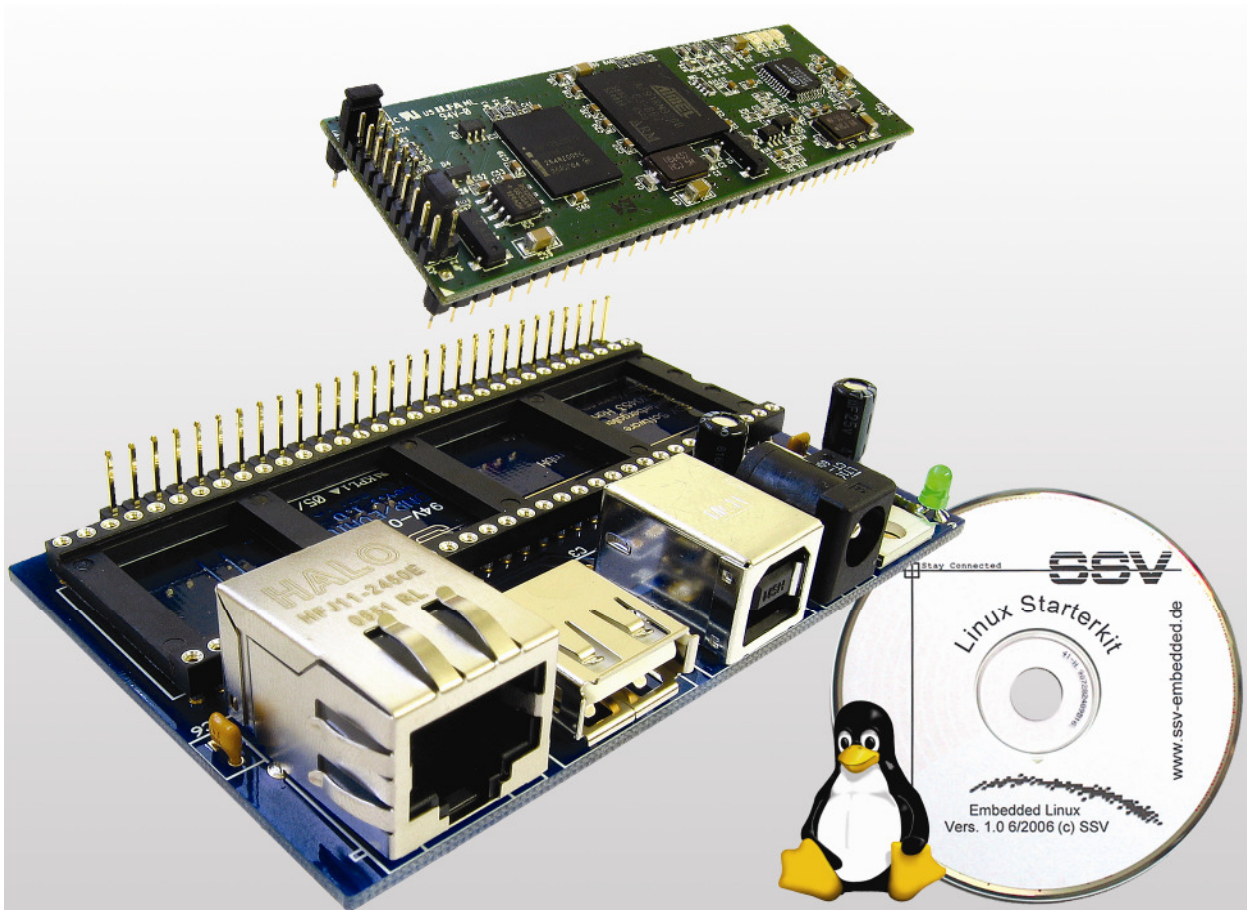# *DNP/SK25*
Embedded Linux Starter Kit

First Steps

SSV Embedded Systems

Heisterbergallee 72
D-30453 Hannover
Phone: +49 (0)511/40 000-0
Fax: +49 (0)511/40 000-40
E-mail: sales@ist1.de

For further information regarding our products please visit us at www.dilnetpc.com.
Or visit our support forum at www.ssv-comm.de/forum

CONTENT

1   INTRODUCTION

The DNP/SK25 Embedded Linux Starter Kit with the DIL/NetPC DNP/9200 contains everything you need to get started with your Atmel AT91RM9200 ARM9-based embedded networking application.

