FM3 Fujitsu Cortex M3

32-BIT MICROCONTROLLER

MB9B610 Series

ETHERNET_FLASH_LOADER

USER MANUAL

ARM™ ARM and Cortex-M3 are the trademarks of ARM Limited in the EU and other countries.

Revision History

Version	Date	Updated by	Approved by	Modifications
1.0.0	2012-11-1	FSS		Initial version

Contents

1   Introduction

1.1   Purpose

This document describes the Ethernet flash loader of MB9BF618T/S, as well as presents a demonstration package based on a free TCP/IP stack, lwIP (lightweight IP).

The Ethernet flash loader is one of implementations for In-Application Programming (IAP), which means upgrading firmware in the field using the MCU communication peripherals (such as UART, USB, Ethernet, etc...). Customers can perform the firmware update without teardown of the product.

Ethernet is often the preferred method for implementing IAP for reasons below,
● High speed (10/100 Mbps)
● Long distance through network
● Construct on widely used protocols (FTP, TFTP, HTTP)

1.2   Definitions, Acronyms and Abbreviations

API	Application Programming Interface
I/F	Interface
IAP	In-Application Programming
EVB	Evaluation board
MAC	Media Access Controller
PHY	Physical Layer
lwIP	Lightweight IP
FTP	File Transfer Protocol
TFTP	Trivial File Transfer Protocol
HTTP	Hypertext Transfer Protocol

1.3   Reference Documents

[1].MB9Bxxx-MN706-00002-4v0-E.pdf
[2].MB9BF616S-DS706-00014-0v01-E.pdf
[3].MB9BF210T_610T-MN706-00015-1v0-E.pdf
[4].Design and Implementation of the LWIP TCP/IP Stack, Feb,2001, Adam Dunkels.
[5]. http://lwip.wikia.com/wiki/LwIP_Wiki

2 Development Environment

Name	Description	Part Number	Manufacturer	Remark
IAR EWARM	Software Developing IDE	V6.40	IAR	
J-link	MCU Emulator	J-link	IAR	
Hardware platform		FSSDC-9B618-EVB	FSS	

3 Ethernet Flash Loader Overview

To demonstrate the Ethernet flash loader, two projects will be involved,

- Flash loader project – Retrieve application image and flash it into internal flash, as well as verification of its version and checksum before running it.

- User application project– Demo project to produce application image, which will make the LED (green) of the EVB blinking .

The protocol adopted for communication between PC and EVB is TFTP, which is widely used in embedded applications to upgrade firmware.

TFTP is a simple file transfer protocol working on top of the UDP layer and it is mainly used in a LAN. Based on client/server mode, the client will request a file transfer (read or write operation) from a server.

In the Ethernet flash loader, a free tool Tftpd32 (http://tftpd32.jounin.net) running on the PC will act as TFTP client while the EVB will be the TFTP server.

During firmware updating (as shown in figure1), the client will transfer a bin file on the PC to EVB, which will flash it into the dedicated internal flash. And only write request is supported by the EVB to simplify the design.
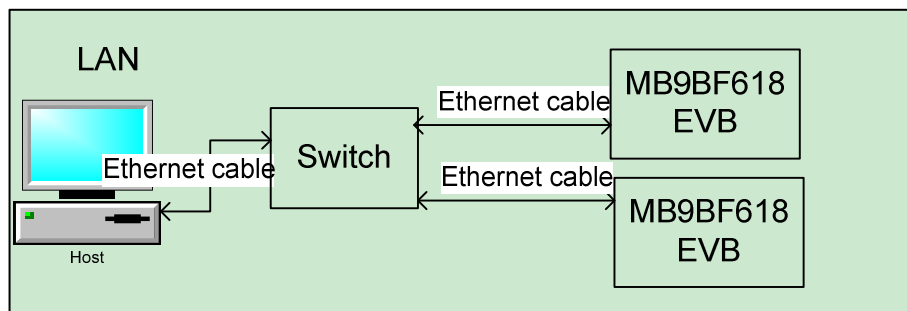

Figure 1 IAP over Ethernet

4 Ethernet Flash Loader demo

4.1 Demo Steps

a. Hardware Setting

- ➢ Burn the flash loader image into the EVB.
- ➢ Compile the user application project to produce the application bin image (Using tool to convert the image file from Hex or MHX to bin file when necessary)

b. Steps

1) Open Tftpd32 tool and select the application image bin file (e.g. **D:\FM3\LED.bin**)

2) Set the IP address, port and block size as shown in figure 2 *****.

3) Power on board (burned with flash loader image) and press **down** button on the joystick within 10 seconds. The LED will be turned on before button is pressed.

