DRAG'N DROP

5th birthday issue

Hardware
Raspberry PI B+
LCD Backpack

Languages
Armcode corner
RISC Lua

Programming
Wimps
Thumbnailer
The Exif Files

PACKED WITH USEFUL STUFF

HANDLE WITH CARE

RISC OS

London Show 2014

This year's London Show is not to be missed. Just a few of the highlights:

- The super-fast ARMiniX and PandaRO
- Lots of hacks on the Raspberry Pi
- RISC OS 5.20 for all machines
- Impression X
- Classic games

Saturday 25th October   11am to 5pm

St Giles Hotel, Hounslow Road, Feltham, TW14 9AD
More information and the latest news on the show website:

http://riscoslondonshow.co.uk

Organised by the RISC OS User Group Of London

http://rougol.jellybaby.net

ROUGOL

EDITORIAL

Welcome to the first issue of volume 6! I hope you had a good summer and are looking forward to the RISC OS London show. Hope to see many of you there!

I am excited about the beta release of Impression X and even wondering whether I will be able to use it for production of the magazine. Easiwriter deserves continued support but it's a document processor not a proper DTP package.

All that's left to say is enjoy the issue, packed with lots of varied stuff as usual, and particular thanks to the contributors.

Chris.

Christopher Dewhurst

At a glance...

Beginner's Bit

Programs listed in *Drag 'N Drop* are assumed to work on all machines with RISC OS 5 e.g. Raspberry Pi, unless otherwise stated

To get the BBC Basic prompt press F12 and type *BASIC and press Return. Type AUTO for automatic line numbering.

To return to the desktop type *QUIT.

You can also type programs in a task window, hold down Ctrl and press F12. You can't use the cursor editing facility or change MODE, however.

```
Task window
*BASIC
ARM BBC BASIC V
version 1.54
Starting with 651516
bytes free
>
```
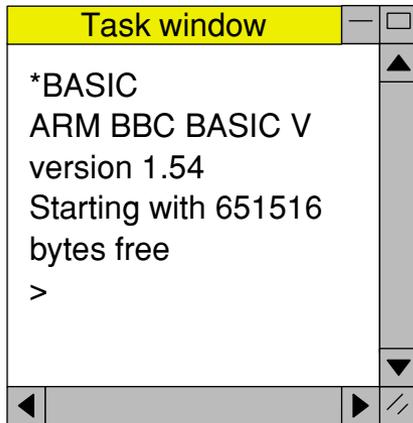
Type SAVE "prog" when you are ready to save your program where "prog" is the program's name.

You can also program and run Basic programs from the desktop. Double-clicking on the filer icon runs it, holding down Shift and double clicking loads it into your text editor.

```
Filer
Display         ▶
File "
Select all
Clear selection
Options         ▶
New directory   ▶
Set directory
Open parent
Refresh
```
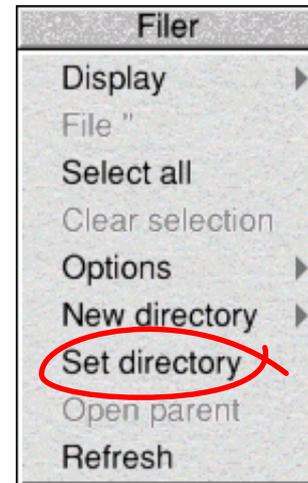
To set the current directory, click the filer menu and select "Set directory".

Or use the EasyCSD application listed in this issue.

News and Apps

Raspberry PI B Plus

The third model of the Pi was released in July 2014. It has four built in USB ports (compared to the two on the B), more pins on the GPIO (user) port and a micro-SD card slot. Cosmetic improve-

The new Raspberry Pi B+ (above) and model B (below)

ments include a slight juggling of the components meaning they don't 'stick out' so much.

At *Drag 'N Drop* we like the additional USB ports but find the micro-SD card card a bit fiddly.

As usual you can make up your own RISC OS card or buy one from www.riscosopen.org. The bare B+ itself costs around £30 and is available from most electronics retailers; at *Drag 'N Drop* we got ours from Rapid Electronics.

RiscOSM 1.08

Shortly after the summer issue of *Drag 'N Drop* went to press, Sine Nomine released an update to the vector mapping software incorporating many of the improvement suggested in our review. It is still excellent value at £20 (or £18 download only) from www.sinenomine.co.uk/software/riscosm/.

RISC OS London Show

The premier computer show for the south east of England will take place on Saturday 25th October at the St Giles Hotel in Feltham. See the website at www.riscoslondonshow.co.uk.

Come along to the *Drag 'N Drop* stand for special offers. Early reports indicate that the long-awaited Impression X is ready for a beta release and a mystery new product is going to be unveiled . . . .

