

## Introduction

This chapter summarizes the development tools that Altera® provides for the Nios® II processor. This chapter does not describe detailed usage of any of the tools, but it refers you to the most appropriate documentation. This chapter contains the following sections:

- “The Nios II IDE Tools” on page 13–1
- “Altera Nios II Build Tools” on page 13–2
- “GNU Compiler Tool Chain” on page 13–5
- “Libraries and Embedded Software Packages” on page 13–6

## The Nios II IDE Tools

Table 13–1 describes the tools provided by the Nios II IDE user interface.

**Table 13–1. The Nios II IDE and Associated Tools**

Tools	Description
The Nios II IDE	The Nios II IDE is the software development user interface for the Nios II processor. All software development tasks can be accomplished within the IDE, including editing, building, and debugging programs. For more information, refer to the Nios II IDE help system.
Flash programmer	The Nios II IDE includes a flash programmer utility that allows you to program flash memory chips on a target board. The flash programmer supports programming flash on any board, including Altera development boards and your own custom boards. The flash programmer facilitates programming flash for the following purposes: <ul style="list-style-type: none"> <li>● Executable code and data</li> <li>● Bootstrap code to copy code from flash to RAM, and then run from RAM.</li> <li>● HAL file subsystems</li> <li>● FPGA hardware configuration data</li> </ul> For more information, refer to the <i>Nios II Flash Programmer User Guide</i> .
Instruction set simulator	Altera provides an instruction set simulator (ISS) for the Nios II processor. The ISS is available within the Nios II IDE, and the process for running and debugging programs on the ISS is the same as for running and debugging on target hardware. For more information, refer to the Nios II IDE help system.
Quartus® II Programmer	The Quartus II programmer is part of the Quartus II Complete Design Suite, however the Nios II IDE can launch the Quartus II programmer directly. The Quartus II programmer allows you to download new FPGA configuration files to the board. For more information, refer to the Nios II IDE help system, or press the F1 key while the Quartus II programmer is open.

## Altera Nios II Build Tools

This section describes the Altera Nios II build tools. Under Windows, you can run these tools from a *Nios II Command Shell* command prompt. Under Linux, use the command shell of your preference.

Each tool provides its own documentation in the form of help pages accessible from the command line. To view the help, open a *Nios II Command Shell*, and type the following command:

```
<name of tool> --help
```

### Nios II Software Build Tools

The Nios II software build tools are utilities and scripts that provide similar functionality to the **New Project** wizard and the **System Library** properties page in the Nios II IDE. You can create, modify and build Nios II programs with commands typed at a command line or embedded in a script.

Table 13–2 summarizes the command line utilities and scripts included in

<b>Command</b>	<b>Summary</b>
<b>nios2-app-generate-makefile</b>	Creates an application makefile
<b>nios2-lib-generate-makefile</b>	Creates a library makefile
<b>nios2-bsp-create-settings</b>	Creates a board support package (BSP) settings file
<b>nios2-bsp-update-settings</b>	Updates the contents of a BSP settings file
<b>nios2-bsp-query-settings</b>	Queries the contents of a BSP settings file
<b>nios2-bsp-generate-files</b>	Generates all files for a given BSP settings file
<b>nios2-bsp-editor</b>	Nios II BSP editor standalone project GUI
<b>nios2-bsp</b>	Creates or updates a BSP
<b>nios2-c2h-generate-makefile</b>	Creates an application makefile fragment for the Nios II C2H compiler

the software build tools. You can invoke these utilities on the command line or from a scripting language of your choice (such as **perl** or **bash**). On Windows, these utilities have a **.exe** extension.

The Nios II BSP editor provides a graphical front end that drives the software build tools.

The Nios II software build tools reside in the *<Nios II EDS install path>/sdk2/bin* directory.

For further information about the Nios II software build tools, refer to the *Introduction to the Nios II Software Build Tools* chapter of the *Nios II Software Developer's Handbook*.

## File Format Conversion Tools

File format conversion is sometimes necessary when passing data from one utility to another. Table 13–3 shows the Altera-provided utilities for converting file formats.

