Using the PIC18F4620 or PIC18F4520

Historically, MIOS was developed to run on a core module stuffed with a PIC18F452. Recently, the PIC18F4620 has become available. It is near code-compatible with the 452, but features a significant increase in RAM/EEPROM/Codespace. See the PIC18F4620 page for details.

The following are intructions on converting old apps, and developing new apps, to run on the PIC18F4620. Small changes to the procedure make it compatible with the PIC18F4520 also.

OS Layers

MIOS v1.9b or above is required. You will need to download the MIOS source from The uCApps.de Download Page or Directly. I recommend checking the first link for the latest version, as the '4620 is current in beta.

The Bootloader and MIOS recompile steps which follow should not be necessary for most cases of '4620 use, as these components are now available precompiled and packaged in a zip file hosted on uCApps.de Instructions follow for reference only, or for '4520 use.

Bootloader

Bootloader v1.2, which is packaged with MIOS v1.9 and up, will need to be recompiled as follows:

- Extract the MIOS source files from the zip
- Edit bootloader\main.asm
- Change

```
#define PIC_DERIVATIVE_TYPE 0
```

To

```
#define PIC_DERIVATIVE_TYPE 1
```

- Compile the project 

wiki link

- Burn the hex file to the PIC 

wiki link

MIOS

The MIOS Operating System itself must also be compiled, as follows:

- Edit src\mios.h from the MIOS source files
- Change

```
#define PIC_DERIVATIVE_TYPE 0
```

To

```
#define PIC_DERIVATIVE_TYPE 1
```

- Compile the project Fix Me! wiki link
- also see: Compiling the MIDIbox source on Linux - using GPASM (Linux, Mac) instead of MPLAB (Windows)

- Upload the hex file with MIOS Studio Fix Me! wiki link

Please note that the above instructions should work for PIC18F4520 also. The only difference is that the PIC_DERIVATIVE_TYPE should be '2', not '1'. This stands for all of the following instructions.

Application Layer

Once your PIC18F4620 has the Bootloader burned onto it, and MIOS uploaded, you are ready to upload your application. A few modifications may be required:

Migration

If you have an existing ASM-based application, which is designed for MIOS v1.8 or lower, then you will need to migrate the application to support MIOS v1.9

- Extract the 'migration' folder from MIOS source zip file
- Overwrite the files contained in the source of your application.

Take note that this may overwrite customisations you have made to your application, so please take a backup first, and a copy for comparison with the new files.

ASM

If your application is either:

1. a freshly migrated application (as above)
2. a brand new ASM-based project based on a skeleton >= v1.9
3. an ASM-based application which already requires MIOS v1.9 or greater (like MBSID v1.7303)

Then the following steps are required:

- Edit mios.h in the source of your application
- Change

```
#define PIC_DERIVATIVE_TYPE 0
```

To

```
#define PIC_DERIVATIVE_TYPE 1
```

- Compile the project 

wiki link

- Upload the hex file with MIOS Studio 

wiki link

C

If your application is C-based, then the following steps are required. Some are optional recommendations, as noted.

Note on compile errors

When compiling your C-based application, you may see an error such as this:

```
Linking project
warning: processor mismatch in "_output\mios_wrapper.o"
```

This error is caused by SDCC compiling the application for the PIC18F452. Fortunately, the code is compatible between the two chips, so this error can be ignored. Thanks to bill, for having the guts to put the app on his PIC, and confirm that this was the case ;)

Header and Library

In the case that you should need to take advantage of the additional EEPROM on the newer PICs, the following alterations to the library and header are necessary:

- Edit pic18f452.c in the source of your application
- Change

```
sfr at 0xfa9 EEADR;
sfr at 0xfab RCSTA;
```

To

```
sfr at 0xfa9 EEADR;
sfr at 0xfaa EEADRH;
sfr at 0xfab RCSTA;
```

- Edit pic18f452.h in the source of your application
- Change

```
extern __sfr __at 0xfa9 EEADR;
extern __sfr __at 0xfab RCSTA;
```

To

```
extern __sfr __at 0xfa9 EEADR;
extern __sfr __at 0xfaa EEADRH;
extern __sfr __at 0xfab RCSTA;
```

Note that the filenames stay as pic18f452., regardless of the PIC model we are actually using. For our purposes, SDCC considers the '4620 to be the same as a '452.*

C-Wrapper

The C-Wrapper will need to be edited as follows:

- In the source of your application, edit mios_wrapper\mios.h
- Change

```
#define PIC_DERIVATIVE_TYPE 0
```

To

```
#define PIC_DERIVATIVE_TYPE 1
```

If you want to use this function, you may want to apply a small fix to the DEC2BCD Helper:

- In the source of your application, edit mios_wrapper\mios_wrapper.asm
- Change

```
global  _MIOS_HLP_Dec2BCD

movwf   MIOS_PARAMETER1               //Moves W (the low byte of the 16-bit
integer) into MIOS_PARAMETER1 - That ain't right. See below from the MIOS
Function Reference
movff   FSR0L, FSR2L                  //These guys
movf    PREINC2, W                    //Put the high byte in W. D'oh!
goto    MIOS_HLP_Dec2BCD
```