Le RISC de France

A new French website has been developed (with an English page too) for RISC OS 5 users. The site including fonts, system sounds, and wallpapers for download and can be reached at www.riscos.fr.
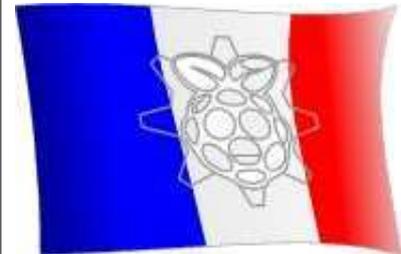
LCD Backpack (Part 2)

In the Summer issue of *Drag 'N Drop* I presented a RISC OS module to drive three pieces of equipment you can attach to your Pi – the LCD display, Real Time Clock module and Hobbytronics Backpack.

We used the I2C connection *("eye squared sea" as it's known to its friends – Ed)*. I have made improvements to the module and added code so you can use the serial port connection as well as the I2C connection. See the Display2 listing at the end of this article.

I have altered the Write0 routine to exit if the buffer is full and the next byte doesn't contain a zero. Similarly, WriteS routine has been modified.

Line 110 sets *buffer_max* to 60. This I believe is the maximum characters the Hitachi LCD's can display. You can alter the lines now or leave them until we come onto routines for the serial port.

The flashing screen routines have had to be altered because if they get called while the processor is in supervisor mode the return address in R14 will be corrupted when we call *IIC_Control* or *PiSerial_TX*.

Now to the serial port. First, change line 160 to DIM code% & 1300.

Change line 490 to a later date e.g. EQUS "1.01 (16 Jul 2014)" so RISC can tell which version is the one to load. You may like to change the REMark in line 20 to July also.
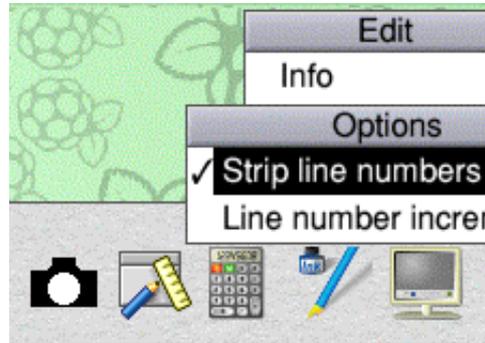

Figure 1

Save the program and click the Menu button on Edit's iconbar icon. Move the pointer to "BASIC options" across to the right to bring up the Options menu. The Strip line numbers should be showing a tick next to it (figure 1).

If there isn't, click to set the option to strip the line numbers. When we drag our Basic program on Edit's icon bar icon Edit will open without showing the line numbers.

I cobbled together a little program to dump the screen *(if you've bought the associated programs it's in the 6i1progs. programs directory – †Ed.)*. I learned to program the Wimp from the PDF book in $.Documents.Books.Beginners Guide Wimp.

The black camera on the icon bar shows it's running. It just saves a screen dump 15 seconds after it is started then every 5 minutes if it is left to keep running.

Use the window scroll buttons to position the text until the *.table* label is at the top of the and the window. Make the window as tall

THE EXIF FILES

You may have heard of the term Exif in conjunction with digital cameras and mobile phones. There are a few Exif utilities for RISC OS (e.g. ExifEdit) but what exactly is Exif?

EXIF stands for EXchangeable Image Format. Neither do I know why it wasn't plain EIF. (Probably "exif" is easier to say.) It forms an invisible part of Jpeg photo files.

It's also used in audio and video files but we won't be looking at those.

Exif stores information about the picture which can include when the photo was taken, camera manufacturer and even *where* the picture was taken. This type of secret information is sometimes called "metadata".

Somebody could actually snoop on your your mobile phone's camera pictures to tell exactly where you were by looking at the Exif information embedded within it.

Jpegs contain hidden information including thumbnail images

Some devices even store the latitude and longitude using GPS. If you are concerned for your digital privacy, read on because you can freely alter the Exif file or even remove it altogether (though of course we wouldn't be teaching you that sort of skulduggery in *Drag 'N Drop* would we?)

The Exif standard was established in the mid 1990s with several updates in the intervening years. All modern devices use Exif.

It's possible you will come across old Jpeg photo files without Exif because the Jpeg standard predates it.

For this article you need a Jpeg from your digital camera or mobile phone, which should not have been processed by any software e.g. ChangeFSI.

Make a copy of it (just in case you accidentally corrupt it!) What I do is to remove the memory card from my camera and insert it into a card reader connected to my Pi. Click on the icon which looks like a memory stick to open a filer window.

You should see a folder called DCIM. All digital cameras I know of store their photos in a folder called DCIM. It stands for Digital Camera IMages (neither to I know why they didn't just call it plain DCI). Drag and drop one of the Jpeg files onto a

Writing a simple app (Part 3)

Last time in our Wimps programming tutorial we got to the stage of putting the calculator's icon on the icon bar and opening a menu on the iconbar icon.

The iconbar menu included an About option which opened a side window to give details about the name, purpose and version number of the program.

