SBC44EC Web Server

SBC44EC Application Note

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1 Introduction

This application note describes how to use, configure and compile 2 different Demo Web Server applications that run on the SBC44EC. There are 2 MPLAB projects per demo, one for the Hi-Tech PICC18 compiler and the other the Microchip C18 compiler. They are modified versions of the *htnicee* and *mpnicee* Web Server projects supplied with the Microchip TCP/IP Stack (v2.20.04.01), and are described in detail in Microchips's Aplication note AN833 which can be downloaded from the Microchip web site. Note that only the demo web server has been modified, the Microchip TCP/IP stack needs **NO** modifications to run on the SBC44EC.

Both Web Server demo programs are HTTP servers that are implemented as cooperative tasks that co-exists with the Microchip TCP/IP Stack and the user's main application (*mxwebsrvr.c* in this case). The only difference between the two demo applications is that one implements DHCP, and the other not. The Server itself is implemented in the source file "HTTP.c", with a user application implementing two callback functions. The demo application source file, "mxwebsrvr.c", should be used as a template for the user to create his/her own Web Server application. The HTTP Server provided here does not implement all HTTP functionality; it is a minimal server targeted for embedded system. The user can easily add new functionality as required. The HTTP Server incorporates these main features:

- Supports multiple HTTP connections
- Contains a simple file system (MPFS)
- Supports Web pages located in either internal program memory or external serial EEPROM
- Includes a PC-based program to create MPFS images from a given directory
- Supports the HTTP method "GET" (other methods can be easily added)
- Supports a modified Common Gateway Interface (CGI) to invoke predefined functions from within the remote browser
- Supports dynamic web page content generation The server consists of the following main components:
- MPFS Image Builder
- MPFS Access Library
- MPFS Download Routine (implemented by the main application)
- HTTP Server Task

All SBC44EC boards have the SBC44EC Web Server on them when delivered, with the following default network settings:

- IP Address: 10.1.0.0
- Gateway Address: 10.1.0.0
- Subnet Mask: 255.0.0.0
- The *htmxwebdee* and *mpmxwebdee* Web Servers have DHCP enabled.
- The *htmxwebee* and *mpmxwebee* Web Servers have DHCP disabled.

These default values will probably have to be changed for the Web Server to work on your network. For details, refer to the *Configuration* chapter of this document.

2 Web Page

The demo web page provided with the SBC44EC Web Server shows the values present on Analog inputs AN0 and AN1, and the digital outputs RC2 and RC5.

The SBC44EC Web Server applications store their web page's in an external EEPROM, which currently can be up to 64KBytes large (24LC512 for example). All pages of the Web Page have to be

in the same directory, and they have to be converted with the *mpfs.exe* program to the MPFS (Microchip File System) format that can be loaded into the EEPROM. See page 83 of AN833 for details. The SBC44EC Web Server stores the MPFS image in an external data EEPROM. There are 3 ways of programming it into the EEPROM:

1. Use a programmer application or device supplied by the data EEPROM vendor to program the MPFS image. Always make sure that MPFS image starts after the "Reserved Block" (See page 83 of AN833 for details of reserved block).
2. Include a download routine in the main application that can accept data from an external data source (i.e., from a computer through a serial data connection) and program it into the EEPROM. The SBC44EC Web Server contains an example routine to do just that – see the configuration part of this document for details.
3. Include the FTP Server module into the project and program the MPFS image remotely across the network using FTP. See "Uploading an MPFS Image Using the FTP Client" (page 85 of AN833) for more information.

The HTTP Server uses the file "index.htm" as its default Web page. If a remote client (browser) accesses the HTTP Server by its IP address or domain name only, "index.htm" is the default page served. This requires that all applications include a file named "index.htm" as part of their MPFS image. If necessary, the name of this default file can be changed
by modifying the compiler definition HTTP_DEFAULT_FILE_STRING in the "http.c" file. It is very important to make sure that none of the Web page file names contain any of the following non-alphanumeric characters:

- single or double quotes (' and ")
- left or right angle brackets (< and >)
- the pound sign (#)
- the percent sign (%)
- left or right brackets or braces ([,{,] and })
- the "pipe" symbol (|)
- the backslash (\ )
- the caret (^)
- the tilde (~)

If a file does contain any of these characters, the corresponding Web page will become inaccessible. No prior warning will be given. The HTTP Server also maintains a list of file types that it supports. It uses this information to advise a remote browser on how to interpret a particular file, based on the file's three-letter extension. By default, the Microchip HTTP Server supports the following files:

- *.txt
- *.htm
- *.gif
- **.**cgi
- *.jpg
- *.cla
- *.wav

If an application uses file types that are not included in this list, the user may modify the table "httpFiles", along with corresponding "httpContents" enumerations in the file "http.c".