4) Press the "**Put**" button on the Tftpd32 tool to start the update.

5) The LED will be blinking when the update succeeds and MCU jumps from flash loader program to run the application program.
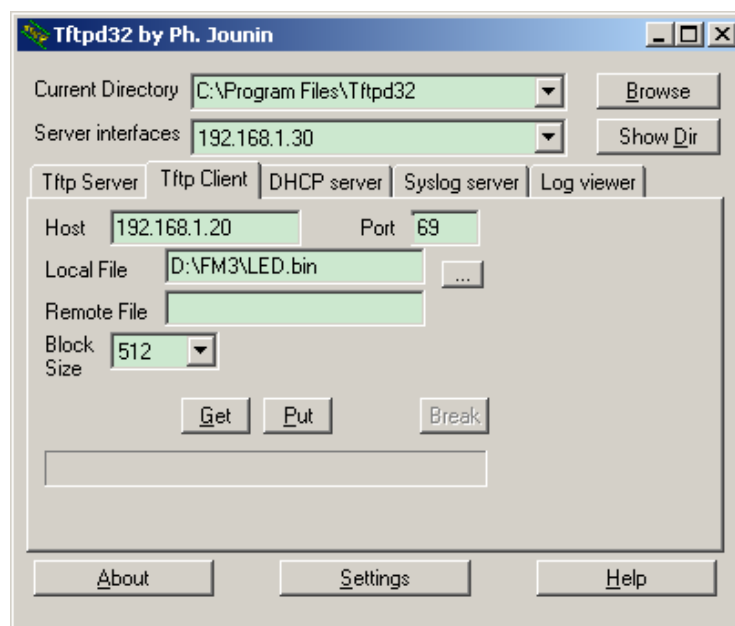

Figure 2 TFTP client tool configuration

*Note:

- IP address comes from static setting by default.
  DHCP_DEMO micro definition in **board.h** needs to be enabled to support getting IP address through DHCP.
- The Tftpd32 tool should be configured as shown in figure 3 before retrieving the IP address (e.g. 192.168.1.20) and setting it in figure 2.
- If the **DHCP_DEMO** micro definition is enabled while DHCP server is not configured properly or not available, the EVB will fail to retrieve the IP address per DHCP. Thereafter a default IP address of 192.168.1.25 will be adopted.
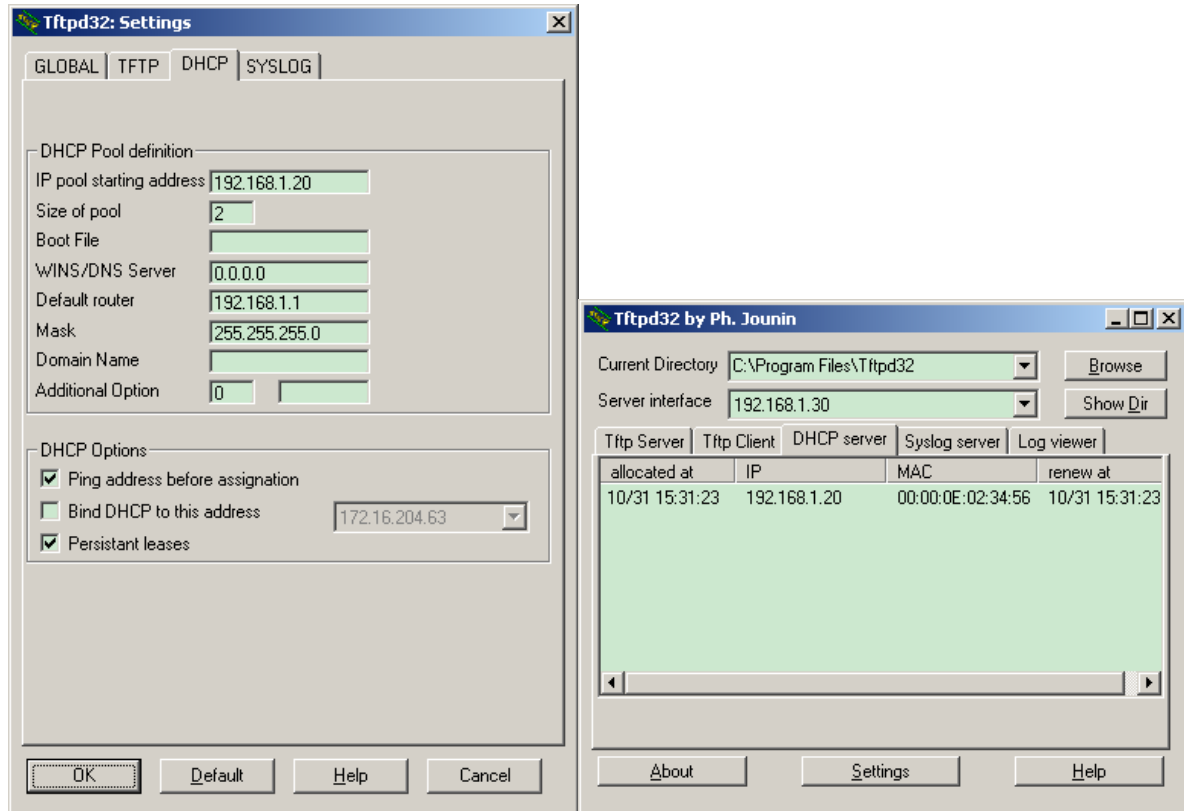
Figure 3 DHCP server configuration and retrieve the IP address