This is pretty standard and you will have seen it in other desktop applications. However you might have been wondering why you couldn't move the window around the screen.

The reason is that we didn't have any code to deal with Wimp event number two is which is a request to open a window. Even though the Info window was opened, RISC OS needs to close and redraw it at the new position when you drag it around.

So insert the following line

```
WHEN 2:SYS "Wimp_OpenWindow",,
block%
```

after the CASE event% OF.

Before we get down to some hardcore programming let's have a bit of fun. Your task for today is to use WinEd to design the calculator keypad window:

There are 18 icons, or buttons to make. Remember, RISC OS regards an icon as any rectangular area of the desktop so the word 'icon' and 'button' are synoymous. If you are at all uncomfortable about using WinEd refer back to the tutorial in the

Winter 2014 edition of *Drag 'N Drop* .

Ensure WinEd has been seen by the filer and double click on !MyCalc.Templates to open it WinEd. Create a new window called 'main'.
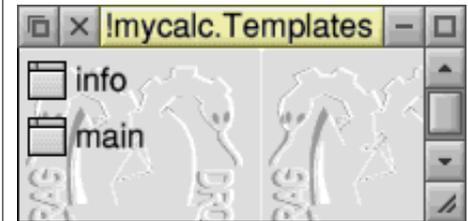
Double click the main icon. Click the Edit title button and type Calculator in the Text/sprite box in the Data options.

Close it and click the Edit window button. Ensure that only the following options are clicked under Tools: back icon, close icon, title bar. Don't worry about the options further down, leave them as they are.

Drag a display field onto the 'main' window. Use the
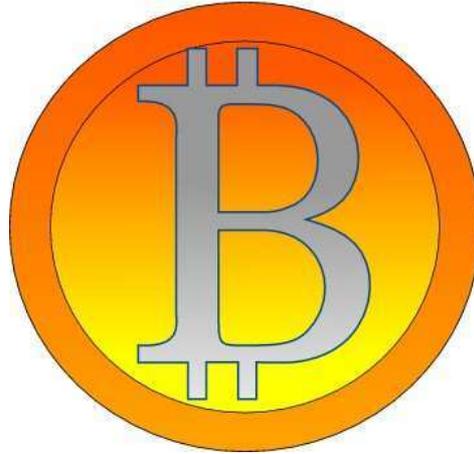
Bitcoin (Part 2)

Risks & Benefits

First the Sales Pitch. Bitcoin is a form of digital currency which can be used either to hold your savings to pay for things online or simply to transfer money from one person to another.

As an online payment system, Bitcoin is similar to Paypal. But unlike Paypal the transaction fees are virtually zero which should, in the long term, benefit both buyers and sellers.

`Using Bitcoin, it is also possible – for the first time – to transfer money from any part of the world to any other using just two computers or mobile phones.

And it is possible to do this, without having to pay either foreign exchange, or transaction fees, thus providing a much cheaper alternative to services like MoneyGram and Western Union.

As the system improves and gains wider acceptance, Bitcoin is increasingly going to challenge Paypal as the major online payment system, and Western Union as the main way of sending money around the world.

More and more businesses are accepting payment in Bitcoin every day, and it is likely that the world's largest online retailer, Amazon, will soon be accepting it as well. The online travel agent, Expedia, is doing so already.

This is hardly surprising when you consider that the total value of the bitcoins already in circulation is around £5 billion!

And as its use increases, and the Bitcoin economy grows in size the value of one bitcoin is likely to rise rapidly because the value of one coin is underwritten by the fact that there can only ever be 21 million of them.

The problem with ordinary currencies is that governments can simply print as many pounds, euros or dollars, as they want – steadily eroding the value of their citizens' savings. So, as long as you can keep them safe, the fixed total number of bitcoins should make them a far better store for people's savings than conventional currencies.

In a few years time, one bitcoin – currently worth about £450 – could well be worth tens of thousans !

Some people are already working for companies that pay their wages entirely in bitcoins, and they can pay for virtually anything they want, anywhere in the world, using this new currency.

Digital currencies have the potential to allow people to do business with one another, more

Putting the bits together

Everybody has heard of the buzzword *modularization* or the slogan *divide and conquer*. To cope with the large and complex you have to break up problems into small pieces. Either so that they can be reused or so that many people can work on the problem in a team, each concentrating on their own small piece.

I am not sure what is the right buzzword or slogan for the art of sticking the pieces back together. *Linking* or *interfacing*, perhaps? This is just as important, especially as in the team scenario it involves information hiding; protecting one member from the mistakes of others.

It also involves *protocols*, the prior agreements that the team has to enforce upon its members to ensure mutual intelligibility.

