



NET+Works with GNU Tools Getting Started Guide

Making
DEVICE NETWORKING
easy™

NET+Works with GNU Tools

Getting Started Guide

Operating system/version: 6.3

Part number/version: 90000718_C

Release date: March 2006

www.digi.com

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Using this guide

Review this section for basic information about this guide, as well as for general support contact information.

About this guide

This guide describes NET+OS with GNU Tools and how to use it as part of your development cycle. Part of the NET+Works integrated product family, NET+OS is a network software suite optimized for the NET+ARM.

Software release

This guide supports NET+OS 6.3. By default, this software is installed in the `/cygdrive/c/netos63_gnu` directory. The instructions in this guide are based on the assumption that NET+Works is installed in the `default` directory.

Who should read this guide

This guide is for software engineers and others who use NET+Works for NET+OS. To complete the tasks described in this guide, you must:

- Be familiar with installing and configuring software.
- Have sufficient user privileges to do these tasks.
- Be familiar with network software and development board systems.

Conventions used in this guide

This table describes the typographic conventions used in this guide:

This convention	Is used for
<i>italic type</i>	Emphasis, new terms, variables, and document titles.
bold, sans serif type	Menu commands, dialog box components, and other screen items.
menu name → option	Menu names and selections selections.
monospaced type	Filenames, pathnames, and code examples.

What's in this guide

This table shows where you can find information in this guide:

To read about	See
Installing NET+Works with GNU Tools, configuring IP parameters, and completing a brief exercise using either the MAJIC probe or the Raven debugger	Chapter 1: "Using NET+Works with GNU Tools and a Hardware Debugger"
Installing NET+Works with GNU Tools, configuring IP parameters, and completing a brief exercise using the GDB software debugger	Chapter 2: "Using NET+Works with GNU Tools and the GDB Software Debugger"
Tips for using NET+Works with GNU Tools with your own projects	Chapter 3, "Tips and Suggestions"

Related documentation

- The *Hardware Installation Guide* describes how set up the hardware.
- *NET+Works with GNU Tools BSP Porting Guide* describes how to port the board support package (BSP) to a new hardware application using *GNU Tools*.
- *NET+Works with GNU Tools Programmer's Guide* describes how to use NET+OS to develop programs for your application and hardware.

- NET+Works online help describes the application programmer interfaces (APIs) that are provided with NET+OS. The online help is located in `C:\netos63_gnu\Documentation`.

For information about third-party products and other components, review the documentation CD-ROM that came with your development kit.

For information about the processor you are using, see your NET+Works hardware documentation.

Documentation updates

Digi occasionally provides documentation updates on the Web site.

Be aware that if you see differences between the documentation you received in your NET+Works package and the documentation on the Web site, the Web site content is the latest version.

Customer support

To get help with a question or technical problem with this product, or to make comments and recommendations about our products or documentation, use the contact information listed next:

- United States telephone: 1 877 912-3444
- International telephone: 1 952 912-3444
- email: digi.info@digi.com
- Web site: <http://digi.com>

Chapter 1: Using NET+Works with GNU Tools and a Hardware Debugger

This chapter provides a series of tasks that will get you up and running with NET+Works with GNU Tools. In these tasks, you will:

- Install NET+Works with GNU Tools.
- Configure IP parameters.
- Complete a brief exercise that demonstrates how to use the tool set, including:
 - Building the board support package (BSP), libraries, and template applications
 - Running and debugging the sample application

You must do all the tasks in this chapter, in the order in which they are presented.

To get started, go on to “Task 1: Getting ready.”

Note: If you are using the GDB software debugger, skip to Chapter 2: “Using NET+Works with GNU Tools and the GDB Software Debugger.”



Plan to spend approximately two hours completing the tasks.

Task 1: Getting ready



This task describes what you need to do before you get started.

The instructions in this document are based on the assumption that you have already installed your hardware.

Gather IP parameters

See your network administrator for IP parameter information:

- If you are using a Raven debugger, you need IP parameters for the development board *only*.
- If you are using a MAJIC probe, you need IP parameters for both the development board and the MAJIC.

You may find it convenient to write the information in the spaces provided.

Development board

- IP address:

- Subnet mask:

- Default gateway:

MAJIC probe

- IP address:

- Subnet mask:

- Default gateway:

Save files and close applications

Save all open files and close any open applications, because after you install the software, you will reboot your PC.

Verify your access rights

Make sure you have administrative rights on the PC on which you are installing NET+Works.

Verify hardware requirements

- Your PC must be running either Microsoft Windows 2000 or XP.

Be aware that Windows 95/98/ME, Windows NT 4.0, and Windows Server 2003 are *not* supported.

- If you are using a MAJIC probe and need to configure it, it's most convenient to have two COM ports on your PC.

MAJIC upgrades

If you are using a MAJIC probe with firmware prior to version 3.6.4, you must upgrade the MAJIC firmware.

For instructions, see the Appendix.

What's next?

Go on to the next task to install the NET+Works software.

Task 2: Installing the NET+Works software

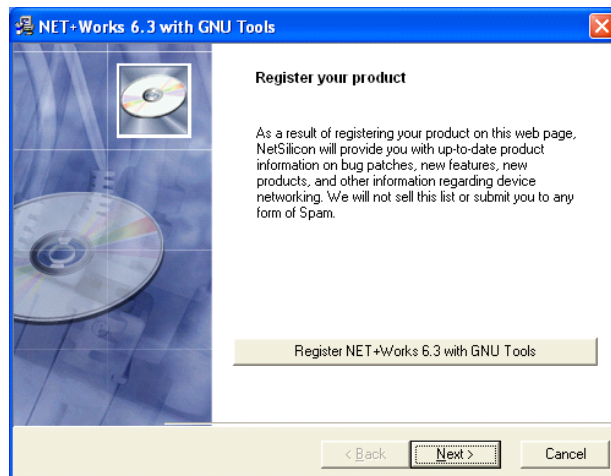
In this task, you will install the NET+Works software on your system, using a wizard that guides you through the process.

During the installation, if you register NET+Works, you are prompted for a serial number. Use the serial number that's located on your development board. If the development board is not available, use Vnnnnnnnn.

► To install NET+Works:

- 1 Place the installation CD in your CD drive, and follow the wizard prompts.

After about 40 minutes, the **NET+Works 6.3 with GNU Tools** dialog box prompts you to register your product:



Digi recommends that you register your software so you can receive information about software updates.

- 2 If you want to register your software, click **Register NET+Works 6.3 with GNU Tools**, and follow the prompts.
Digi recommends that you register your software so you can receive information about software updates.
- 3 To complete the installation, in the **NET+Works 6.3 with GNU Tools** dialog box, click **Next**.
After the NET+Works software is installed, you see a prompt about whether to restart your PC.
- 4 You *must* click **OK**.

What's next?

If you are using a MAJIC probe, go to the next task to set up the MAJIC's IP address.

If you are using a Raven debugger, skip to Task 5, "Configuring the IP address of the development board."

Task 3: Setting up the IP address of the MAJIC probe

This task describes how to set up the IP address of the MAJIC probe. In this procedure, you'll use the EPI MAJIC Setup Wizard and provide the information you gathered in Task 1.

You must follow the instructions in this task if:

- You are a new user.
- You are upgrading and do not know the IP address of your MAJIC probe.

Otherwise, skip to the next task.

► To set up the MAJIC's IP address:

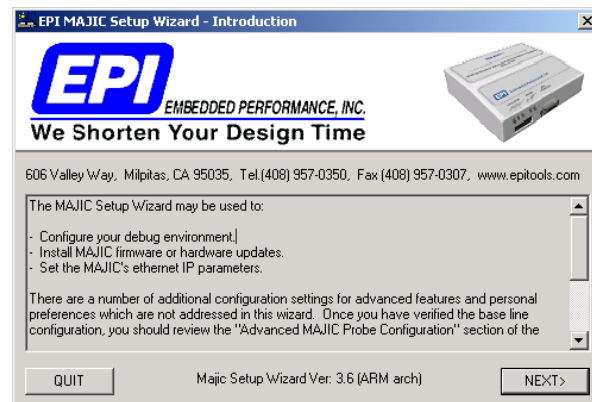
- 1 Using the serial cross cable that ships with the MAJIC, connect the MAJIC to an available COM port on your PC.

If you don't have an available connection on your PC, reuse the one that's already connected to the development board. In this case, close all applications associated with the COM port, such as HyperTerminal.