<b>Utility</b>	<b>Description</b>
<b>bin2flash</b>	Converts binary files to a Motorola S-record file ( <b>.flash</b> ) for programming into flash memory.
<b>elf2dat</b>	Converts an executable and linking format file ( <b>.elf</b> ) to a <b>.dat</b> file format appropriate for Verilog HDL hardware simulators.
<b>elf2flash</b>	Converts an executable and linking format file to an S-record file for programming into flash memory.
<b>elf2hex</b>	Converts an executable and linking format file to the Intel hexadecimal file ( <b>.hex</b> ) format.
<b>elf2mem</b>	Generates the memory contents for the memory devices in a specific Nios II system.
<b>elf2mif</b>	Converts an executable and linking format file to the Quartus II memory initialization file ( <b>.mif</b> ) format
<b>flash2dat</b>	Converts an S-record file to the <b>.dat</b> file format appropriate for Verilog HDL hardware simulators.
<b>sof2flash</b>	Converts an SRAM object file to an S-record file for programming into flash memory.

The file format conversion tools are in the `<Nios II EDS install path>/bin/` directory.

## Other Command-Line Tools

Table 13–4 shows other Altera-provided command-line tools for developing Nios II programs.

<b>Tool</b>	<b>Description</b>
<b>nios2-download</b>	Downloads code to a target processor for debugging or running.
<b>nios2-flash-programmer</b>	Programs data to flash memory on the target board.
<b>nios2-gdb-server</b>	Translates GNU debugger (GDB) remote serial protocol packets over TCP to joint test action group (JTAG) transactions with a target Nios II processor.
<b>nios2-terminal</b>	Performs terminal I/O with a JTAG universal asynchronous receiver-transmitter (UART) in a Nios II system
<b>validate_zip</b>	Verifies if a specified zip file is compatible with Altera's read-only zip file system.
<b>nios2-debug</b>	Downloads a program to a Nios II processor and launches the Insight debugger.
<b>nios2-console</b>	Opens the FS2 command-line interface (CLI), connects to the Nios II processor, and (optionally) downloads code.
<b>nios2-configure-sof</b>	Configures an Altera configurable part. If no explicit SRAM object file ( <b>.sof</b> ) is specified, it tries to determine the correct file to use.
<b>jtagconfig</b>	Allows you configure the JTAG server on the host machine. It can also detect a JTAG chain and set up the download hardware configuration.

The command-line tools described in this section are in the `<Nios II EDS install path>/bin/` directory.

## Nios II IDE Command-Line Tools

Table 13–5 on page 13–5 shows the command-line utilities that form the basis of the Nios II IDE. These tools can create and build Nios II IDE projects without launching the Nios II IDE graphical user interface (GUI). However, Altera recommends that you use the Nios II software build tools for new projects.

For detailed information about the Nios II software build tools, refer to the *Introduction to the Nios II Software Build Tools* chapter of the *Nios II Software Developer's Handbook*.

Each of the Nios II IDE command-line tools launches the Nios II IDE in the background, without displaying the GUI. You cannot use these utilities while the IDE is running, because only one instance of the Nios II IDE can be active at a time.

**Table 13–5. Nios II IDE Command-Line Tools**

Tool	Description
<b>nios2-create-system-library</b>	Creates a new system library project.
<b>nios2-create-application-project</b>	Creates a new C/C++ application project.
<b>nios2-build-project</b>	Builds a project using the Nios II IDE managed-make facilities. Creates or updates the makefiles to build the project, and optionally runs make. <b>nios2-build-project</b> operates only on projects that exist in the current Nios II IDE workspace.
<b>nios2-import-project</b>	Imports a previously-created Nios II IDE project into the current workspace.
<b>nios2-delete-project</b>	Removes a project from the Nios II IDE workspace, and optionally deletes files from the file system.

The Nios II IDE command-line tools are in the *<Nios II EDS install path>/bin/* directory.