A programming language, if it is to be used for anything other than small programs, must provide the means for modularization.
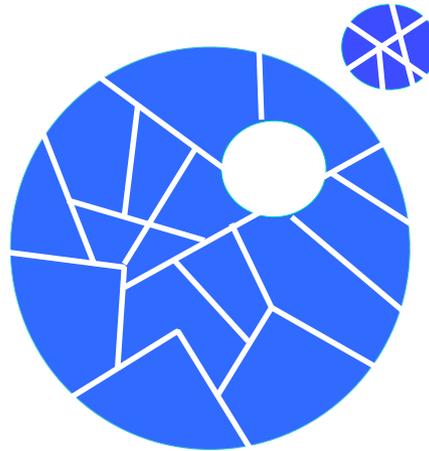
BBC Basic offers the LIBRARY and INSTALL keywords in this respect. Certainly large programs, and libraries of functions and procedures, have successfully been written in Basic.

But Basic can hardly be said to have been designed with modularization in mind. More recent languages have, however.

The good thing about large libraries of procedures written by other people is that they save you from having to reinvent the wheel.

The bad thing is that you cannot use them unless you know what the library procedures actually do. A library without good searchable documentation and tutorials is unusable.

Perl and Python come with extensive libraries. Learning the syntax of these languages requires only a miniscule fraction of the energy that has to be put into knowing about their libraries.

These are *batteries included* languages unlike Lua which has at times been castigated for taking a contrary tack: only providing a minimum of libraries in the interests of simplicity.
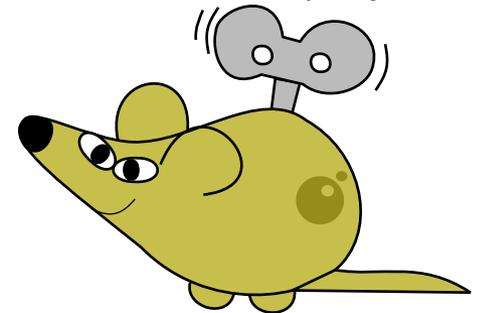
Lua is not a batteries-included language.

Previous articles on RiscLua in *Drag 'N Drop* have concentrated

Mr.Frog's Armcode Corner
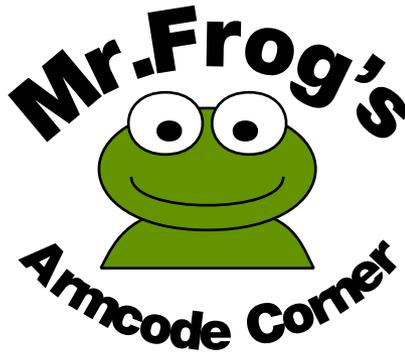
So far in Mr F's corner we've spent a lot of time talking about Armcode but doing very little. This time it's all different and you get to do some scary stuff like writing code! A quick recap though:

● Armcode instructions always fit into four bytes (one word) of memory.

● Armcode instructions look like:

■ ■ , ■ , ■

where the red box tells the machine to do *something*, the green and blue (and occasionally the yellow) boxes are the registers to do the *something* with.

● There are sixteen registers numbered 0 to 15 but reg 15 is special because it's the program counter (PC to its friends). It tells the computer where in memory it's got to in running your armcode.

Type in and run program 1, which assembles some code to greet the amphibian world. You'll see Basic give a commentary on what it assembles.

The first three lines of program 1 are compulsory for *any* assembly program. The DIM statement puts aside some memory,100 bytes to be precise. P% has a special meaning in Basic, it gives the address in memory where the code is to start.

We said just now that reg 15 is the program counter (PC). The PC starts equal to P% and as each instruction is obeyed the PC is incremented until the last instruction. Remember your three Ps – Program counter, P%, Position in memory.

You can see by looking down the left hand side that the code begins at address &8FA4 and ends at &8FBC. So the PC starts at &8FA4 and ends up at &8FBC.

The [in line 30 is called an opening square bracket and means that all instructions following are armcode, so no more Basic is allowed until the closing square bracket.

Words beginning with a full stop are labels. If somebody asked you where the nearest cash machine was you wouldn't give them the latitude and longitude, you would tell them that there's one in Poundland, or the Post Office or wherever. Likewse

```
00008FA4
00008FA4                  .mess
00008FA4                          EQUS "Hello Pond!"
00008FAF 00                       EQUB 0
00008FB0          .biz
00008FB0 E24F0014                 ADR R0,mess
00008FB4 E3A01000                 MOV R1,#0
00008FB8 EF000002                 SWI "OS_Write0"
00008FBC E1A0F00E                 MOV PC,R14
```