3 Configuration

At delivery, the SBC44EC Web Server is configured with the following network settings:
- IP Address: 10.1.0.0
- Gateway Address: 10.1.0.0
- Subnet Mask: 255.0.0.0
- DHCP disabled

These default values will probably have to be changed for the Web Server to work on your network. In short, all that needs to be done is the SBC44EC must be connected up to a terminal (19200, 8 bits, 1 stop and start bit, no parity or flow control) via it's serial port. At startup this will bring up a configuration menu that allows all network and other parameters to be configured and saved.

After the network is configured, the SBC44EC can be connected to you network, and you will be able to view it's web page via a standard Internet browser. With the default network setting one will enter "http://10.1.0.0" into the web browsers address, and it will bring up the web page contained on the SBC44EC.

3.1 Configuration menu

The SBC44EC is configured via it's serial port, using a terminal configured for 19200 baud, 8 bits, 1 stop and start bit, no parity or flow control. At power up, the following message will be displayed for 3 seconds.

```
Press any key for Configuration menu........
```

If any button is pressed withing about 3 seconds, the SBC44EC will enter configuration mode, if not, it will start up it's default web page contained in it's EEPROM memory. When entering configuration mode, the following menu will be displayed:

```
MCHPStack Demo Application v1.1 (MpStack 2.20.04, Feb 15 2004)

        1: Change Board serial number.
        2: Change default IP address.
        3: Change default gateway address.
        4: Change default subnet mask.
        5: Enable DHCP & IP Gleaning.
        6: Disable DHCP & IP Gleaning.
        7: Download MPFS image.
        8: Save & Quit.

Enter a menu choice (1-8):
```

3.1.1 Serial Number

Allows the serial number to be changed. When selected, it prompts the user for the new serial number:

```
Serial Number (0):
```

3.1.2 IP Address

Allows the default IP address to be changed. When selected, it prompts the user for the new IP address:

```
Default IP Address (10.1.0.0):
```

3.1.3 Gateway Address

Allows the default Gateway address to be changed. When selected, it prompts the user for the new Gateway address:

```
Default Gateway Address (10.1.0.0):
```

3.1.4 Subnet Mask

Allows the default Subnet Mask to be changed. When selected, it prompts the user for the new Subnet Mask:

```
Default Subnet Mask (255.0.0.0):
```

3.1.5 Download MPFS Image

When selected, it prompts the user for the new MPFS image of the web page to be displayed. This must be a file created with the *mpfs.exe* utility with the "/b" option. See page 84 of AN833 for details.

```
Ready to download MPFS image - Use Xmodem protocol.
```

4 Installation

To install the SBC44EC Web Server source code on your PC, simply copy the contents of the downloaded zip file to a folder on your PC, for example: "c:\mxnet".

5 Building the Web Servers

Building the web servers is real easy. You will need MPLAB V6.40 (might work with other MPLAB V6.xx versions, but has not been tested) or higher and either the HITECH PICC-18 V8.10PL1 compiler or higher or the Microchip MCC18 v1.00.50 compiler or higher.

5.1 Compiling with the Hi-Tech compiler

After copying the SBC44EC Web Server source code to a folder on your hard drive, open the ".\sbc44ec\websrvr\htmxwebdee.mcp" or ".\sbc44ec\websrvr\htmxwebee.mcp" project in MPLAB and select *Build All*. This will create the output hex file in the ".\sbc44ec\websrvr\out" folder.

5.2 Compiling with the Microchip compiler

After copying the SBC44EC Web Server source code to a folder on your hard drive, open the ".\sbc44ec\websrvr\mpmxwebdee.mcp" or ".\sbc44ec\websrvr\mpmxwebee.mcp" project in MPLAB and select *Build All*. This will create the output hex file in the ".\sbc44ec\websrvr\out" folder.

5.3 Compiling the web page

Run the ".\sbc44ec\websrvr\src\webpages\doall.bat" batch file. This will create c files and binary images of all demo web pages. The binary image (*.bin file) can be loaded into the SBC44EC's EEPROM as decribed above.

6 Changes to Microchip's demo web server

The following lists all changes that were made to the Microchip TCP/IP stack v2.20.04.01 for the SBC44EC Web Server.