To

```
global  _MIOS_HLP_Dec2BCD             //The low byte is already in W

movff   FSR0L, FSR2L                  //These guys
movff   PREINC2, MIOS_PARAMETER1      //Put the high byte in
MIOS_PARAMETER1. Yay!

goto    MIOS_HLP_Dec2BCD
```

Linker Script

Modifications should be made to the linker script in order to take advantage of the additional capabilities of the 4620/4520. If you are using a standard, PIC18F452-based application, these steps should not be necessary. These procedures are intended for applications being developed which will require the additional capabilities of the newer PICs.

Extend Codepage

Both the 4620 and 4520 have extended code memory. To utilise this fully, make the following alterations:

- In the source of your application, edit project.lkr
- Change

```
CODEPAGE   NAME=page       START=0x3000         END=0x7FFF
```

To

```
CODEPAGE   NAME=page       START=0x3000         END=0xFFFF
```

If you are using a GLCD with your PIC18F4620 the GLCD Font of the MIOS will be overwritten by this change though, as it lies in the range of 0x7C00-0x7FFF. There are two approaches to prevent this (also see forum thread http://www.midibox.org/forum/index.php?topic=7540.0):

- To leave out the Font space in the PIC´s code memory, change

```
 CODEPAGE   NAME=page       START=0x3000         END=0x7FFF
```

To

```
 CODEPAGE   NAME=page0      START=0x3000         END=0x7BFF
 CODEPAGE   NAME=page1      START=0x8000         END=0xFFFF
```

or try this solution from TK:

- copy the mios_glcd_font.inc file from the MIOS release into your application directory, rename it to mios_glcd_font.asm
- add following code to the file header:

```
      LIST P=PIC18F4620, R=DEC
DEFAULT_FONT code
FONT_ENTRY MACRO width, height, x0, char_offset
      dw      ((height) << 8) | (width), ((char_offset) << 8) | (x0)
      ENDM
```

- change the “org” (start address) from 0x7cfc to 0xfcfc
- add a “END” at the file footer
- add the new .asm file to the MAKEFILE.SPEC (behind the MK_SET_OBJ statement)
- change the font pointer within the Init() routine:

```
void Init(void)
{
MIOS_GLCD_FontInit(0xfcfc);
}
```

- if you are working under MacOS or Linux, type “perl tools/mkmk.pl MAKEFILE.SPEC; make”, under DOS just type “make”

The first approach has the advantage, that it isn't required to upload the font again and again with each program update. The second approach that new fonts can be inserted into the project in a similar way. Please see the forum article mentioned above on instructions how to use labels in combination with fonts.

Add Databanks

In order to give our application the ability to recognise all that lovely, lovely RAM in the newer '4620 and '4520 PICs, one or a mixture of the following options is required:

Standard Bank Size

- In the source of your application, edit project.lkr
- Change

```
DATABANK   NAME=miosram_u  START=0x380          END=0x5FF      PROTECTED
```

```
ACCESSBANK NAME=accesssfr  START=0xF80          END=0xFFF      PROTECTED
```

To

```
DATABANK   NAME=miosram_u  START=0x380          END=0x5FF      PROTECTED
DATABANK   NAME=gpr6       START=0x600          END=0x6FF
DATABANK   NAME=gpr7       START=0x700          END=0x7FF
DATABANK   NAME=gpr8       START=0x800          END=0x8FF
DATABANK   NAME=gpr9       START=0x900          END=0x9FF
DATABANK   NAME=gpr10      START=0xA00          END=0xAFF
DATABANK   NAME=gpr11      START=0xB00          END=0xBFF
DATABANK   NAME=gpr12      START=0xC00          END=0xCFF
DATABANK   NAME=gpr13      START=0xD00          END=0xDFF
DATABANK   NAME=gpr14      START=0xE00          END=0xEFF
DATABANK   NAME=gpr15      START=0xF00          END=0xF7F

ACCESSBANK NAME=accesssfr  START=0xF80          END=0xFFF      PROTECTED
```

Extended Bank Capacity

The above change will enable SDCC to allocate the variables in your application to any of the specified banks above. The very observant among you may have noticed that these banks are 256 bits each…. So what happens if you want to use a variable which is greater than 256 bits in size, such as a large array, or string of characters? For this, you will need to create a bank of extended size, and you will need to direct your application to use that bank to store your large variable.

In order to create memory banks of extended capacity, it is necessary to section off a greater range than those given above. A good way to go about this is to combine two or more of the default banks. The following are examples of this.