Figure 1

Delegate review

A desktop bin is a standard feature of all modern day operating systems. RISC OS didn't have one to start with, RISC OS Select added one but it was unfortunately removed when RISC OS 5 came along.
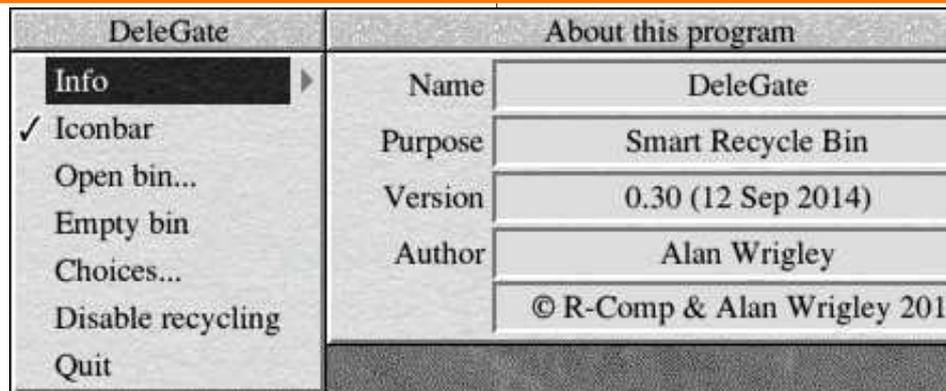
So we had no back up for file deletion anymore.

You wouldn't find this on any other platform these days so it seemed weird that such a useful function was removed.

I lost some articles I was writing for the now defunct magazine *Risc World.* Although I had earlier back up versions it was annoying to lose the finished articles,

I found a simple freeware desktop bin later on to prevent this from happening again.

Delegate is a desktop file bin. You can choose how the files you delete from the computer are managed and where you store them.

Using Delegate is straight forward – once installed the icon will appear on the icon bar on the left hand side.

Clicking the menu button on the icon gets you the program menu with a number of options – Iconbar icon yes or no, open bin, empty bin, the choices menu and disable recycling.

If you click on Choices this will take you to the main configuration area of Delegate. Here you can set up how the program will work with your computer.

In the Choices... section you can select to run the program automatically at boot up. Also you can opt to expire the bin automatically after a number of days (it will delete the folders in the recycle bin) or you can leave it to never delete anything.

In the Master bin section, you select where you want to keep the master bin. I keep mine in !Scrap so it is easy to find.

I haven't used Remote Bins but that is for setting up recycle bins on other drives.

Boot guard is a useful feature which protects !Boot from deletion.

ADFS::Iyonix.$.!BOOT.Resources.!Scrap.ScrapDirs.ScrapDir.D

DeleGate configuration
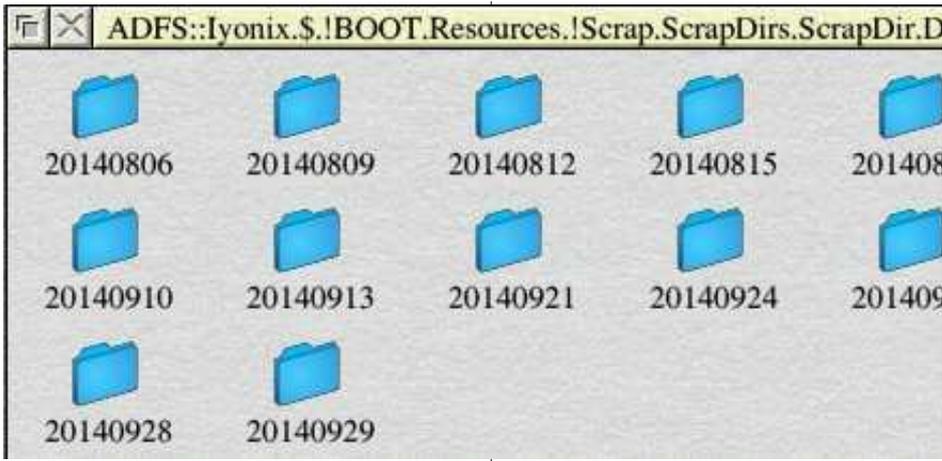
Then there is an Ignore option to specify drives to ignore. The final option is Protect which allows you to protect certain files and drives from deletion of files.

Delegate also has built in help option which clicking on the blue information sign will tell you what that section of the menu does.