The DNP/SK25 includes a DNP/9200 module with a pre-installed U-Boot boot loader and an embedded Linux, the Evaluation Board DNP/EVA10, a USB cable, a CD-ROM with software and documentation and a printed user manual for the first steps with the DNP/SK25.

The Starter Kit CD-ROM comes with a full GNU cross tool chain for C/C++ software development. The binary files of this pre-build tool chain run on an x86 Linux-based host (SuSE, Red Hat or other) and build executable files for the Atmel AT91RM9200 ARM9-based microcontroller.

For using the DNP/SK25 Embedded Linux Starter Kit you need a development system. The minimal configuration for this system is a Windows-based PC with Telnet, an 10 Mbps or 10/100 Mbps Ethernet LAN interface and an USB interface. This environment allows web server programming (HTML pages, Java Applets) and Linux shell script programming. For using the GNU C/C++ cross tool chain, it is necessary to run Linux on the development system.

1.1   Safety Guidelines

Please read the following safety guidelines carefully! In case of property or personal damage by not paying attention to this document and/or by incorrect handling, we do not assume liability. In such cases any warranty claim expires.
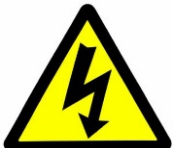
> **ATTENTION**: Observe precautions for handling – electrostatic sensitive device!

- Discharge yourself before you work with the device, e.g. by touching a heater of metal, to avoid damages.

- Stay grounded while working with the device to avoid damage through electrostatic discharge.

1.2   Conventions

Convention	Usage
bold	Important terms
italic	Filenames, user inputs
`monospace`	Pathnames, program code, command lines

Table 1:   Conventions used in this Document

1.3   Features and Technical Data

The DIL/NetPC DNP/9200 comes with a pre-installed U-Boot boot loader and an Embedded Linux operating system. The DNP/9200 Linux consists of two main components: 1. the Linux kernel and 2. the root file system.

The DNP/9200 U-Boot boot loader allows the downloading* of new Linux kernel versions and root file systems to the DNP/9200 RAM and Flash.

- DIL/NetPC DNP/9200 with Atmel AT91RM9200, 16 Mbytes Flash and 32 Mbytes SDRAM, 3.3 VDC VCC

- U-Boot boot loader and Embedded Linux pre-installed in Flash memory

- Evaluation Board DNP/EVA10

- USB cable

- CD-ROM with user manual and hardware/programmers manuals

- Embedded Linux with source

- GNU cross tool chain for C/C++ software development for Linux-based PCs

- GNU gdb and gdbserver for Ethernet-based remote debugging

- Linux remote login with Telnet

- Web server setup sample

- FTP server setup sample

- Many source code samples

*Please note: The download of a new Linux kernel needs an RS232-based serial link and an Ethernet LAN link between the DNP/9200 and a PC. The RS232 connector is not available on the DNP/EVA10.

2 GETTING STARTED

2.1 Ethernet Link between DNP/EVA10 and PC

Setup the Ethernet link between the DNP/SK25 and the PC before connecting the power supply. Use an Ethernet cross-over cable for the connection.
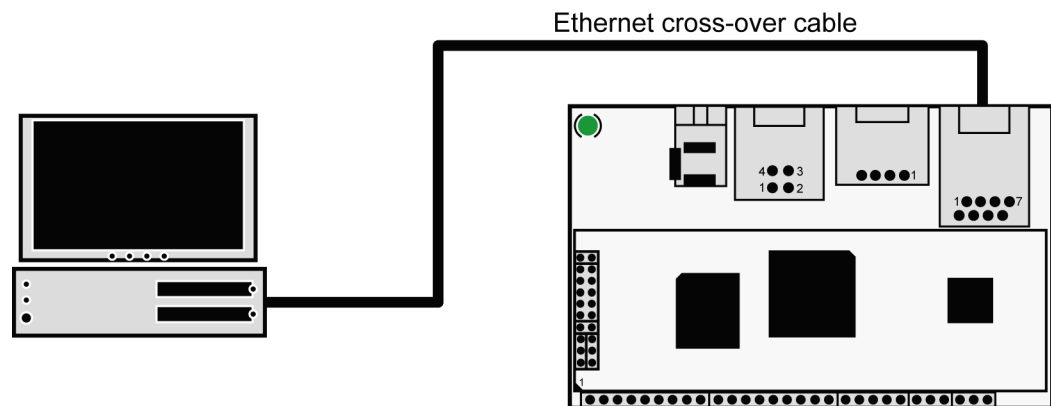