- 2 Do one of these steps:

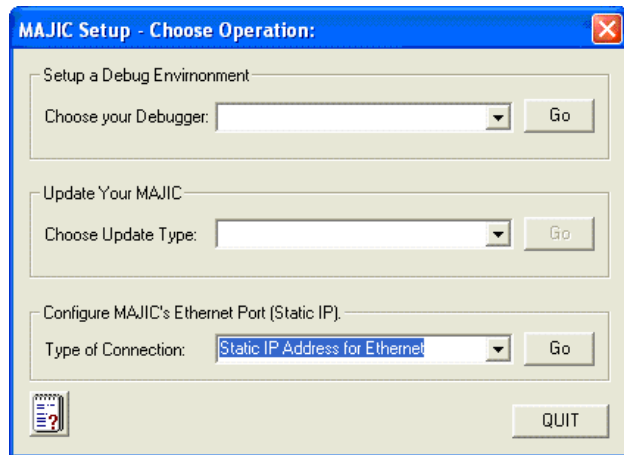
- **Windows XP systems.** Select Start → All Programs → EPI Tools-EDTA 2.2a → MAJIC Setup Wizard.
- **Windows 2000 systems.** Select Start → Programs → EPI Tools-EDTA 2.2a → MAJIC Setup Wizard.

The EPI MAJIC Setup Wizard Introduction window opens:



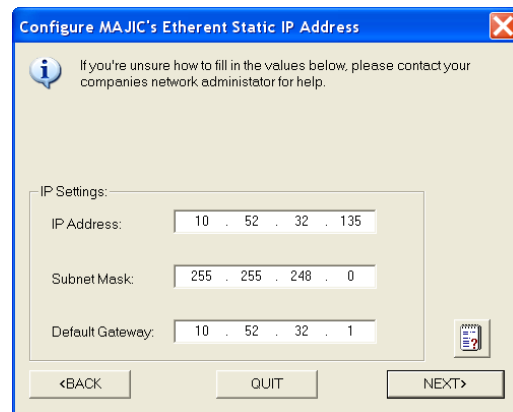
- 3 Click NEXT.

The Choose Operations window opens:



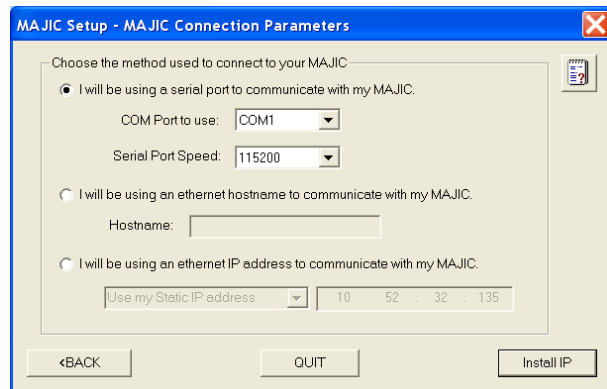
- 4 From the Type of Connection pulldown menu, select **Static IP Address for Internet**, and then click **Go**.

The Configure MAJIC's Ethernet Static IP Address window opens; this example has the information filled in.

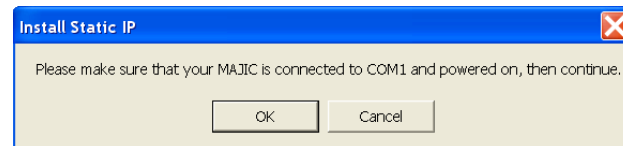


- 5 Enter the information you got from your network administrator, using the format shown in the example:
- **IP Address**
 - **Subnet Mask**
 - **Default Gateway**
- and then click **NEXT**.

The MAJIC Connection Parameters window opens:



The Install Static IP dialog box opens:



- 7 In the Install Static IP dialog box, click **OK**.
A dialog box and a DOS window open.
- 8 In the Check Your Installation Result dialog box, confirm that the IP address information in the DOS window is correct by clicking **OK**.
If there is a problem, correct it, and go back to step 1 of this task.
- 9 After the MAJIC configuration completes, power-cycle the MAJIC.

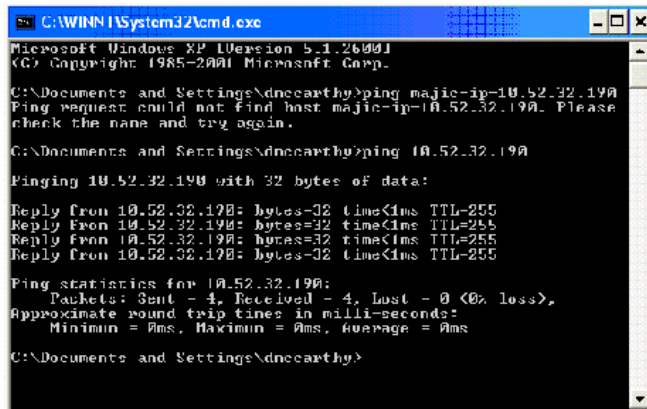
- 6 Do these steps:
 - a Click **I will be using a serial port to communicate with my MAJIC**.
 - b From the **COM port to use** pulldown menu, select the serial port number.
Make sure no other programs are using the COM port you select.
 - c Click **Install IP**.

- 10 In the DOS window, which opened as a result of step 7, ping the MAJIC's IP address; for example:

```
ping 10.52.32.135
```

where 10.52.32.135 is the IP address of your MAJIC, which you configured in step 5.

This is what you see in the DOS window:



```
C:\WINNT\System32\cmd.exe
Microsoft Windows XP [Version 5.1.2600.1
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\dncearthy>ping majic-ip-10.52.32.190
Ping request could not find host majic-ip-10.52.32.190. Please
check the name and try again.

C:\Documents and Settings\dncearthy>ping 10.52.32.190

Pinging 10.52.32.190 with 32 bytes of data:

Reply from 10.52.32.190: bytes=32 time<1ms TTL=255
Reply from 10.52.32.190: bytes=32 time<1ms TTL=255
Reply from 10.52.32.190: bytes=32 time<1ms TTL=255
Reply from 10.52.32.190: bytes=32 time<1ms TTL=255

Ping statistics for 10.52.32.190:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Documents and Settings\dncearthy>
```

If the ping receives replies, the IP address is installed.

If the ping times out, do these steps:

- Check the Ethernet connection to the MAJIC.
- Confirm that the IP parameters are legal.
- Verify that you power-cycled your MAJIC.

Otherwise, repeat this task.

- 11 Close the DOS window.

What's next?

Now that you've set up your MAJIC's IP address, you'll create an MDI-server icon that you can use to debug with gdbtk. Go on to the next task.

Task 4: Creating an MDI server icon

The MDI server icon is the interface between the MAJIC and GDB, which is the debug environment. In this task, you'll make software configuration settings for the MDI server icon.

The EPI MAJIC Setup Wizard guides you through this process, in which you'll make selections and provide information.

► To create the MDI server icon:

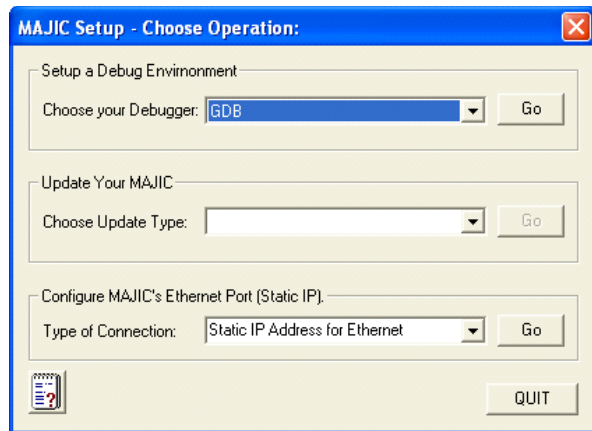
- 1 Start the EPI MAJIC Setup Wizard by doing one of these steps:
 - **Windows XP systems.** Select Start → All Programs → EPI Tools-EDTA 2.2a → MAJIC Setup Wizard.
 - **Windows 2000 systems.** Select Start → Programs → EPI Tools-EDTA 2.2a → MAJIC Setup Wizard.