Delegate fills a gap in the market for an application that really should be part of the core operating system.
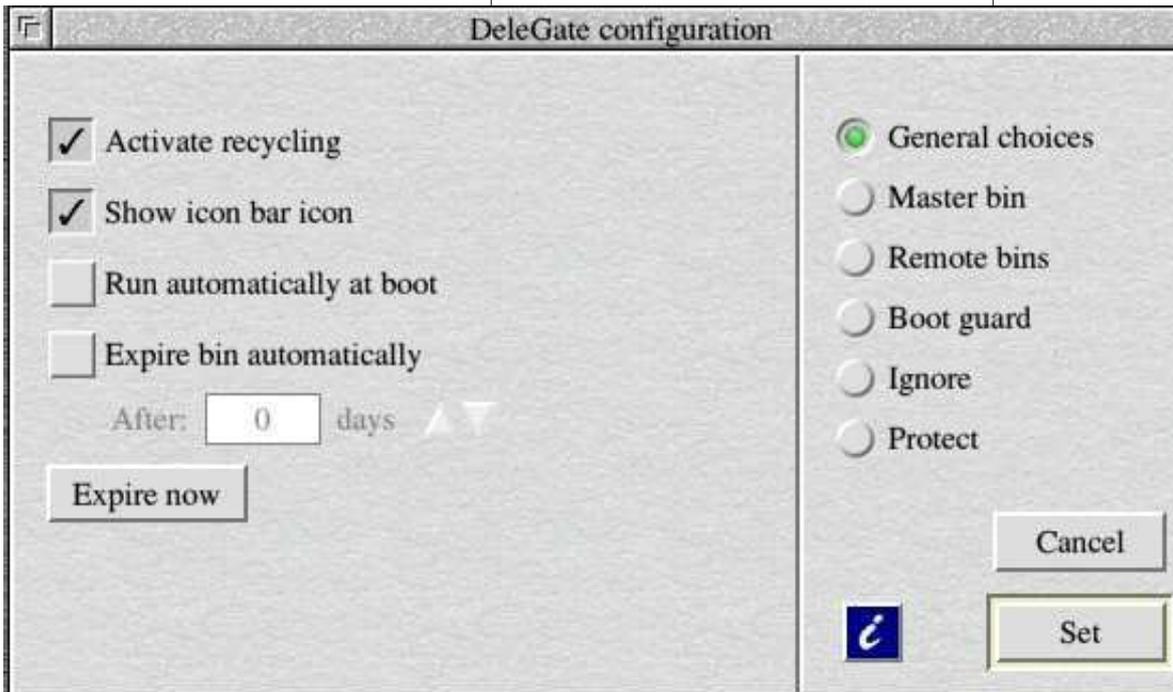
● Delegate is highly recommended. It costs just £12.99 and is available from R-Comp and is available to buy in the PlingStore.

A simple thumbnailer

Thumbnails are postage stamp sized versions of photos which enable quick and easy viewing of pictures. Instead of opening full sized photos one by one (which could each be several megabytes) you can flick through the thumbnails and identify the one you want.

Several thumbnailing applications already exist for RISC OS. However, I like to keep things simple (like my good self). The article on Edit's find and replace in the July 2014 issue of *Drag 'N Drop* inspired me to write this article, which is presented as like slide show or step-by-step guide.

I learned a lot about Edit's find and replace language, it's tricky to learn but powerful once mastered.

We use Edit and ChangeFSI to create a sprite file of thumbnails. ChangeFSI is located in the Utilities folder on your hard disc and of course Edit is in the Apps folder accessed by the icon bar.

Step 1

Open a blank Edit document and open filer window on your photos:

Almost all digital cameras put their images in a folder called DCIM on their memory card and some cameras have sub folders for every month.

Files Inside Out

What are little files made of?
Bits and bytes,
Ascii, words and other types.
That's what little files are made of

Like many other operating systems you double click a file on RISC OS to run it, assuming the application which runs it has been installed on your machine.

But on RISC OS you can open any file in a text editor, either by holding down the shift key and double clicking, or dragging the file onto a text editor's icon on the icon bar.

Try doing this with one of the Maestro files inside Documents. Music. Or in fact any file which isn't a text file. Have you wondered what all those strange characters mean?

It's a *binary representation* of the file. Numbers (bytes) are organised in a certain way so that the application loading it knows what to do with it.

The first few bytes of a file usually give the name of the application which processes it, for example Maestro.

Now, normally in *Drag 'N Drop* we use Edit. For an application which comes free with the operating system it's very good, particularly compared to the text editors on other platforms. But it's rather limiting for the sort of work we'll be doing.

If you don't have it installed already, get StrongEd (it's free) from the downloads page at http://stronged.iconbar.com/ You need to click on **se469f6.zip**. It's currently version 4.69, ignore the rest of the gobbledygook on that page.

You also need a *Modes* file. This isn't anything to do with the Basic screen mode. It's a set of instructions to StrongEd to display the binary in a particular way, grouping bytes together or even making an attempt to disassemble machine code.

The one we need is RISC OS on the "Modes database" page.

Download the RISC OS modes file, unzip it and copy it over the StrongEd app wherever you have it installed and the relevant modes file is installed.

To check that it works, load up !StrongEd and drag **BachFXVI** file onto its iconbar icon.

StrongEd will display the binary like Edit except colour code the printable characters in black, punctuation marks in green and control codes in red.

Click Menu > BaseMode > Change mode >. You will see a dozen or so modes on the menu – click Dump.

Easy CSD

Frequently in *Drag 'N Drop* we call for the currently selected directory (CSD) to be set before typing in listings.

This can be done by navigating to your desired location and choosing 'Set Directory' from the filer window but the small application listed here provides a much easier method.

EasyCSD puts an icon on the bar and to set the directory simply drag the relevant directory icon to it. If you drag a file (and not a directory) it will set the CSD to the directory the file is in.