Figure 1: Ethernet link between DNP/SK25 and PC

Please note: The DNP/9200 comes with the default IP address **192.168.0.126**. Please make sure that the PC can work with the IP address range 192.168.0.x.

In DHCP-enabled networks the DNP/9200 is automatically assigned an IP address as it is DHCP-enabled by default. If DHCP does not work (i.e. no DHCP server is available), the DNP/9200 takes its default IP address.

2.2 Connecting USB Cable and Power-up the Starter Kit

Please setup the Ethernet link first (see chapter 2.1). Then connect the PC and the DNP/SK25 with the USB cable. Use the USB device port of the DNP/SK25. This USB connection provides the DNP/SK25 with power.
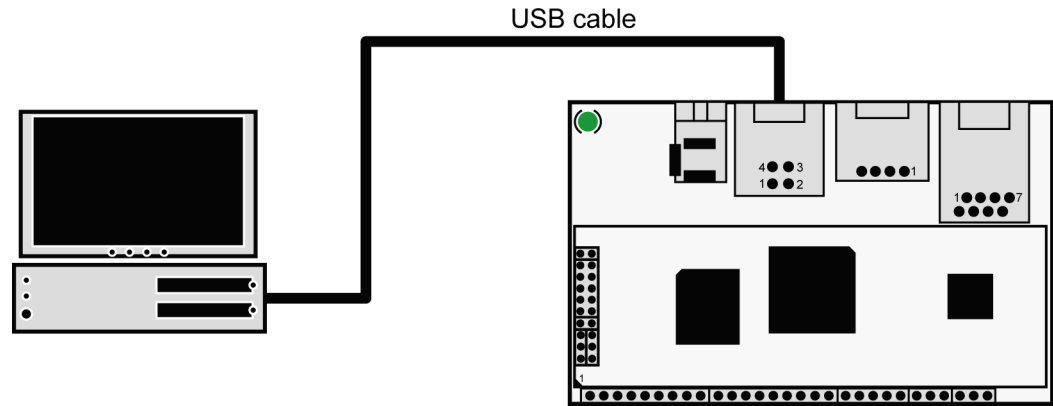

Figure 2: Power supply for the Evaluation Board

Directly after connecting the PC with the DNP/SK25 via USB, the boot process of the DNP/9200 Linux begins. If the PC is shut down, the USB-based power supply will be switched off.

Alternatively it is possible to use a 5 VDC power supply with a 5.5 mm x 2.5 mm jack plug to provide the DNP/SK25 with power.

CAUTION: Providing the DNP/SK25 with a voltage higher than the regular 5 VDC ±10% could resolve in damaged board components!

Do not connect both, the USB cable and the power supply, at the same time with the DNP/SK25! This could resolve in damaged board components!

Please pay attention to the polarity of the power connector: the **+ pole is in the center!**
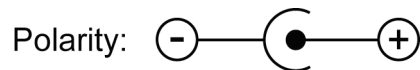

Figure 3: Polarity of the power connector

2.3   Checking IP Address of PC

Directly after providing the DNP/SK25 with power, the boot process of the DNP/9200 begins. The boot process takes approx. 30 seconds.

After the boot process make sure that the PC is using the right IP address for the Ethernet-based TCP/IP communication with the DIL/NetPC. Use 192.168.0.1 or 192.168.0.254 for the PC. The IP address of the DNP/9200 is set ex factory to 192.168.0.126.