The EPI MAJIC Setup Wizard Introduction window opens:

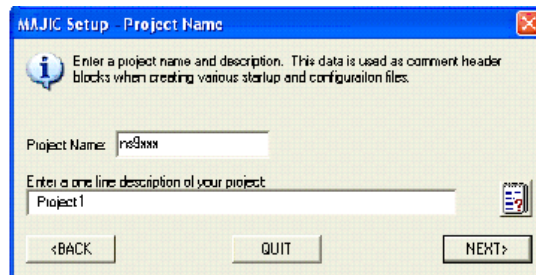


- 2 After you review the introduction, click NEXT.

The Choose Operation window opens:



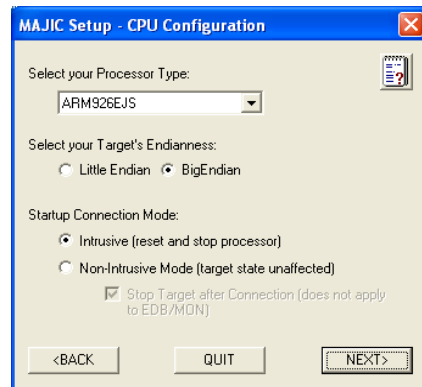
The Project Name window opens:



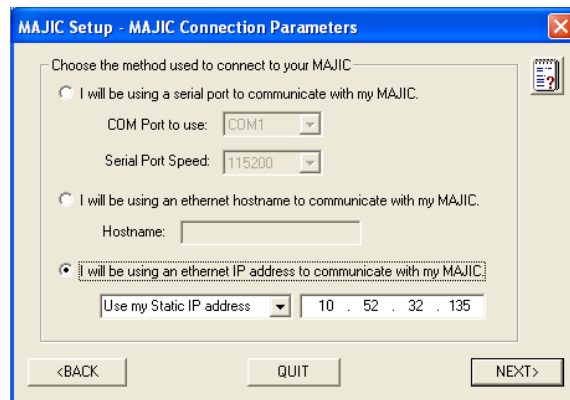
- 3 From the **Choose Your Debugger** pulldown menu, select **GDB**, and then click **Go**.

- 4 Create a new project by entering a project name and a brief description. Then click **NEXT**.

The CPU Configuration window opens:



The MAJIC Connection Parameters window opens:



5 Do these steps:

- a From the **Select Your Processor Type** pulldown menu, select **ARM926EJS**.
- b Under **Select your Target's Endianness**, click **BigEndian**.
- c Under **Startup Connection Mode**, click **Intrusive Mode (reset and stop processor)**.

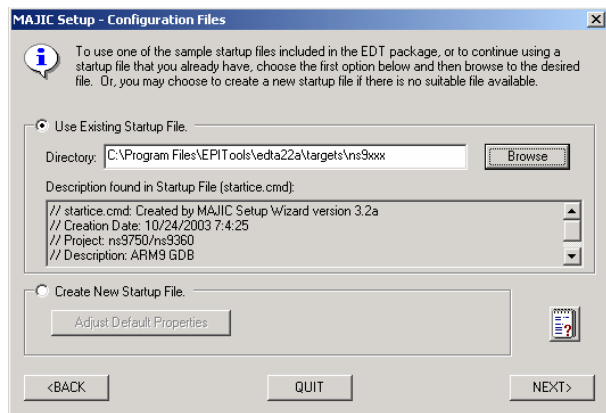
Then click **NEXT**.

6 Do these steps:

- a Click **I will be using an Ethernet IP address to communicate with my MAJIC**, and verify the IP address for the MAJIC. The address should match the one you installed in Task 3
- b Make sure **Use My Static IP address** is selected.

Then click **NEXT**.

The Configuration Files window opens:



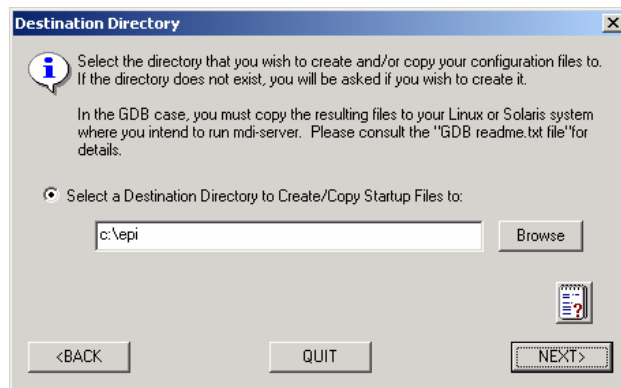
7 Click Use Existing Startup File.

Then do these steps:

- a Click Browse.**
- b Navigate to the Program Files → EPITools → edta22a → targets → ns9xxx directory, and click Open.**

Then click NEXT.

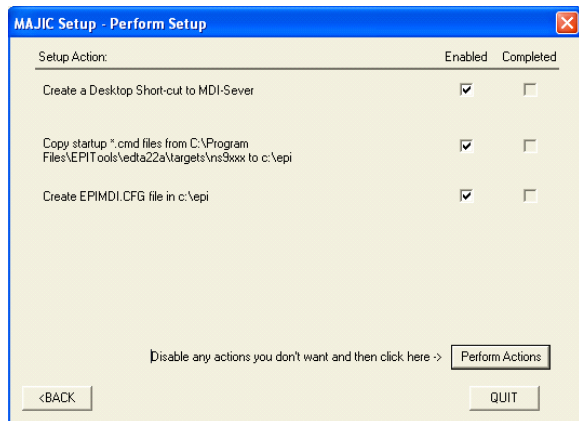
The Destination Directory window opens:



8 Click Select a Destination Directory to Create/Copy Startup Files to.

Then either browse to or create the directory you want to use for files that are created or copied during the MAJIC setup, and click NEXT.

The **Perform Setup** window opens with a summary of your selections:



9 Check Enabled for each item, and then click **Perform Actions**.

This step creates MAJIC setup files in the directory you specified in step 8.

If the directory does not exist, the MAJIC Setup Wizard prompts you with a popup warning to create one. To create the directory, click **Yes**.

The wizard also creates a shortcut to the MDI server on your desktop.

10 To exit from the wizard, click **Done**.

What's next?

Go to the next task to configure the IP address of your development board.

Task 5: Configuring the IP address of the development board

In this task, you'll configure the IP address of your development board, using the information you gathered in Task 1.

During this procedure, be prepared to move quickly to your HyperTerminal window at step 3, because you have only five seconds to respond to the prompt.

If you re-used serial cables to communicate with your MAJIC, reconnect them to your development board now, following the instructions in the *Hardware Installation Guide*.

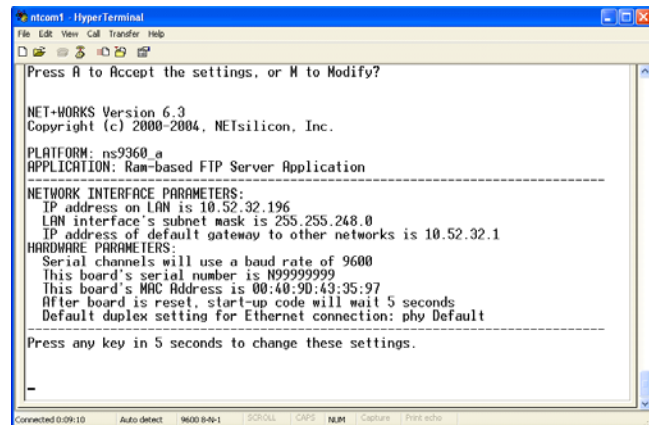
► To configure the IP address of your development board:

- 1 Open a HyperTerminal window by doing one of these steps:
 - **Windows XP systems.** Select Start → All Programs → NET+OS 6.3 GNU Tools → HyperTerminal Connection, and then select the COM port you connected your development board to (either COM1 or COM2).

- **Windows 2000 systems.** Select Start → Programs → NET+OS 6.3 GNU Tools → HyperTerminal Connection, and then select COM port you connected your development board to (either COM1 or COM2).

- 2 Reboot the development board by disconnecting it from the power source and reconnecting it.

In the HyperTerminal window, you see information similar to this:



- 3 *Within five seconds*, press a key.

At the bottom of the window, you see a prompt:

Press A to Accept the settings, or M to Modify?

- 4 To change the configuration, press M, and then press Enter.

You are prompted for a root password.