The LED will indicate the status of the flash loader operation.

Table1 LED status

LED (Green)	On	Off	Blinking
signification	Boot project is running and waiting for selection of flash loader program.	Flash loader program is running.	User application is running.

4.2 Demo features

- ● LwIP functionality of UDP
- ● Ethernet driver of MCU
- ● Flash operation of MCU

The H/W resource used in this solution includes:

1) Ethernet MAC0 of the MCU

2) System timer

3) Dual Timer: Used for LED blinking control

4) Flash I/F: The I/F to operate the MCU internal Flash ROM

5) NVIC: The interrupt related resource

6) Clock: The clock for the whole system

Figure 4 is the flow chart of this demo.

When power on, if the "down" button is pressed within specified time (such as 10seconds), the Ethernet flash loader will run, which will communicate with the TFTP client to retrieve image data and jump to execute the valid user code.
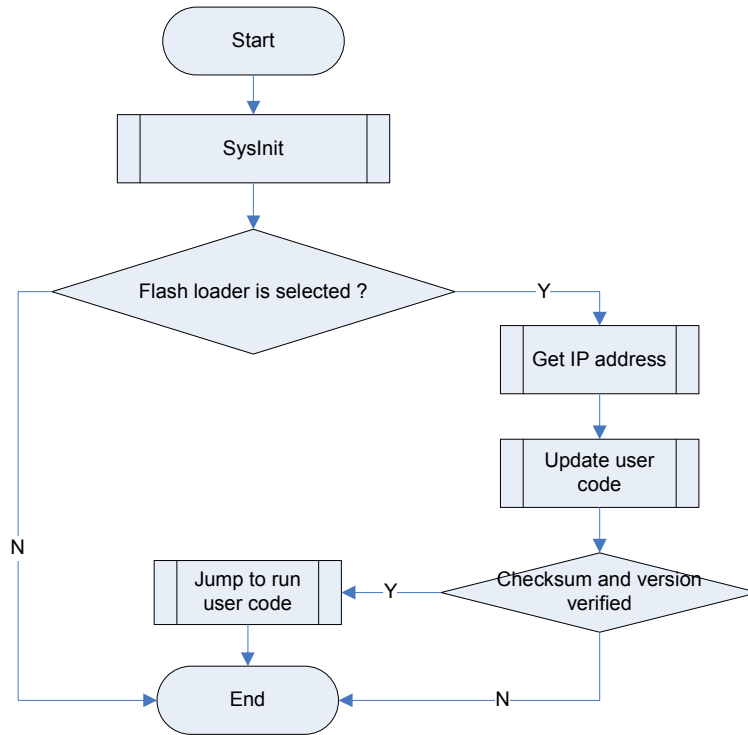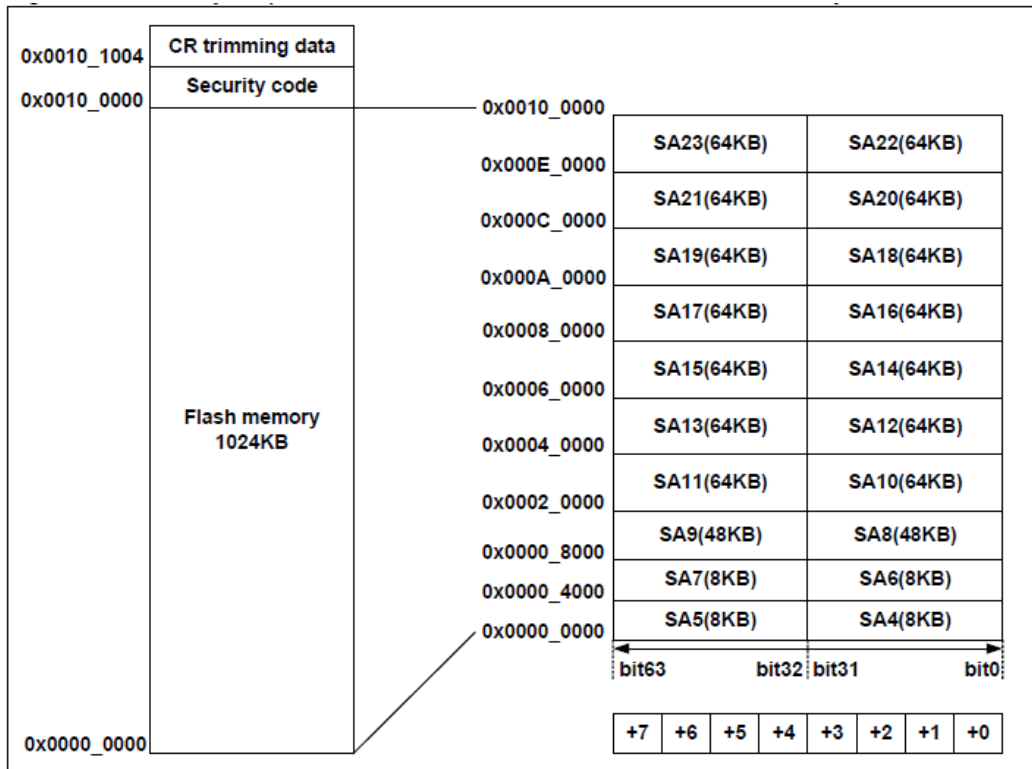