Please note: In DHCP-enabled networks the DNP/9200 is automatically assigned an IP address as it is DHCP-enabled by default. If DHCP does not work (i.e. no DHCP server is available), the DNP/9200 takes its default IP address.
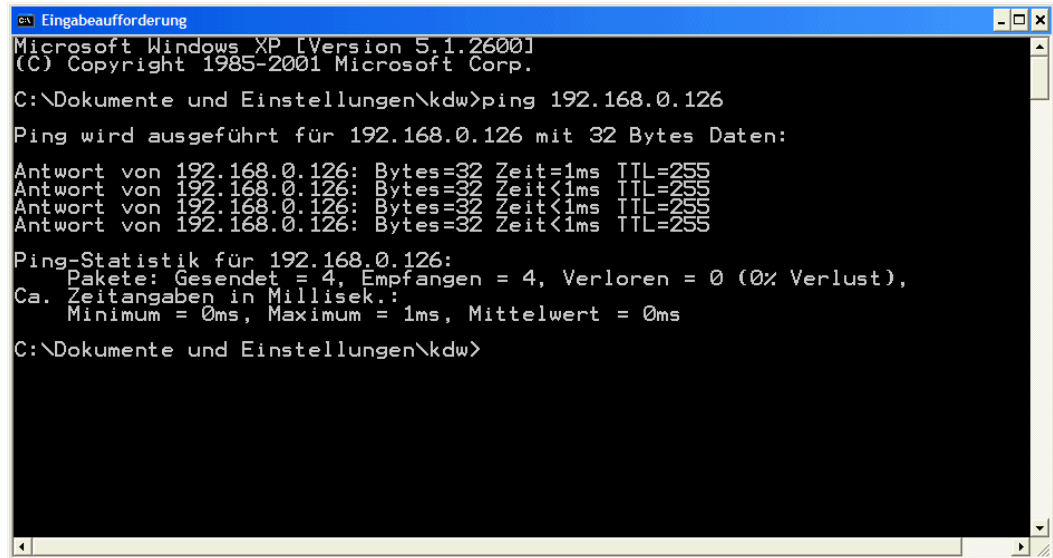
Figure 4:   Windows-PC IP address check with *ipconfig*

Talk to your network administrator if you have problems with the IP address understanding.

2.4 Checking Ethernet-based TCP/IP Communication

Check the Ethernet-based TCP/IP communication between the DNP/9200 and the PC with a simple *ping* command. The IP address of the DNP/9200 is set ex factory to 192.168.0.126.

> **Please note:** In DHCP-enabled networks the DNP/9200 is automatically assigned an IP address as it is DHCP-enabled by default. If DHCP does not work (i.e. no DHCP server is available), the DNP/9200 takes its default IP address.

Figure 5: Windows-PC TCP/IP communication check with *ping*

First check the cable connections and then the IP addresses if the ping does not work. Then check the TCP/IP setup of the PC.

2.5   Using a Telnet Connection

Run a Telnet client program on the PC with the IP address of the DNP/9200. You can use a Telnet session for remote entering Linux commands.
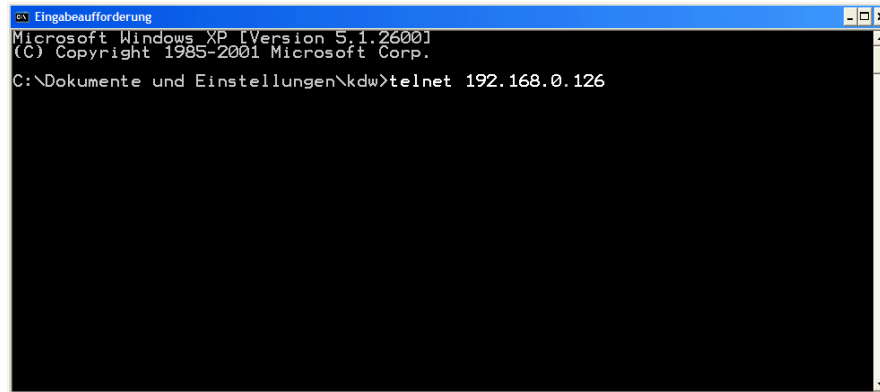

Figure 6:   Run the Windows telnet client program

Wait until the DNP/9200 Linux requests a user name. Enter the user name *root*. This user name needs no password. Just hit Enter if the DNP/9200 Linux requests a password.