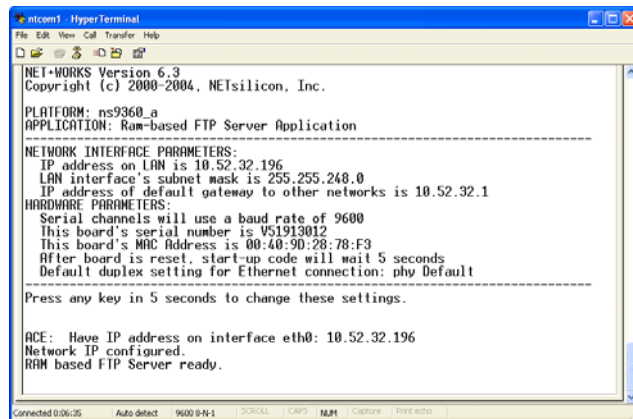
- 5 Enter the default root password — Netsilicon — and press Enter.

The first of a series of configuration prompts appears.

- 6 At each prompt, do one of these steps:
- To accept the current or default value, press Enter.
 - To change a setting, enter a value and press Enter.

After you finish entering the settings, a prompt indicates that you must press a key within five seconds if you want to change additional settings.

After you make your selections, the HyperTerminal window looks similar to this one:



```
ntcom1 - HyperTerminal
File Edit View Call Transfer Help

NET-WORKS Version 6.3
Copyright (c) 2000-2004, NETsilicon, Inc.

PLATFORM: ns9360_a
APPLICATION: Ram-based FTP Server Application
-----
NETWORK INTERFACE PARAMETERS:
IP address on LAN is 10.52.32.196
LAN interface's subnet mask is 255.255.248.0
IP address of default gateway to other networks is 10.52.32.1
HARDWARE PARAMETERS:
Serial channels will use a baud rate of 9600
This board's serial number is V51913012
This board's MAC Address is 00:40:9D:28:78:F3
After board is reset, start-up code will wait 5 seconds
Default duplex setting for Ethernet connection: phy Default
-----
Press any key in 5 seconds to change these settings.

ACE: Have IP address on interface eth0: 10.52.32.196
Network IP configured.
RAM based FTP Server ready.

Connected 0.06:25 Auto detect 9600 Bps-1 SERIAL LANS NUI Capture Print echo
```

What's next?

You are ready to use the development board. You can now build, download, and debug the template application.

[illegible]

1. *Journal of Management Studies*, 1990, 27, 1, 1-14.

You see a list of platforms:

```
/cygdrive/c/netos63_gnu/src/bsp
GNU X-Tools and Bash Shell ready...
Setting up Shell for arm-elf
arm-elf GNU X-Tools Shell Ready...

Pjacobso@ual-cms-train2 /cygdrive/c/netos63_gnu
$ cd /cygdrive/c/netos63_gnu/src/bsp
Pjacobso@ual-cms-train2 /cygdrive/c/netos63_gnu/src/bsp
$ ls platforms/ -l
total 0
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 connectcore9c_a
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 connectm
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 connectsp
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 connectuism
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 connectuime
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 net50_d
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 net50bga_a
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 ns7520_a
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 09:33 ns9360_a
drwx-----+ 2 Pjacobso Domain U      0 Jun 21 08:31 ns9750_a

Pjacobso@ual-cms-train2 /cygdrive/c/netos63_gnu/src/bsp
$
```

- 4 In the X-Tools shell, to build the NS9360 development board, enter this command:

make PLATFORM=ns9360_a clean all
and press Enter.

The build takes several minutes to complete; during this time, you don't see any activity on your screen.

This is an example of a successful BSP build:

```
/cygdrive/c/netos63_gnu/src/bsp
r - ./objs/32h/gnu/ns9360_a/IRQREG.o
r - ./objs/32h/gnu/ns9360_a/getOwner.o
r - ./objs/32h/gnu/ns9360_a/mainvalidate.o
r - ./objs/32h/gnu/ns9360_a/main.o
r - ./objs/32h/gnu/ns9360_a/addpconf_api.o
r - ./objs/32h/gnu/ns9360_a/mmu.o
r - ./objs/32h/gnu/ns9360_a/cache.o
r - ./objs/32h/gnu/ns9360_a/post_isr.o
r - ./objs/32h/gnu/ns9360_a/attb.o
r - ./objs/32h/gnu/ns9360_a/blExe_arm9.o
r - ./objs/32h/gnu/ns9360_a/mainvalidate.o
r - ./objs/32h/gnu/ns9360_a/main.o
r - ./objs/32h/gnu/ns9360_a/main.o
MAKE make PLATFORM=ns9360_a ENDIAN=mbig-endian PROCESSOR=arm9 TOOLSET=gnu_CPU_I
LAG=ncpu-arm9tdmi DEBUG=off
/usr/arm-elf/bin/arm creating ../libs/gnu/ns9360_a/libnet.a
Compressing bhran.bin to bhranzip.bin
Using LZSS Encoder/Decode (v2)
Input bytes:      68492
Output bytes:     37376
Compression ratio: 45%
Compressing temp_bhran.bin to bhranzip.bin
Using LZSS Encoder/Decode (v2)
Input bytes:      86280
Output bytes:     47905
Compression ratio: 45%
Building SPI bin 2 $
Insert SPI boot header in temp_rom.bin to generate ../platforms/ns9360_a/spi
rom.bin
Pjacobso@ual-cms-train4 /cygdrive/c/netos63_gnu/src/bsp
$ =
```

Building the template application

► To build the template application:

- 1 In the X-Tools shell, change to the build directory of the template sample:

```
cd /cygdrive/c/netos63_gnu/src/apps/template/32b
and press Enter.
```

- 2 To create a .gdbinit file, do one of these steps:

- If you are using a MAJIC, enter this command:
make PLATFORM=ns9360_a gdbinit
and press Enter.

This step creates an ARM9 MAJIC .gdbinit file.

- If you are using a Raven, do either of these steps:

ARM9-based platforms. Copy /cygdrive/c/

netos63_gnu/debugger_files/gdbns9xxx.raven to the 32b folder for your application, and rename it .gdbinit by entering:

```
cp ../../../../debugger_files/gdbns9xxx.raven
./gdbinit
and press Enter.
```

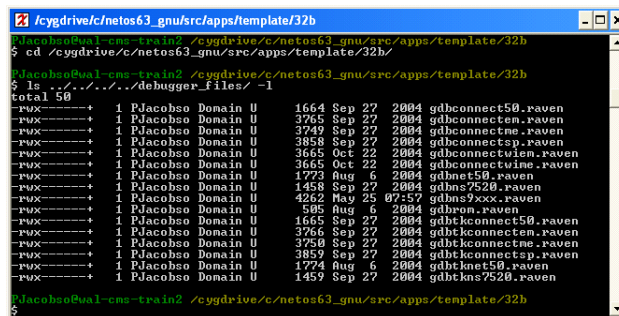
ARM7-based platforms. Copy /cygdrive/c/

netos63_gnu/debugger_files/gdbmyplatform.raven to the 32b folder for your application, and rename it .gdbinit

where *gdbmyplatform* corresponds to the platform you are using. For example, for the ConnectSP, you would enter:

```
cp ../../../../debugger_files/
gdbconnectsp.raven ./gdbinit
and press Enter.
```

You see a list of debugger scripts in the X-Tools shell:



```

/cygdrive/c/netos63_gnu/src/apps/template/32b
Pjacobso@ual-cms-train2 /cygdrive/c/netos63_gnu/src/apps/template/32b
$ cd /cygdrive/c/netos63_gnu/src/apps/template/32b/
Pjacobso@ual-cms-train2 /cygdrive/c/netos63_gnu/src/apps/template/32b
$ ls ../../../../debugger_files/ -l
total 50
-rwxr-xr-x+ 1 Pjacobso Domain U 1664 Sep 27 2004 gdbconnect50.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3765 Sep 27 2004 gdbconnecten.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3749 Sep 27 2004 gdbconnectne.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3858 Sep 27 2004 gdbconnectsp.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3665 Oct 22 2004 gdbconnectwien.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3665 Oct 22 2004 gdbconnectwien.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 1773 Aug 6 2004 gdbnet50.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 1458 Sep 27 2004 gdbns7520.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 4252 May 25 07:57 gdbns7xxx.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 506 Aug 6 2004 gdbns7xxx.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 1665 Sep 27 2004 gdbtkconnect50.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3766 Sep 27 2004 gdbtkconnecten.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3768 Sep 27 2004 gdbtkconnectne.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 3859 Sep 27 2004 gdbtkconnectsp.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 1774 Aug 6 2004 gdbtknet50.raven
-rwxr-xr-x+ 1 Pjacobso Domain U 1459 Sep 27 2004 gdbtkns7520.raven
Pjacobso@ual-cms-train2 /cygdrive/c/netos63_gnu/src/apps/template/32b
$
```

