 = 1 minute blanking time
                                011 = 2 minutes blanking time
                                100 = 5 minutes blanking time
                                101 = 10 minutes blanking time
                                110 = 15 minutes blanking time
                                111 = 30 minutes blanking time
                Bit    6        Should screen blank ignore WRCH?
                                0 = Ignore WRCH (D)
                                1 = WRCH un-blanks display.
                Bit    7        Hardware test enable
                                0 = Enable long tests   (D)
                                1 = Disable long tests
BD-C0   XX      ADFS Hard Disc map size (in sectors) for drives 4-7
C1      XX      Protection state for immediate Econet commands
                Bit    0        Peek
                                0 = Disabled    (D)
                                1 = Enabled
                Bit    1        Poke
                                0 = Disabled
                                1 = Enabled     (D)
                Bit    2        JSR
                                0 = Disabled
                                1 = Enabled     (D)
                Bit    3        User RPC
                                0 = Disabled    (D)
                                1 = Enabled
                Bit    4        OS RPC
                                0 = Disabled
                                1 = Enabled     (D)
                Bit    5        Halt
                                0 = Disabled
                                1 = Enabled     (D)
                Bit    6        GetRegs
                                0 = Disabled
                                1 = Enabled     (D)
                Bit    7        Undefined
C2      02      Mouse multiplier
C3      55      Miscellaneous
                Bit    0        AUN ROMBoot
                                0 = Disabled
                                1 = Enabled     (D)
                Bit    1        AUN Dynamic station numbering
                                0 = Disabled    (D)
                                1 = Enabled
                Bit    2        Reset CMOS Bit
```

```
                                0 = Last reset was not a
                                        Delete/Copy/R/T reset
                                1 = Last reset was a
                                        Delete/Copy/R /T reset  (D)
                    Bit    3    Power saving bit
                                0 = Disabled    (D)
                                1 = Enabled
                    Bit    4    Mode/WimpMode auto bit
                                0 = Use WimpModeCMOS
                                1 = Auto        (D)
                    Bit    5    Processor cache
                                0 = Cache enabled       (D)
                                1 = Cache disabled
                    Bit    6    Broadcast loading
                                0 = Broadcast loading enable
                    Bit    7    Broadcast loader colours
                                0 = disable     (D)
                                1 = enable
C4      00          Wimp mode
C5      6F          Wimp flags
                    Bits 0-3    Instant dragging (1=allow, 0=disallow)
                                Bit 0 position  D=1
                                Bit 1 size      D=1
                                Bit 2 horizontal scroll D=1
                                Bit 3 vertical scroll   D=1
                    Bit    4    Action on error
                                0 = beep        (D)
                                1 = don't beep
                    Bits 5,6    Allow windows off screen (1=allow,
                                        0=don't allow)
                                Bit 5 to bottom and right       D=1
                                Bit 6 to top and left   D=1
                    Bit    7    Auto open sub-menus
                                0 = don't auto open     (D)
                                1 = do open
C6      40          Desktop State
                    Bits 0,1    Display mode (Filer)
                                00 = Large icons        (D)
                                01 = Small icons
                                10 = Full info
                                11 = Reserved
                    Bits 2,3    Sort mode (Filer)
                                00 = Sort by name       (D)
                                01 = Sort by type
                                10 = Sort by size
                                11 = Sort by date
                    Bit    4    Force option (Filer)
                                0 = Do not overwrite    (D)
                                1 = Do overwrite
                    Bit    5    Confirm option (Filer)
                                0 = Do not confirm      (D)
```

```
                                1 = Do ask for confirmation
                Bit    6        Verbose option (Filer)
                                0 = No verbose
                                1 = Verbose     (D)
                Bit    7        Newer option (Filer)
                                0 = When looking, just look     (D)
                                1 = When looking, look newer
C7      XX      ADFS Directory cache size
                0 = no. of buffers depends on memory
                1MB = 2x1K buffers
                >1MB = 4x1K buffers for each 1MB fitted
C8      00      Max font cache size
C9      00      Max height of rescaled bitmaps  D=0 (16 point)
CA      2C      Max height of anti-aliased fonts        D=44 (32 point)
CB      38      Max height of cached bitmaps    D=56 (32 point)
CC      00      Max point width for horiz. sub-pixel anti-aliasing
CD      00      Max point height for vertical sub-pixel anti-aliasing
CE-CF   00      Not used (was FontMax6,7)
D0      XX      SCSIFS flags
D1      XX      SCSIFS file cache buffers
D2      XX      SCSIFS Directory cache size
D3-D6   XX      SCSIFS Disc 1 to 4 sizes        (Map Size / 256)
D7,D8   00      Not used (was Deskboot CMOS)
D9-DB   00      UNPLUG bytes 14 to 16
DC      XX      Alarm and time byte
                Bits 0-2        Format state
                                000 = Illegal
                                001 = Analogue with seconds
                                010 = Analogue without seconds
                                011 = HH:MM
                                100 = "%24:%mi:%se"
                                101 = "%z12:%mi:%se %am %zd %zmn %yr"
                                110 = Reserved
                                111 = Reserved
                Bit    3        Deletion flag
                                0 = No confirmation     (D)
                                1 = Ask for confirmation
                Bit    4        Auto save flag
                                0 = No auto save
                                1 = Auto save   (D)
                Bit    5        5 day week flag
                                0 = Disabled    (D)
                                1 = Enabled
                Bit    6        Alarm noise
                                0 = Not silent  (D)
                                1 = Silent
                Bit    7        Daylight Saving Time flag
                                0 = Normal time (non-DST)       (D)
                                1 = Daylight Saving Time (DST)
DD      00      Wimp Drag Time
DE      00      Wimp Drag - Move Limit
```

```
DF      00      Wimp Double - Click Time
E0-E5   XX      Local print server name (overlays RISCiX CMOS)
E6      00      Power saving CMOS (overlays RISCiX CMOS)
E7      00      UNPLUG byte 17
E8      00      IR device
                Bits 0-3        Device id
                Bit    4        Device id enable
                                0 = disabled
                                1 = enabled
                Bits 5-7        Reserved
E9-ED   XX      FSLock CMOS     No locked system, no password
EE      XX      FSLock Checksum CMOS
EF      XX      CMOS RAM Checksum       Re-calculated at save time.
```

Appendix D: NetStation Modem AT Command Set

Basic AT set:

A	Answer command
A/	Repeat last command
AT	Attention command
Bn	Communication standard
	Options:
	B0 Initiate calls using ITU-T V.21 at 300bps and ITU-T V.22/V.24bis at 1200bps and 2400bps
	B1

Note: All commands except A/ must be prefixed by AT

To be finished.

Appendix E: NCFresco Plugin API Specification

To be cleared for release.