Please note: The DNP/9200 Linux comes with *BusyBox*. All Linux command line commands are implemented in *BusyBox*. *BusyBox* combines tiny versions of many common UNIX utilities into a single small executable. It provides replacements for most of the utilities you usually find in GNU *fileutils*, *shellutils*, etc. The utilities in *BusyBox* generally have fewer options than their full-featured GNU cousins; however, the options that are included provide the expected functionality and behave very much like their GNU counterparts. *BusyBox* provides a fairly complete environment for any small or embedded system.
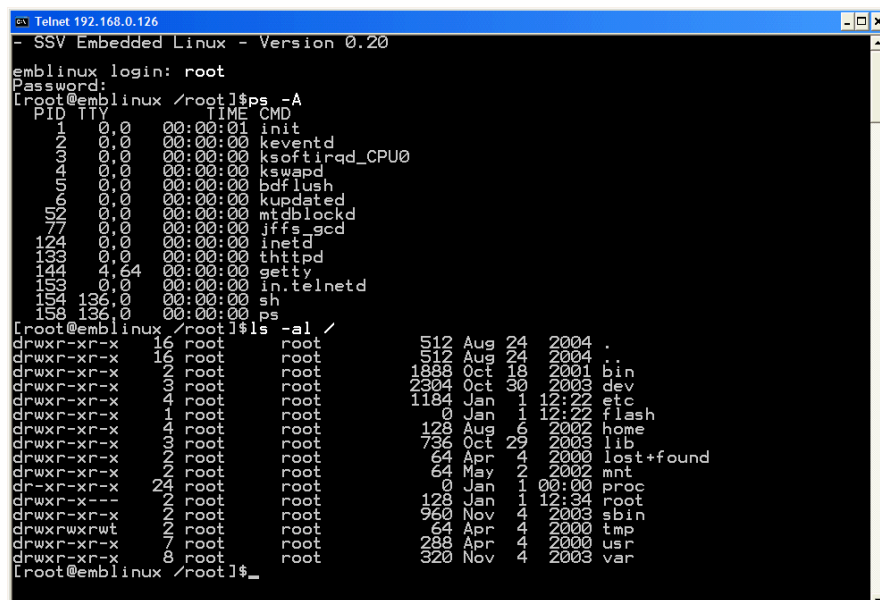

Figure 7:   Using Linux commands within a Telnet client window

2.6   Checking Embedded Web Server

The DNP/9200 default Linux configuration comes with a pre-installed embedded web server. The object storage space (HTML pages, CGI programs, Java Applets etc.) for this web server is located within the DNP/9200 Flash memory.

Setup a Telnet session like shown in **chapter 2.5** between PC and DNP/9200. Enter the following command lines within this Telnet session:

```
cd /flash
mkdir www
cd www
cat > test.html
<html>
<head>
<title>Hallo Welt!</title>
</head>
<body>
<h1>Hallo Welt!</h1>
</body>
</html>
```

CTRL-D (CTRL-D stops the Linux cat command)

These command lines create an HTML file `/flash/www/test.html` within the DNP/9200 Flash memory with the German version of "Hello World" ("Hallo Welt!").

Reboot your DNP/9200 by interrupting the USB-based power supply. This reboot defines `/flash/www/` as default directory for the web server.

Figure 8:   Create an HTML file within a Telnet session

Run a web browser on the PC to open the HTML file *test.html* with the browser. Use the URL `http://192.168.0.126/test.html`. This URL assumes that the DNP/9200 uses the IP address 192.168.0.126. Change this IP address if necessary (see chapter 2.9).
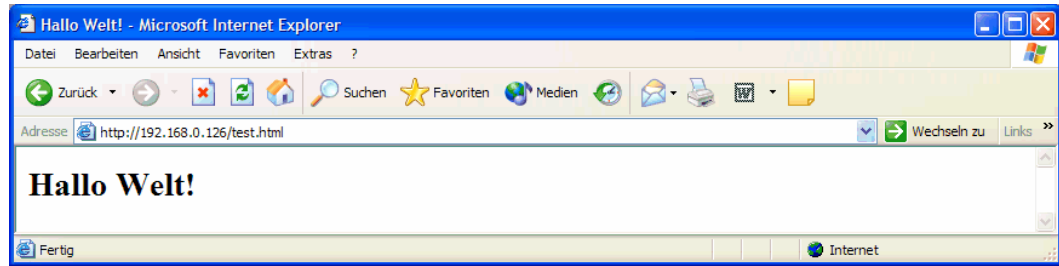
Figure 9: Check the embedded web server with Internet Explorer

Please note: /flash/www is the default directory for the DNP/9200 embedded web server.