Do not use the gdbtk scripts.*

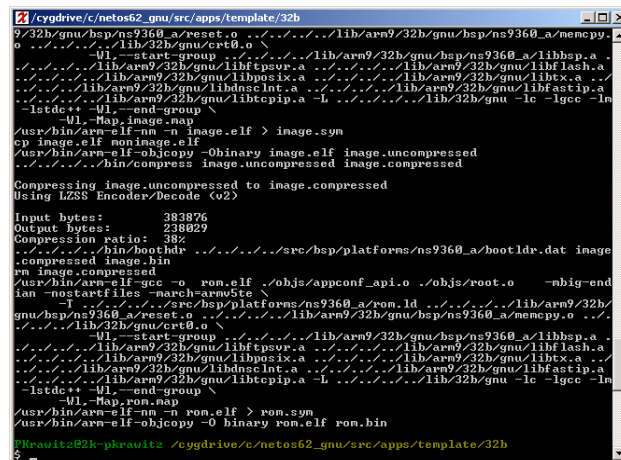
3 To build the application, enter this command in the X-Tools shell:

```
make PLATFORM=ns9360_a clean all
```

and press Enter.

This command builds `image.elf`, which is the image you'll download to the debugger, and `rom.bin`, which is the corresponding ROM image. The process, which you can see in the X-Tools shell, takes a few seconds.

Here is an example of a successful application build:



```
cygdrive/c/netos62_gnu/src/apps/template/32b
9/32h/gnu/bsp/ns9360_a/reset.o ../../../../lib/arm9/32h/gnu/bsp/ns9360_a/memcpy.o
../../../../lib/32h/gnu/crt0.o \
    -Wl,--start-group ../../../../lib/arm9/32h/gnu/bsp/ns9360_a/libbsp.a
../../../../lib/arm9/32h/gnu/libftpsvr.a ../../../../lib/arm9/32h/gnu/liblash.a
../../../../lib/arm9/32h/gnu/libposix.a ../../../../lib/arm9/32h/gnu/libtx.a
../../../../lib/arm9/32h/gnu/libnscInt.a ../../../../lib/arm9/32h/gnu/libfastip.a
../../../../lib/arm9/32h/gnu/libtcpip.a -L ../../../../lib/32h/gnu -lc -lgcc -lm
-lstdc++ -Wl,--end-group \
-Wl,-Map,image.map
/usr/bin/arm-elf-ld -r image.elf > image.sym
cp image.elf nonimage.elf
/usr/bin/arm-elf-objcopy -O binary image.elf image.uncompressed
../../../../bin/compress image.uncompressed image.compressed
Compressing image.uncompressed to image.compressed
Using LZSS Encoder/Decode (v2)
Input bytes:      383876
Output bytes:     238029
Compression ratio: 38%
../../../../bin/bootldr ../../../../src/bsp/platforms/ns9360_a/bootldr.dat image
.compressed image.bin
rm image.compressed
/usr/bin/arm-elf-gcc -o rom.elf ./objs/appconf_api.o ./objs/root.o -nbig-end
ian -nostartfiles -march=armv5te \
-I ../../../../src/bsp/platforms/ns9360_a/rom.ld ../../../../lib/arm9/32h/
gnu/bsp/ns9360_a/reset.o ../../../../lib/arm9/32h/gnu/bsp/ns9360_a/memcpy.o
../../../../lib/32h/gnu/crt0.o
-Wl,--start-group ../../../../lib/arm9/32h/gnu/bsp/ns9360_a/libbsp.a
../../../../lib/arm9/32h/gnu/libftpsvr.a ../../../../lib/arm9/32h/gnu/liblash.a
../../../../lib/arm9/32h/gnu/libposix.a ../../../../lib/arm9/32h/gnu/libtx.a
../../../../lib/arm9/32h/gnu/libnscInt.a ../../../../lib/arm9/32h/gnu/libfastip.a
../../../../lib/arm9/32h/gnu/libtcpip.a -L ../../../../lib/32h/gnu -lc -lgcc -lm
-lstdc++ -Wl,--end-group \
-Wl,-Map,rom.map
/usr/bin/arm-elf-ld -r rom.elf > rom.sym
/usr/bin/arm-elf-objcopy -O binary rom.elf rom.bin
phrawitz@2k-phrawitz /cygdrive/c/netos62_gnu/src/apps/template/32h
$
```


Downloading the template application

► To download Hello World:

- 1 Power-cycle the development board.
- 2 Power-cycle the MAJIC or Raven.
- 3 Do one of these steps:
 - If you are using a MAJIC probe, click the MDI server icon on your desktop.
 - If you are using a Raven debugger, click the icon for your board:
Ocd Remote for NET+50
Ocd Remote for NS7520
Ocd Remote for ARM926EJ-S

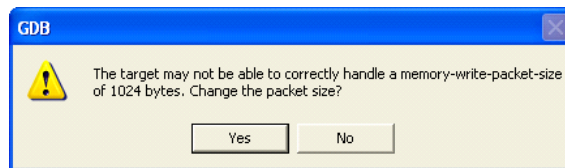
(If you get Error 43, check that your board has power and that the Raven is connected properly, and try again. If the window closes immediately or is blank, power-cycle your board and try again.)

- 4 To start up GDB, enter this command in the X-Tools shell:

```
gdbtk -se image.elf
```

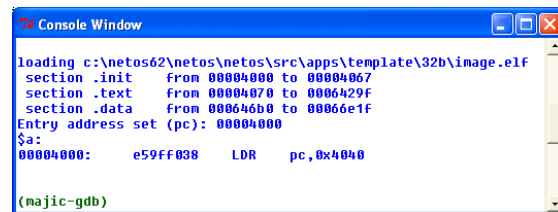
and press Enter.

If you are using a Raven debugger, you see this GDB popup warning:



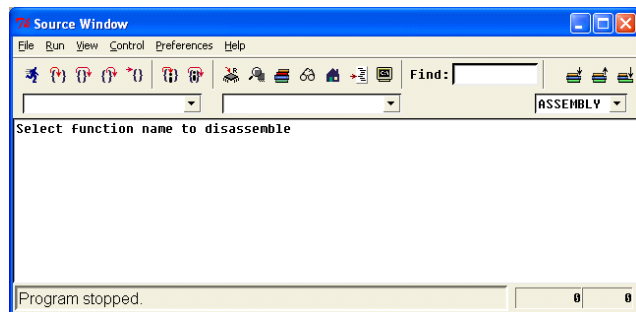
Click Yes.

The Console Window opens:



If you are using a Raven debugger, and you see errors in the **Console Window**, power-cycle your board, and do this task again.

Then the **Source Window** opens:



What's next?

Now you're ready to run and debug the template application. Go on to the next task.

- 5 (ARM7 platforms only) To load the `image.elf`, in the **gdbtk Console Window**, enter:

```
load image.elf
```

and then press Enter.

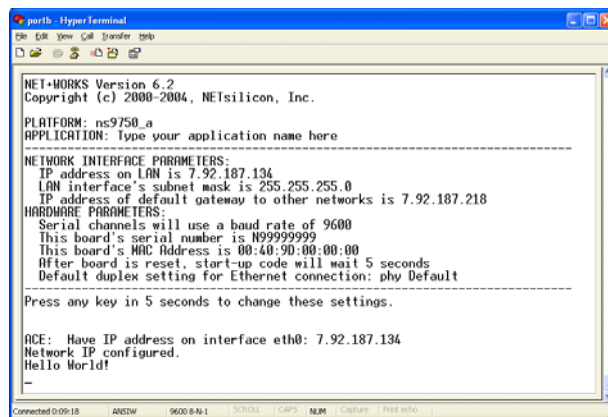
Task 7: Running and debugging the template application

You run and debug your application in the Debugger window.