Before typing in the listing you'll need to set up an application directory. Click menu over a filer window and choose New directory > !EasyCSD.

Next you'll need a suitable icon. The easiest way is to modify a built-in one. Press menu over Apps iconbar icon and choose the only option there – Open $.

Double click on Resources and scroll down to open the Wimp directory and double click on Sprites. These are the standard icons used by RISC OS.

Locate the 'directory' icon and drag it out and back onto Paint's icon bar icon and you'll see:
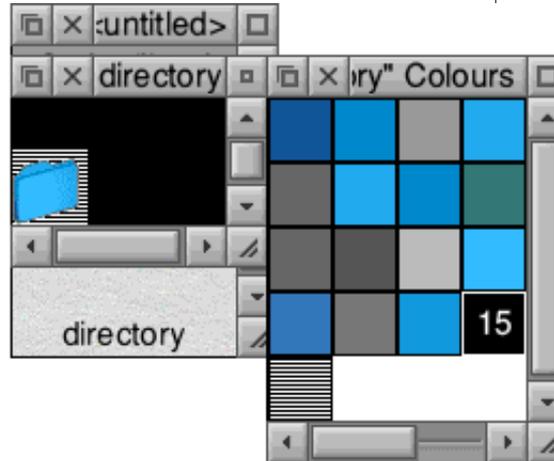
Click menu over the <untitled> window (backmost in the above picture) and choose Sprite 'directory' > Rename. Delete directory and type !easy-csd. Enlarge the sprite (front left) by menu > zoom to 8:1. Either

choose the black (15) colour or a dark grey in the colours window (above right).

Click menu > show tools and click the text (AZ) icon. Type CSD in the box and 'stamp' the text onto the directory sprite. It should now look like the picture below.

Save the sprite inside !EasyCSD as *Sprites*. Now load up !Edit and choose Create > Obey. In the Edit document type the one liner:

```
iconsprites <obey$dir>.sprites
```

save it as !Boot inside !EasyCSD. What this does is to make RISC OS recognise the icon you made as belonging to the application we're building.

C is a computer programming language. It was the successor to a language in the 1960s called B. The next letter in the alphabet is C so that's one reason why it was called C.

These days there are all sorts of fancy versions like C+, C++, C# and even C++11 . . . computer folk have no real imagination! But they are all based on C which is what we'll be talking about.

A second reason is that it is a **C**ompiled language, instead of an interpreted one like Basic. If you have had even the slightest encounter with assembly language then you'll know that you have source code (assembly) and object code (machine code or ARM code).

Object code is the compiled version of the source code such as assembly language and it can be *RUN, or double clicked.

A third reason is that there are **C**onventions. C is very strict and there are rules which must be observed before you can even get a C program to compile, let alone work. More of that in a moment.

Unlike BBC Basic there is no built-in C in RISC OS so you have to get one and there's a lot of setting up to do.

There are two C compilers for RISC OS. There is a commercial one called Norcroft, also known as Acorn C,and is available on either the NutPi pack, and a free one called GCC. We will look at the free one first.

Navigate to www.riscos.info/index.php/GCC_for_RISC_OS. The Cs in GCC have nothing to do with the programming language C. GCC stands for "Gnu Compiler Collection" of which C is just one language.

There is the basic package with several supporting files. First of all download the "base GCC with C support" zip file. It weighs in at a massive 21 megabytes which expands to about 58 megabytes so make sure you have enough room on your hard disc. Inside the zip file GCC4_4/1/2-Rel2 are two folders. Copy only the Apps folder and drop it on the root directory of your hard disc (e.g. 16GbPi). It will merge with the Apps folder on your hard disc.

When the unpacking is complete, open up Apps and you will find you have a folder therein called Development , and inside that is the !GCC app.
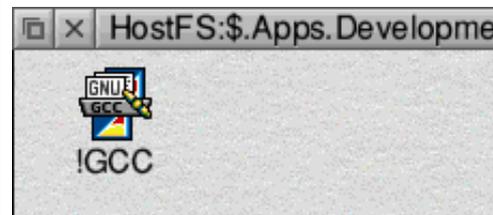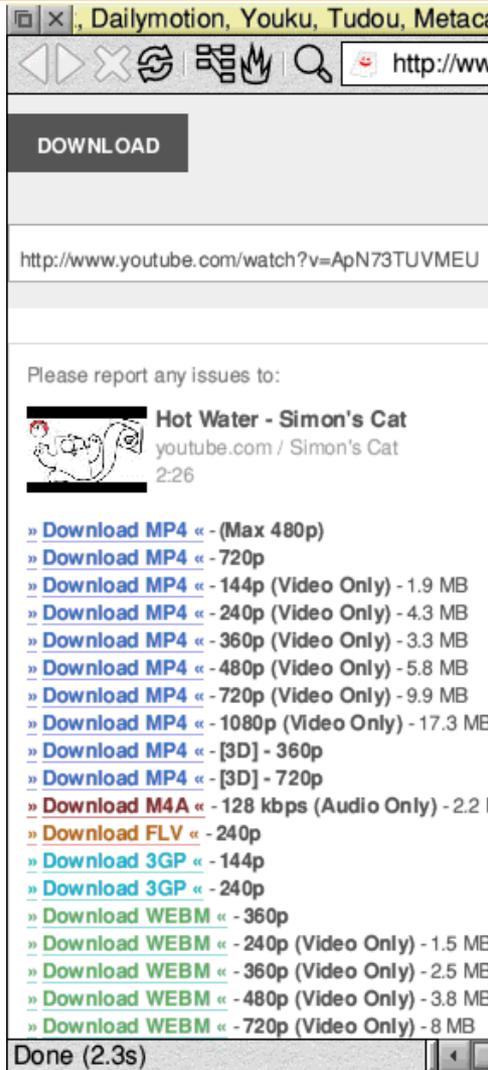