Making a single, 512-bit bank:

```
DATABANK   NAME=miosram_u  START=0x380          END=0x5FF      PROTECTED
// DATABANK   NAME=gpr6       START=0x600          END=0x6FF
// Remove this bank
// DATABANK   NAME=gpr7       START=0x700          END=0x7FF
// And remove this bank
DATABANK   NAME=gpr67      START=0x600          END=0x7FF
// And create this one out of the two
DATABANK   NAME=gpr8       START=0x800          END=0x8FF
DATABANK   NAME=gpr9       START=0x900          END=0x9FF
DATABANK   NAME=gpr10      START=0xA00          END=0xAFF
DATABANK   NAME=gpr11      START=0xB00          END=0xBFF
DATABANK   NAME=gpr12      START=0xC00          END=0xCFF
DATABANK   NAME=gpr13      START=0xD00          END=0xDFF
DATABANK   NAME=gpr14      START=0xE00          END=0xEFF
DATABANK   NAME=gpr15      START=0xF00          END=0xF7F
```

```
ACCESSBANK NAME=accesssfr  START=0xF80          END=0xFFF      PROTECTED
```

Note that the START of the bank is the same as the START of the first bank removed, and the END of the bank, is the same as the END of the last bank removed.

This can be extended into larger ranges, and multiple customised ranges, as below:

```
DATABANK   NAME=miosram_u  START=0x380          END=0x5FF      PROTECTED
// DATABANK   NAME=gpr6       START=0x600          END=0x6FF
// Remove this bank,
// DATABANK   NAME=gpr7       START=0x700          END=0x7FF
// And remove this bank,
DATABANK   NAME=gpr67      START=0x600          END=0x7FF
// And create this 512-bit bank out of the two 256-bit banks.
DATABANK   NAME=gpr8       START=0x800          END=0x8FF
DATABANK   NAME=gpr9       START=0x900          END=0x9FF
DATABANK   NAME=gpr10      START=0xA00          END=0xAFF
// DATABANK   NAME=gpr11      START=0xB00          END=0xBFF
// Remove this bank,
// DATABANK   NAME=gpr12      START=0xC00          END=0xCFF
// And remove this bank,
// DATABANK   NAME=gpr13      START=0xD00          END=0xDFF
// And remove this bank,
// DATABANK   NAME=gpr14      START=0xE00          END=0xEFF
// And remove this bank!
DATABANK   NAME=gpr1114    START=0xB00          END=0xEFF
// And create this 1024-bit (1 Kilobit) bank out of the four 256-bit banks.
DATABANK   NAME=gpr15      START=0xF00          END=0xF7F

ACCESSBANK NAME=accesssfr  START=0xF80          END=0xFFF      PROTECTED
```

Or of course you could make the whole lot into one bank if you wanted to:

```
DATABANK   NAME=miosram_u  START=0x380          END=0x5FF      PROTECTED
DATABANK   NAME=gpr615     START=0x600          END=0xF7F
// That's almost 2.5kilobits!!

ACCESSBANK NAME=accesssfr  START=0xF80          END=0xFFF      PROTECTED
```

Add Sections

In order to assist in the use of these memory banks, we can give create 'sections' with names, and those names can be referenced in our code later on. I will use the 2nd example above, to demonstrate:

```
DATABANK   NAME=miosram_u  START=0x380          END=0x5FF      PROTECTED

DATABANK   NAME=gpr67      START=0x600          END=0x7FF
// And create this 512-bit bank out of the two 256-bit banks.
DATABANK   NAME=gpr8       START=0x800          END=0x8FF
DATABANK   NAME=gpr9       START=0x900          END=0x9FF
DATABANK   NAME=gpr10      START=0xA00          END=0xAFF

DATABANK   NAME=gpr1114    START=0xB00          END=0xEFF
// And create this 1024-bit (1 Kilobit) bank out of the four 256-bit banks.
DATABANK   NAME=gpr15      START=0xF00          END=0xF7F

ACCESSBANK NAME=accesssfr  START=0xF80          END=0xFFF      PROTECTED

SECTION    NAME=CONFIG     ROM=config
// This SECTION entry will already exist in the file. Do NOT alter this
line!

SECTION    NAME=gpr8    RAM=gpr8
// This creates a SECTION called 'gpr8' which references the normal 256-bit
bank 'gpr8'
SECTION    NAME=b512    RAM=gpr67
// This creates a SECTION called 'b512' which references our 512-bit bank
SECTION    NAME=b1024   RAM=gpr1114
// This creates a SECTION called 'b1024' which references our 1kb bank
```

You may create as many or as few sections as you require for your application.

Application Code

Once these sections are created, you can use them within your application, by forcing a variable to be stored within that section. This is done using the 'udata' pragma statement with the following syntax:

```
 #pragma udata section_name variable_name
```

For example, referencing the above section:

```
#pragma udata b512 MIDI_Table       // This means "store a variable named
'MIDI_Table' in the SECTION named 'b512'
unsigned char MIDI_Table[512];       // Declare the array named
'MIDI_Table', and now it will be stored in 'b512'
```

- Compile the project 

wiki link

- Upload the hex file with MIOS Studio Fix Me! wiki link

Still reading? Shouldn't you be writing code right now? ;)

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Last update: **2007/03/30 11:21**