Running the application

To run the template application, from the gdbtk Source Window, select Control → Continue

The application dialog scrolls in the HyperTerminal window:



```
port0 - HyperTerminal
File Edit View Call Transfer Help
[Icons]
NET+WORKS Version 6.2
Copyright (c) 2000-2004, NETsilicon, Inc.

PLATFORM: nc9750_a
APPLICATION: Type your application name here

-----
NETWORK INTERFACE PARAMETERS:
IP address on LAN is 7.92.187.134
LAN interface's subnet mask is 255.255.255.0
IP address of default gateway to other networks is 7.92.187.218
HARDWARE PARAMETERS:
Serial channels will use a baud rate of 9600
This board's serial number is N99999999
This board's MAC Address is 00:40:90:00:00:00
After board is reset, start-up code will wait 5 seconds
Default duplex setting for Ethernet connection: phy Default
-----
Press any key in 5 seconds to change these settings.

ACE: Have IP address on interface eth0: 7.92.187.134
Network IP configured.
Hello World!
--
Connected 0:00:18  ANSI  9600 8-N-1  3000  100%  RJ45  Cable  Port 000
```

Note that Hello World! appears in the last line of the window.

Debugging the application with a break point

In this section, you will insert a break point at the beginning of your application. Because the application already will have completed, you need to rerun the application to demonstrate the breakpoint.

► To debug the template application:

- 1 In the **Source Window**, click **Stop**.

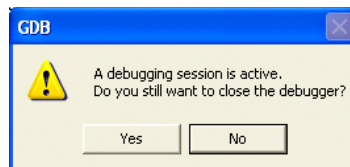
You see this warning, which is not a fatal error:



- 2 Click **OK**.
- 3 To insert a break point, enter this command in the **gdbtk Console Window**:
`b applicationStart`
and then press **Enter**.

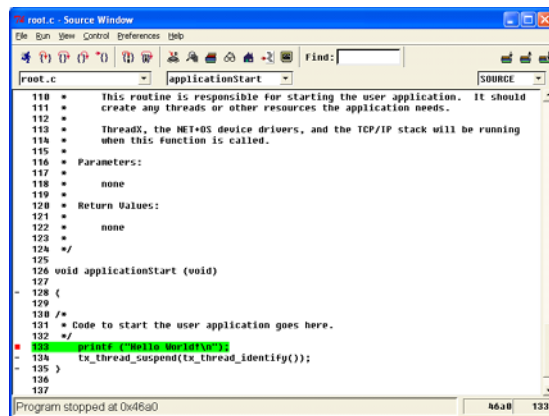
- 4 To rerun the application, close the debugger by closing the **Source Window**.

A GDB popup opens:



- 5 Click **Yes**.
- 6 (*Raven only*). Close the **Ocd Remote**, power-cycle the development board, and restart the **Ocd Remote**.
The **Source Window** opens.
- 7 To restart GDB, enter this command in the **X-Tools shell**:
`gdbtk -se image.elf`
and press **Enter**.
- 8 To rerun the program, in the **gdbtk Source Window**, select **Control → Continue**.

After a few seconds, you see this window:



```
root.c - Source Window
File Edit View Control References Help
Find:
root.c applicationStart SOURCE
110 * This routine is responsible for starting the user application. It should
111 * create any threads or other resources the application needs.
112 *
113 * ThreadX, the NET-OS device drivers, and the TCP/IP stack will be running
114 * when this function is called.
115 *
116 * Parameters:
117 *
118 * none
119 *
120 * Return Values:
121 *
122 * none
123 *
124 */
125
126 void applicationStart (void)
127 {
128 {
129
130 /*
131 * Code to start the user application goes here.
132 */
133 printf("Hello World!\n");
134 tx_thread_suspend(tx_thread_identify());
135 }
136
137
Program stopped at 0x48a0 h6a0 133
```

What's next?

Because you are using a hardware debugger, you do not need to do the tasks and procedures in Chapter 2.

You may, however, want to get some tips and suggestions in Chapter 3.

Chapter 2: Using NET+Works with GNU Tools and the GDB Software Debugger

This chapter provides a series of tasks that will get you up and running with NET+Works with GNU Tools and the GDB software debugger. In these tasks, you will:

- Install NET+Works with GNU Tools.
- Configure IP parameters.
- Set up the GDB software debugger.
- Debug the template application using the GDB software debugger.

You must do all the procedures in this chapter, in the order in which they are presented.

To get started, go on to Task 1, “Getting ready.”

Note: If you are using NET+Works with GNU Tools with a hardware debugger, do not do the tasks in this chapter.



Note Plan to spend approximately two hours completing the tasks in this chapter.

Task 1: Getting ready



This task describes what you need to do before you get started.

The instructions in this document are based on the assumption that you have already installed your hardware.

Gather IP parameters

See your network administrator for IP parameters for your development board.

You may find it handy to write the information in the spaces provided:

- IP address:

- Subnet mask:

- Default gateway:

TFTP server

To use the GDB software debugger, you must have a TFTP-compliant server installed and running on your development PC.

TFTP freeware is readily available on the Web, as are commercial grade versions. Before you go on to Task 2, download and install a TFTP-compliant server.

In addition, you need to know the IP address of your PC:

- PC/TFTP server IP address:

Save files and close applications

Save all open files and close any open applications, because after you install the software, you will reboot your PC.

Verify your access rights

Make sure you have administrative rights on the PC on which you are installing NET+Works.

Verify hardware requirements

- Your PC must be running either Microsoft Windows 2000 or XP.

Be aware that Windows 95/98/ME, Windows NT 4.0, and Windows Server 2003 are *not* supported.

- The PC must have two COM ports.

What's next?

Go to the next task to install NET+Works.

Task 2: Installing the NET+Works software

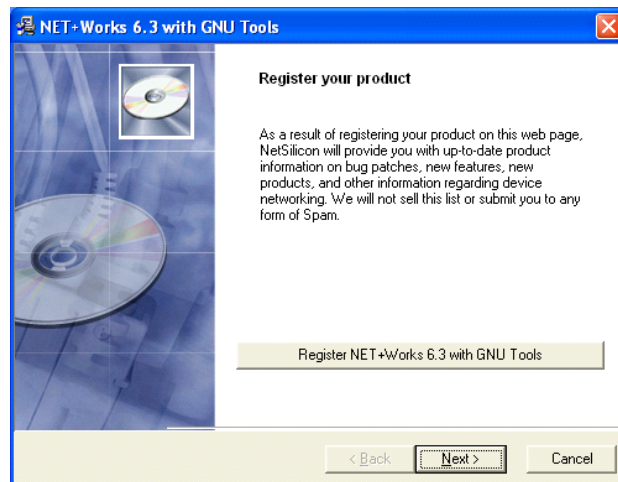
In this task, you will install the NET+Works software on your system, using a wizard that guides you through the process.

During the installation, if you register NET+Works, you are prompted for a serial number. Use the serial number that's located on your development board. If the development board is not available, use Vnnnnnnnn.

► To install NET+Works:

- 1 Place the installation CD in your CD drive, and follow the wizard prompts.

After about 40 minutes, the **NET+Works 6.3 with GNU Tools** dialog box prompts you to register your product:



Digi recommends that you register your software so you can receive information about software updates

- 2 If you want to register your software, click **Register NET+Works 6.3 with GNU Tools**, and follow the prompts.
- 3 To complete the installation, in the **NET+Works 6.3 with GNU Tools** dialog box, click **Next**.

After the NET+Works software is installed, you see a prompt about whether to restart your PC.

- 4 You *must* click **OK**.

What's next?

Go to the next task to configure the IP address of your development board.

Task 3: Configuring the IP address of the development board

In this task, you'll configure the IP address of your development board, using the information you gathered in Task 1.

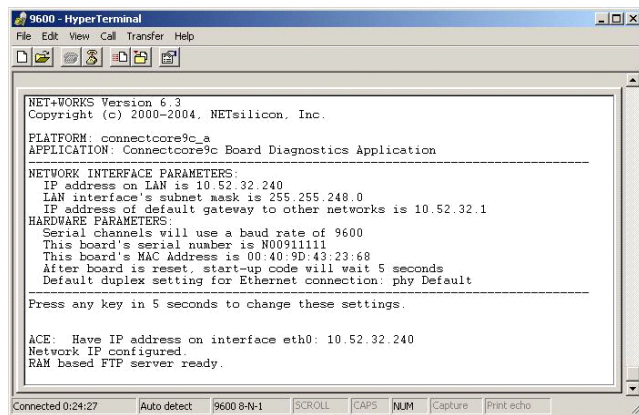
Be prepared to move quickly to your HyperTerminal window at step 3, because you have only a few seconds to respond to the prompt.