Restart the DNP/9200 Linux after the creation of /flash/www/test.html and before the first access with a web browser.

The DNP/9200 embedded web server looks out for /flash/www at boot time. If the directory /flash/www does not exist at boot time, the DNP/9200 embedded web server works with the RAM disk-based directory /usr/local/www.

2.7   Checking FTP Server

The DNP/9200 Linux comes with a pre-installed FTP server. This server allows the file transfer between a PC and the DNP/9200.

Run an FTP client program on the PC. Set the session parameters for the FTP client to the IP address **192.168.0.126**, user name **guest** and password **guest**. The DNP/9200 default directory for the FTP user name guest is `/home/guest`. This directory is located within the DNP/9200 RAM disk.
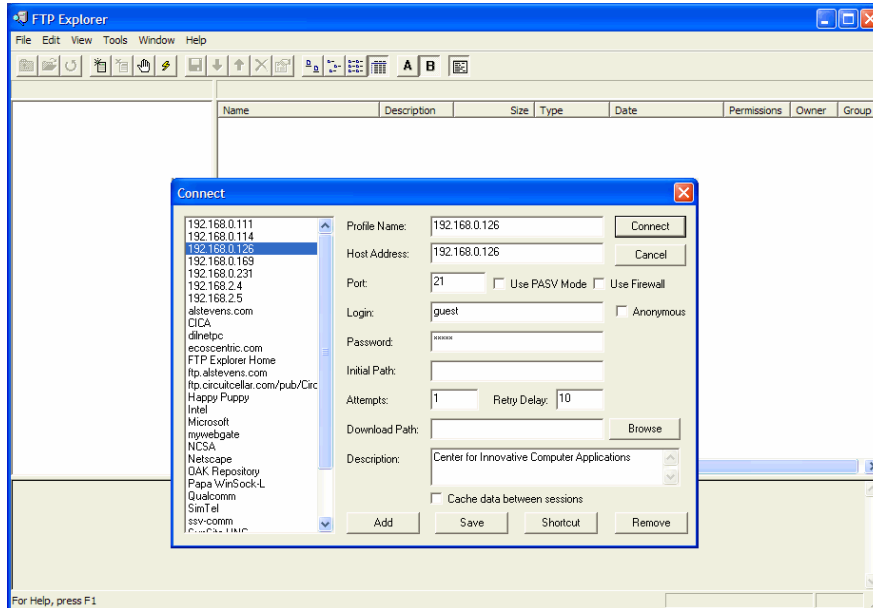
Figure 10: Set the session parameters for an FTP client program