Figure 4 Flow chart

4.3 Memory Allocation

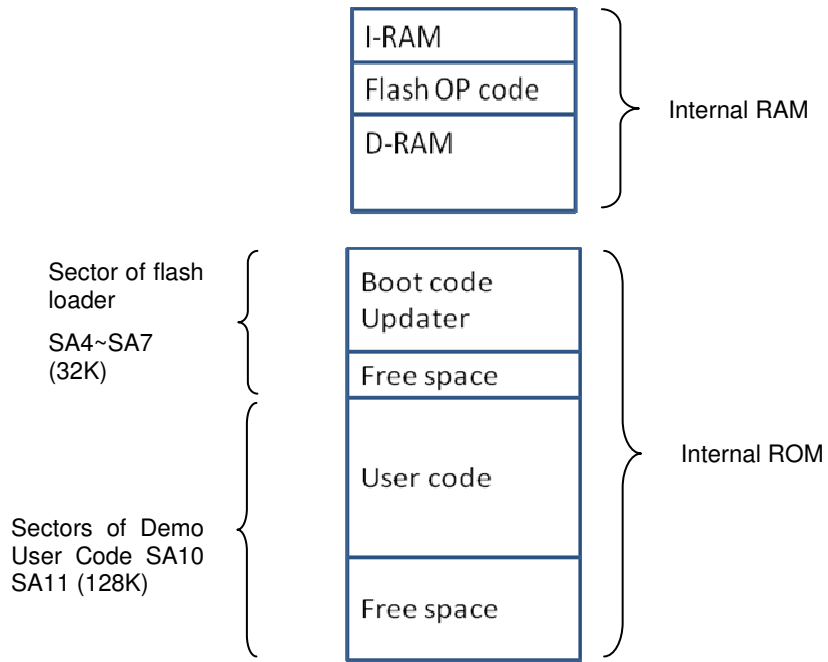Figure 5 Memory map of M9BF618 flash memory

Figure 6 Code allocation

The Ethernet loader code of MCU will be allocated at the SA4~SA7.

The user application program will be allocated at SA10 and SA11, whose vector table shall be placed at the beginning of the sector, as shown in figure 7.
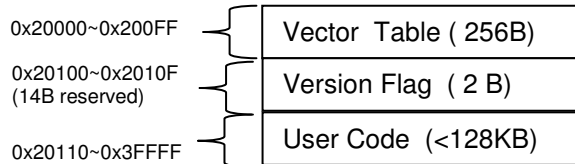

Figure 7 User code components

Note:

While the Ethernet flash loader operates the internal flash, the related flash R/W API will be copied and run in internal RAM area.

4.4　Limitations

In the design of this flash loader, the following limitations are treated as design assumptions.
● Supporting write request command only for TFTP.
● The Ethernet flash loader will target to work on LAN only (the client and EVB are connected to the same switch of the network).More complex network topology will be supported in the further enhancement.

5 Additional Information

For more Information on FUJITSU semiconductor products, visit the following websites:

English version address:

http://www.fujitsu.com/cn/fsp/mcu/32bit/fm3/an.html

Chinese version address:

http://www.fujitsu.com/cn/fss/mcu/32bit/fm3/an.html