File	*Change*
stacktsk.h	• Changed default IP and Gateway addresses fron 10.10.5.15 to 10.1.0.0 • Changed default Mask from 255.255.255.0 to 255.0.0.0 • Changed maximum sockets from 4 to 10 • Changed maximum HTTP connections from 2 to 5
compiler.h	• Added a *#define PORTA_RA2*directive for Hi-Tech and Microchip compilers • Commented out lines redefining Hi-Tech LATA2 – LATA4 directives to LA2-LA4. The new Hi-Tech compilers seem to use LATAx naming convention.

As mentioned previously, the SBC44EC Web Server is a modified version of the Microchip demo web server included with the Microchip TCP/IP stack. The only changes made to the stack are listed above. The SBC44EC Web Server main application program (*mxwebsrvr.c*) is a modified version of the *websrvr.c* application file of the Microchip web server. The modifications were required seeing that Microchip's demo applications was written for Microchip's demo board, that has a LCD display and a button on port RB5 - the SBC44EC has not. Microchip's *websrvr.c* file was modified, and renamed to *mxwebsrvr.c*

The main changes are that all LCD related code is commented out with #ifdef directives, and at startup the Web Server will wait for input on the serial port for 3 seconds before starting the web server. If it gets any input on the serial port during this time, it will run a configuration menu that allows the user

to configure the SBC44EC.

7 Projects

The SBC44EC Web Server consists out of 4 different projects. All projects starting with "ht" are for the Hi-Tech PICC18 compiler. All projects starting with "mp" are for the Microchip MPLAB C18 compiler.

7.1 Projects overview

Project Name	*Description*
htmxwebdee	SBC44EC Web Server with DHCP, IP Gleaning, FTP Server and EEPROM support for the Hi-Tech PICC18 compiler.
htmxwebee	SBC44EC Web Server with DHCP, FTP Server and EEPROM support for the Hi-Tech PICC18 compiler.
mpmxwebdee	SBC44EC Web Server with DHCP, IP Gleaning, FTP Server and EEPROM support for the Microchip C18 compiler.
mpmxwebee	SBC44EC Web Server with DHCP, FTP Server and EEPROM support for the Microchip C18 compiler.

7.2 htmxwebdee

• Derived from htnicee
• SBC44EC Web Server with DHCP, IP Gleaning, FTP Server and EEPROM support for the Hi-Tech PICC18 compiler.

To create htmxwebdee from htnicee (included in the Microchip TCP/IP stack), open htnicee in MPLAB and do the following.
1. In the project window, remove the following source files:
    • websrvr
    • xlcd.c
2. In the project window, add the following source files:
    • mxwebsrvr.c
3. Save as htmxwebdee

7.3 htmxwebee

• Derived from htnicee
• SBC44EC Web Server with IP Gleaning, FTP Server and EEPROM support for the Hi-Tech PICC18 compiler.

To create htmxwebee from htnicee (included in the Microchip TCP/IP stack), open htnicee in MPLAB and do the following.
1. In the project window, remove the following source files:
    • websrvr.c
    • dhcp.c
    • udp.c
    • xlcd.c
2. In the project window, add the following source files:
    • mxwebsrvr.c

3. Remove the following from the project properties
   - STACK_USE_DHCP
4. Save as htmixwebee

7.4 mpmxwebdee

- Derived from mpnicee
- SBC44EC Web Server with DHCP, IP Gleaning, FTP Server and EEPROM support for the Microchip C18 compiler.

To create mpmxwebdee from mpnicee (included in the Microchip TCP/IP stack), open mpnicee in MPLAB and do the following.
1. In the project window, remove the following source files:
   - websrvr
   - xlcd.c
2. In the project window, add the following source files:
   - mxwebsrvr.c
3. Save as mpmxwebdee

7.5 mpmxwebee

- Derived from mpnicee
- SBC44EC Web Server with IP Gleaning, FTP Server and EEPROM support for the Microchip C18 compiler.

To create mpmxwebee from htnicee (included in the Microchip TCP/IP stack), open htnicee in MPLAB and do the following.
1. In the project window, remove the following source files:
   - websrvr.c
   - dhcp.c
   - udp.c
   - xlcd.c
2. In the project window, add the following source files:
   - mxwebsrvr.c
3. Remove the following from the project properties
   - STACK_USE_DHCP
4. Save as mpmxwebee

8 References

Large parts of this application note were copied from Microchip's AN833 application note.