Connect the FTP client with the DNP/9200 FTP server. Please watch the DNP/9200 default FTP directory. Transfer some files from the PC to the DNP/9200. The DNP/9200 stores these files in the DNP/9200 default FTP directory.
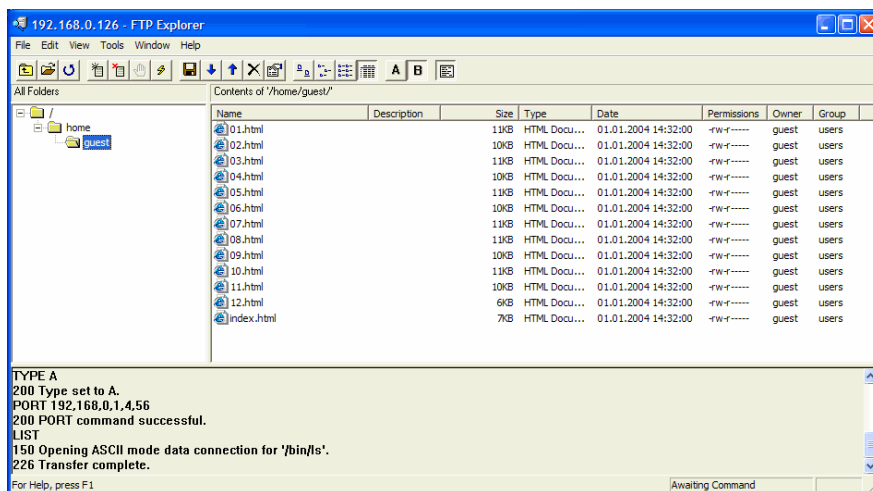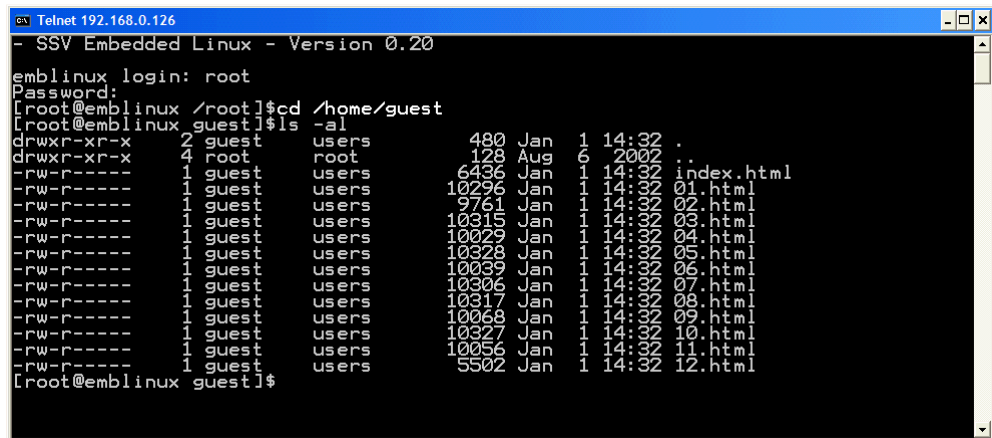
Figure 11: Transfer some files to the DNP/9200

Check the new files with a Telnet session. Change to the DNP/9200 default FTP directory `/home/guest` within the Telnet session.

Figure 12: The new files within /home/guest

2.8 Checking TFTP Client

The DNP/9200 Linux offers also a pre-installed TFTP client. This program allows the TFTP-based file transfer between a PC and the DNP/9200.

First run a TFTP server program on the PC. Linux-based PCs offer a TFTP server as part of the standard networking feature set. For Windows-based PCs please use the free *Win32 TFTP* server program from the Starter Kit CD-ROM (see directory `/TFTP-Server-Win32` at the Starter Kit CD-ROM).
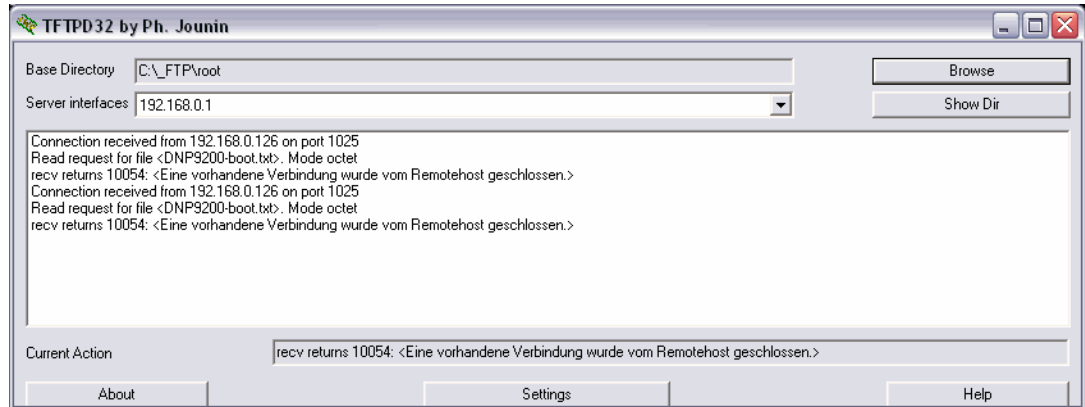