The C programming language relies on what is called *shared libraries*. *Shared* because other applications you run on the desktop make use of them, and *libraries* because the code inside the libraries are like books in a

Weblog – Keepvid

Keepvid.com is a website which allows you to save offline copies from websites like YouTube. The good news is that it works with Netsurf on RISC OS. The not-so-good news is that you'll still have to do some conversion (using !FFmpeg) so you play the video the native video player, KinoAmp.

If you don't already have KinoAmp, download it from http://users.skynet.be/Andre.Timmermans/image/kinoamp/kinoamp.htm and FFmpeg is at http://www.users.on.net/~belles/software/ffmpeg/.

In Netsurf open a window and go to http://www.keepvid.com. Open another window and go to http://www.youtube.com. Find a video you like (for example *Simon's Cat in Hot Water*). Position the pointer over Netsurf's URL bar at the top and click and drag the URL (no need to highlight anything) to the Keepvid window. Drop onto the field below the Download button.

Click on the Download button and you will be presented with a list of links to various formats of differing resolutions. Usually the topmost one will be the one you need "Download MP4 (max 480p)" so click on the link and download the file to a suitble location on your hard disc.

You can also link directly to Keepvid's converter putting the web address after www.keepvid.com/?url=... though you will have to convert the punctuation to the hexadecimal equivalent - %3A for colon, %2F for slash, %3D for equals.

Start up !FFMpeg. This utility's aim in life is to convert everything to MPEG format for playing on RISC OS. Drag the downloaded file to its iconbar icon. There is a short pause whilst FFmpeg examines the file to see what the format is. Then the main window opens with the filename of the video at the top. Add a /mpg extension and drag and drop the icon to another location on your

DOWNLOAD

http://www.youtube.com/watch?v=ApN73TUVMEU

Please report any issues to:

Hot Water - Simon's Cat
youtube.com / Simon's Cat
2:26

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» Download WEBM « - 240p (Video Only) - 1.5 ME
» Download WEBM « - 360p (Video Only) - 2.5 ME
» Download WEBM « - 480p (Video Only) - 3.8 ME
» Download WEBM « - 720p (Video Only) - 8 MB

Done (2.3s)

Weblog – archive.org

Having nothing to do with the somewhat erratic RISC OS mag called *Archive*, this website is a worldwide repository of historical data including RISC OS software and magazines.

Several CD-Roms are available for download. We take a look at the *pret-a-manger* applications – software which can be run on the Pi with no modification or update required.

The CDs are in image (ISO) format which means they are very large (500ish megabytes) and take an hour or so to download. You'll then have to burn them onto a real CD media, or use !CDfaker. If you are part of R-Comp's PiPlus scheme you will have this on your hard disc already. If not get it from www.huber-net.de/cdfaker.html.

To set up a CD-Drive and get CDFaker to respond to a double click on ISO images (filetype & DF6) insert the following star commands in !Boot.Choices. Boot.PreDesktop – underneath the 'Put other things which need setting up here' line:

```
*configure cdromdrives 1
*set alias$@runtype_df6 cdfake
r_mount 0 %%*0
```

Then set the filetype of the download, double it and click on the CD drive icon to open a filer window on the CD's contents.

Software is stored in compressed format, either /zip or /arc. SparkFS can handle both types but may need to be 'taught' to open /arc files on double click which can be done by inserting the following line in !SparkFS.!Run, just after the Set File$Type_.... lines:

```
*Set Alias$@RunType_A91 SparkF
SFiler_OpenDir %%*0
```

The apps discussed below are from the Bike Ride 2 CD 1 collection.

Sky Guide

This is an astronomy app which shows you what to see in the night sky by projecting the celestial sphere on the desktop, correct for the date and time and your position on Earth. There is a comprehensive search feature for finding stars and constellations. Click on any astronomical object on the screen for information.