► To configure the development board's IP address:

- 1 Open a HyperTerminal window by doing one of these steps:
 - **Windows XP systems.** Select **Start → All Programs → NET+OS 6.3 GNU Tools → HyperTerminal Connection**, and then select the COM port you connected your development board to (either **COM1** or **COM2**).
 - **Windows 2000 systems.** Select **Start → Programs → NET+OS 6.3 GNU Tools → HyperTerminal Connection**, and then select COM port you connected your development board to (either **COM1** or **COM2**).

- 2 Reboot the development board by disconnecting it from the power source and then reconnecting it.

In the HyperTerminal window, you see information similar to this:



```
9600 - HyperTerminal
File Edit View Call Transfer Help

NET+WORKS Version 6.3
Copyright (c) 2000-2004, NETsilicon, Inc.

PLATFORM: connectcore9c_a
APPLICATION: Connectcore9c Board Diagnostics Application

-----
NETWORK INTERFACE PARAMETERS:
IP address on LAN is 10.52.32.240
LAN interface's subnet mask is 255.255.248.0
IP address of default gateway to other networks is 10.52.32.1
HARDWARE PARAMETERS:
Serial channels will use a baud rate of 9600
This board's serial number is N00911111
This board's MAC Address is 00:40:9D:43:23:68
After board is reset, start-up code will wait 5 seconds
Default duplex setting for Ethernet connection: phy Default

Press any key in 5 seconds to change these settings.

ACE: Have IP address on interface eth0: 10.52.32.240
Network IP configured
RAM based FTP server ready.

Connected 0:24:27  Auto detect  9600 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

- 3 Within five seconds, press a key.
- 4 To change the configuration, press M, and then press Enter.

You are prompted for a root password.

- 5 Enter the default root password — `Netsilicon` — and then press Enter.

The first of a series of configuration prompts appears.

- 6 At each prompt, do one of these steps:
 - To accept the current setting, press Enter.
 - To change a setting, enter a value, and press Enter.

After you scroll through the settings, a prompt indicates that you must press a key within five seconds if you want to change additional settings.

If you don't press a key, after the five-second timeout, you see your selections in the **HyperTerminal** window.

What's next?

Go on to the next task to set up the GDB software debugger.

Task 4: Setting up the GDB software debugger

This task demonstrates how you can enable the GDB software debugger on your platform. The examples use the ConnectCore 9C, using serial port B (“/com/1”) to transport the GDB protocol.

In this task, you’ll:

- Update the BSP.
- Build the BSP.
- Download the GDB software debugger-enabled bootloader to the development board
- Update the application.
- Launch a TFTP server that contains the debug image.
- Execute the GDB-enabled bootloader.

Updating the BSP

To create a GDB-server-enabled bootloader and application, you need to update the platform BSP.

► To update the BSP:

- 1 Edit the `/cygdrive/c/netos63_gnu/src/bsp/platforms/connectcore9c_a/bsp.h` file by setting `BSP_GDB_SERVER_ENABLE` to `TRUE`.
- 2 Edit the `/cygdrive/c/netos63_gnu/src/bsp/platforms/connectcore9c_a/gdb.h` file by setting `NA_GDB_TFTP_SERVER` to the TFTP server address you got in Task 1.

► To build the BSP:

- 1 Double-click the **NET+Works 6.3 Build Environment** icon on your desktop.
An X-Tools shell opens.
- 2 In the X-Tools shell, change the working directory to the top-level BSP directory by typing:
`cd /cygdrive/c/netos63_gnu/src/bsp`
and then press Enter.

- 3 In the X-Tools shell, build the ConnectCore 9C development board by entering this command:

```
make PLATFORM=connectcore9c_a clean all
```

and press Enter.

The build takes several minutes to complete; during this time, you don't see any activity on your screen.

Loading the GDB-server-enabled bootloader

The development board ships with a default application that contains an FTP server. You will use a remote FTP client to update the development board's original bootloader (rom.bin), using the development board's FTP server. The FTP server login is:

username: root

password: Netsilicon

► To load the GDB-server-enabled bootloader:

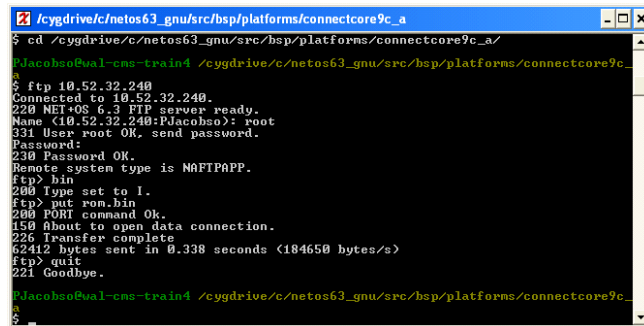
- 1 Power-cycle the development board.
- 2 From an X-Tools shell, set the working directory to the BSP platform directory; for example:

```
cd /cygdrive/c/netos63_gnu/src/bsp/platforms/  
connectcore9c_a
```

and then press Enter.

- 3 Using the X-Tools FTP client, download the platform's rom.bin bootloader file, in binary mode, to the development board.

This is what you see during the download:

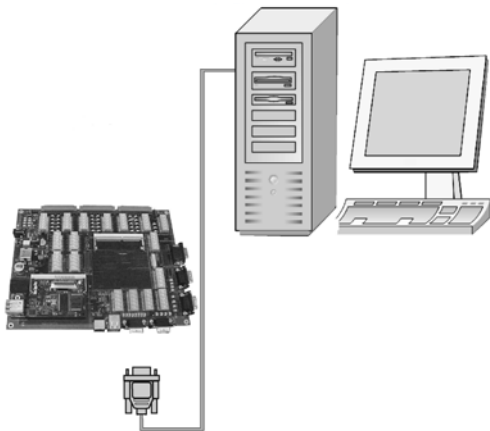


```
/cygdrive/c/netos63_gnu/src/bsp/platforms/connectcore9c_a  
$ cd /cygdrive/c/netos63_gnu/src/bsp/platforms/connectcore9c_a/  
PJacobso@ual-cms-train4 /cygdrive/c/netos63_gnu/src/bsp/platforms/connectcore9c_a  
$ ftp 10.52.32.240  
Connected to 10.52.32.240.  
220 NET-OS 6.3 FTP server ready.  
Name (10.52.32.240:PJacobso): root  
331 User root OK, send password.  
Password:  
230 Password OK.  
Remote system type is NAFTAPP.  
ftp> bin  
200 Type set to I.  
ftp> put rom.bin  
200 PORT command Ok.  
150 About to open data connection.  
226 Transfer complete  
62412 bytes sent in 0.338 seconds (184650 bytes/s)  
ftp> quit  
221 Goodbye.  
PJacobso@ual-cms-train4 /cygdrive/c/netos63_gnu/src/bsp/platforms/connectcore9c_a  
$
```

The rom.bin bootloader file contains the GDB software debugger.

Adding a second serial connection

Connect a second crossover cable from COM2 on your PC to the development board's serial port B, as shown here:



Updating the template application

Make these changes so the application can use the GDB software debugger. The template application is located in:
`/cygdrive/c/netos63_gnu/src/apps/template`

► To update the template application:

- 1 In the template application's `root.c` file, make these changes:
 - Add `naGdbStart("/com/1");` to the first call in the `applicationStart` function.
 - Add `#include "armgdb.h"` to the top of the file.
- 2 In the application's Makefile, add `libgdb.a` to the `APP_LIBS` definition.

- 3 In the X-Tools shell, change to the template build directory:
`cd /cygdrive/c/netos63_gnu/src/apps/template/32b`
and press Enter.
- 4 In the X-Tools shell, build the application:
`make PLATFORM=connectcore9c_a clean all`
and press Enter.

Launching the TFTP server

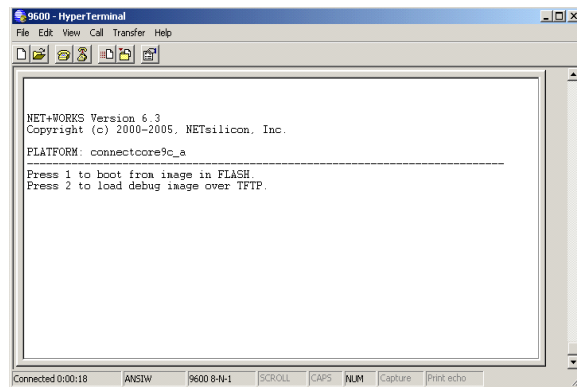
Start the TFTP server, and point it to the template application `image.bin` file located in this directory:
`/cygdrive/c/netos63_gnu/src/apps/template/32b`

Executing the GDB software debugger-enabled bootloader

► To execute the GDB-server-enabled bootloader:

- 1 Power-cycle the development board.

This menu appears on the standard serial out port:



This menu has a five-second timeout, after which it defaults to a boot from flash.

The development board contains a default FTP server image that it runs if you don't intervene within five seconds. Allow this timeout; the standard NET+Works dialog scrolls after a pause.

- 2 Power-cycle the development board again.

The menu from step 1 opens again.

- 3 Enter 2.

The menu continues.

- 4 At the Enter TFTP server IP address prompt, press Enter.

- 5 At the Enter debug image filename prompt, press Enter.

The GDB-server-enabled bootloader downloads the debug `image.bin` application and begins execution.

You see the template application dialog in your HyperTerminal window.

The development board is now waiting for the GDB software debugger, which is at a break point at `naGdbStart` in the `root.c` file.

What's next?

Go to the next task to debug with the GDB software debugger.

Task 5: Debugging the template application

► To debug the template application:

- 1 Create the application's `.gdbinit` file in the application's build directory; for example:

```
make PLATFORM=connectcore9c_a gdbdebuginit
```

and then press Enter.

The `gdbinit` file sets up the PC to communicate with the GDB software debugger on `/dev/com1` at 115200 baud rate.

- 2 In the `.gdbinit` file, change the last line from `/dev/com1` to `/dev/com2`.

- 3 To start the debugger, enter:

```
gdbtk -se image.elf
```

and press Enter.

As soon as you start GDB, it is idling at the `naGdbStart` break point.

- 4 To continue to run the template application in the console window, enter `c`.

What's next?

You have now completed all the tasks in this chapter.

You may, however, want to see Chapter 3 for some tips and suggestions.

Chapter 3: Tips and Suggestions

Now that you've completed the exercise, here are some tips for when you start using NET+Works with GNU Tools with your own projects.

Where should I put my code, and why?

Add your code as a subdirectory of the `netos63_gnu/src/examples` directory. The software calls the `applicationStart` function in the `root.c` file.

Start by duplicating some other example and modify the Makefiles. (For information about modifying Makefiles, see the *NET+OS with GNU Tools BSP Porting Guide*).

A good choice is `naftpapp`, the FTP server example. Add your application to this example, which allows you reload new code after it's running in flash. Without the FTP server in your application, you can't re-flash the system.

Modify the `root.c` file to load your specific application, and modify the `appconf.h` file for your board settings.

What should my next step be?

The next step should be running your application from flash. The flash code is broken up into two parts: the bootloader and your application.

The bootloader (`rom.bin`) is located in the `netos63_gnu/src/bsp/platforms/your_platform` directory.

Your application (`image.bin`) is located in the `netos63_gnu/src/examples/your_example/32b` directory.

Appendix: Updating the MAJIC Probe's Firmware

This appendix describes how to update the firmware for your MAJIC probe using the MAJIC Setup Wizard.

You must do this procedure if you have a previous version of the MAJIC firmware.

If you need to set up the IP address of the MAJIC probe, see Task 3.

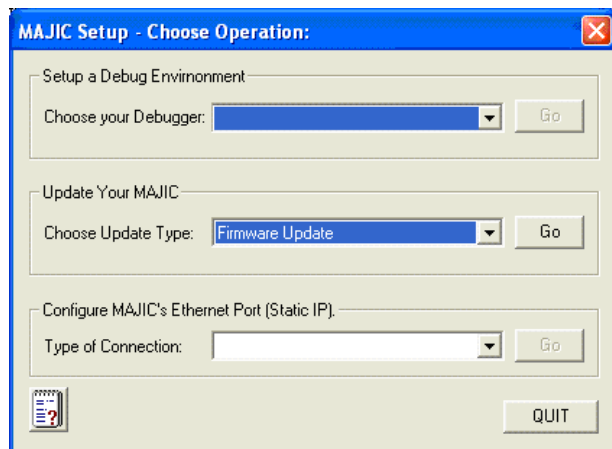
► To update the MAJIC's firmware:

- 1 Start the MAJIC Setup Wizard by doing one of these steps:
 - Windows XP systems. Select Start → All Programs → EPI Tools-EDTA 2.2a → MAJIC Setup Wizard.
 - Windows 2000 systems. Select Start → Programs → EPI Tools-EDTA 2.2a → MAJIC Setup Wizard.

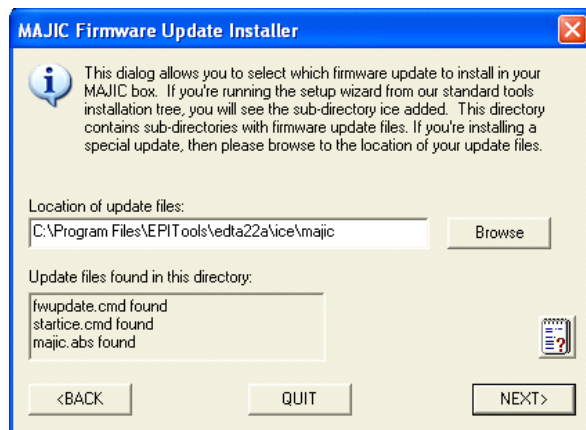
The EPI MAJIC Setup Wizard Introduction window opens:



- 2 After you review the introduction, click NEXT.
The Choose Operation window opens:



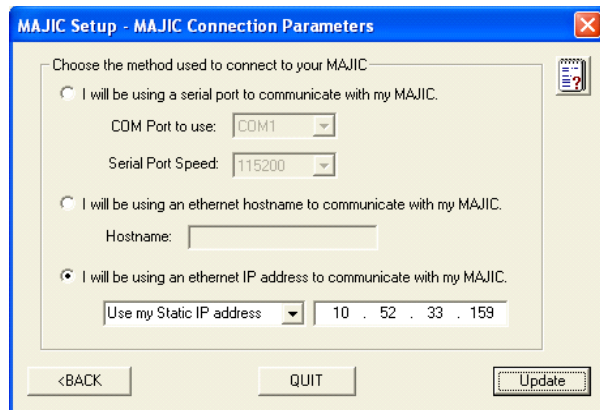
The MAJIC Firmware Update Installer dialog box opens:



- 3 From the Choose Update Type pulldown menu, select Firmware update.
Then click Go.

- 4 If the directory name is not already in the Location of update files input box, browse to this directory:
C:\Program Files\EPITools\edta22A\ice\majic
and click NEXT.

The MAJIC Connection Parameters dialog box opens:

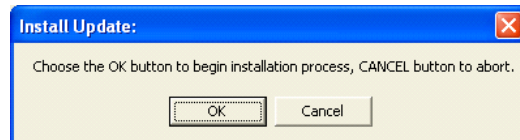


5 Do these steps:

- a Click I will be using an Ethernet IP address to communicate with my MAJIC.
- b Enter the IP address for the MAJIC.
- c Make sure Use My Static IP address is selected.

Then click Update.

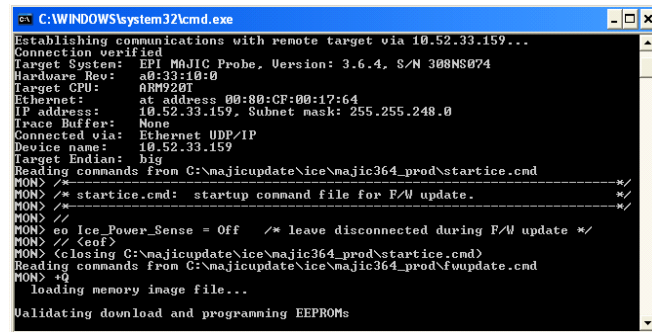
The Install Update dialog box opens:



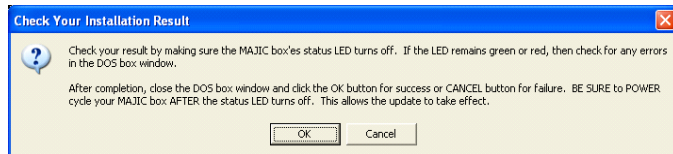
6 To begin the update, click OK.

A DOS window and the Check Your Installation Result dialog box open.

The firmware download takes place in the DOS window:



- 7 When the download finishes, do one of these steps:
- If the download was successful, click **OK** in the **Check Your Installation Result** dialog box.
 - If the download was not successful, click **Cancel** in the **Check Your Installation Result** dialog box, and repeat this procedure.



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