Figure 13: Running the Win32 TFTP server

Figure 13 shows the free Win32 TFTP server in action. This server allows file transfers to and from any DNP/9200 directory.
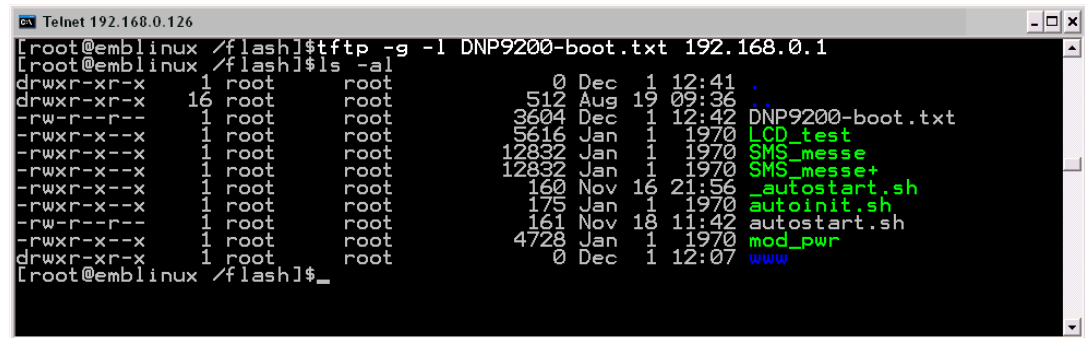

Figure 14: Download with TFTP *get* command

Enter the get and put commands within a Telnet session. Figure 14 shows a sample for a TFTP get command (getting a file from the PC to the DNP/9200). Here we enter:

tftp –g –l DNP9200-boot.txt 192.168.0.1

DNP9200-boot.txt is the filename which is requested from the TFTP server. **192.168.0.1** is the IP address of the TFTP server.

2.9   Changing Ex Factory IP Address (ipaddree usage)

The DNP/9200 is automatically assigned an IP address on DHCP-enabled networks as it is DHCP-enabled by default. If DHCP does not work (i.e. no DHCP server is available), the DNP/9200 takes its default IP address.

The ex factory value for this default IP address is **192.168.0.126**. The network mask for this address is **255.255.255.0**. You can change this IP address during a Telnet session with help of the program called *ipaddree*.
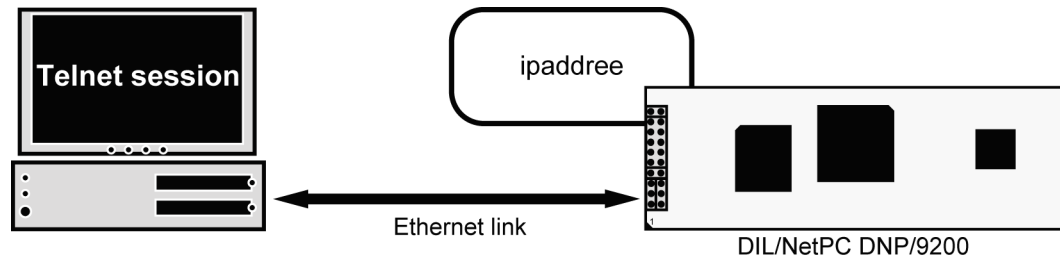
Figure 15: Environment for ipaddree usage

Establish a Telnet session like shown in **chapter 2.5**. Then execute the following command:

ipaddree –w 192.168.2.126 –m 255.255.255.0

"ipaddree" is the name of a command line IP setup tool. "192.168.2.126" is the new IP address. Use an IP address of your choice for your setup on this position. "255.255.255.0" is a network mask. Use a valid network mask for the new IP address.

Figure 16: Telnet session with *ipaddree* command line

Figure 17: Check the new IP address with *ping*

Please note: Do not forget to change the IP address of the PC to 192.168.2.1 or similar otherwise the *ping* will not work.

3   HELPFUL LITERATURE

- Atmel AT91RM9200 data sheet summary

- Atmel AT91RM9200 user guide

- ARM ARM926EJ-S technical reference manual

- ARM ARM9EJ-S technical reference manual

- DIL/NetPC DNP/9200 hardware reference manual (SSV Starter Kit item)

- Evaluation Board DNP/EVA10 hardware reference manual (SSV Starter Kit item)

CONTACT

SSV Embedded Systems
Heisterbergallee 72
D-30453 Hannover / Germany
Phone: +49 (0)511/40 000-0
Fax: +49 (0)511/40 000-40
E-mail: sales@ist1.de
Internet: www.dilnetpc.com
Support: www.ssv-comm.de/forum

DOCUMENT HISTORY

Revision	Date	Remarks	Name
1.0	2006-09-13	first version	WBU