## GNU Compiler Tool Chain

### GNU Tool Chain

Altera provides and supports the standard GNU compiler tool chain for the Nios II processor. Complete HTML documentation for the GNU tools resides in the Nios II Embedded Design Suite (EDS) directory. The GNU tools are in the *<Nios II EDS install path>/bin/nios2-gnutools* directory.

GNU tools for the Nios II processor are generally named **nios2-elf-*<tool name>***. The following list shows some examples:

- nios2-elf-gcc
- nios2-elf-as
- nios2-elf-ld
- nios2-elf-objdump
- nios2-elf-size

The exception is the **make** utility, which is simply named **make**.



For a comprehensive list of GNU tools, refer to the GNU HTML documentation, installed with the Nios II EDS.

## Libraries and Embedded Software Packages

Table 13–6 shows the Nios II libraries and software packages.

<b>Name</b>	<b>Description</b>
Hardware abstraction layer (HAL) system library	See the <i>Overview of the Hardware Abstraction Layer</i> chapter of the <i>Nios II Software Developer's Handbook</i> .
MicroC/OS-II RTOS	See the <i>MicroC/OS-II Real Time Operating System</i> chapter of the <i>Nios II Software Developer's Handbook</i> .
NicheStack TCP/IP Stack - Nios II Edition	See the <i>Ethernet and the NicheStack TCP/IP Stack - Nios II Edition</i> chapter of the <i>Nios II Software Developer's Handbook</i> .
newlib ANSI C standard library	The complete HTML documentation for newlib resides in the Nios II EDS directory. Also see the <i>Overview of the Hardware Abstraction Layer</i> chapter of the <i>Nios II Software Developer's Handbook</i> .
Read-only zip file system	See the <i>Read-Only Zip File System</i> chapter of the <i>Nios II Software Developer's Handbook</i> .
Host file system	See the <i>Developing Programs using the HAL</i> chapter of the <i>Nios II Software Developer's Handbook</i> .

## Example Designs

The Nios II EDS provides documented software examples to demonstrate all prominent features of the Nios II processor and the development environment.

## Referenced Documents

This chapter references the following documents:

- *Introduction to the Nios II Software Build Tools* chapter of the *Nios II Software Developer's Handbook*
- *Overview of the Hardware Abstraction Layer* chapter of the *Nios II Software Developer's Handbook*
- *MicroC/OS-II Real Time Operating System* chapter of the *Nios II Software Developer's Handbook*.
- *Ethernet and the NicheStack TCP/IP Stack - Nios II Edition* chapter of the *Nios II Software Developer's Handbook*.
- *Read-Only Zip File System* chapter of the *Nios II Software Developer's Handbook*.
- *Developing Programs using the HAL* chapter of the *Nios II Software Developer's Handbook*
- GNU documentation installed with the Nios II EDS

## Document Revision History

Table 13–7 shows the revision history for this document.

<b>Date &amp; Document Version</b>	<b>Changes Made</b>	<b>Summary of Changes</b>
May 2008 v8.0.0	Describe BSP editor	<ul style="list-style-type: none"> <li>• BSP editor</li> </ul>
October 2007 v7.2.0	<ul style="list-style-type: none"> <li>• <b>mk-nios2-signaltap-mnemonic-table</b> deprecated</li> <li>• Add <b>jtagconfig</b></li> <li>• Add Host File System</li> </ul>	
May 2007 v7.1.0	<ul style="list-style-type: none"> <li>• Discuss Nios II software build tools</li> <li>• Added table of contents to Introduction section.</li> <li>• Added Referenced Documents section.</li> </ul>	Nios II software build tools
March 2007 v7.0.0	No change from previous release.	
November 2006 v6.1.0	No change from previous release.	
May 2006 v6.0.0	<ul style="list-style-type: none"> <li>• Added <b>nios2-configure-sof</b> tool.</li> <li>• Removed utilities for the legacy SDK flow, because it is no longer supported.</li> </ul>	
October 2005 v5.1.0	No change from previous release.	
May 2005 v5.0.0	No change from previous release.	
December 2004 v1.1	Added Nios II command line tools information.	
May 2004 v1.0	Initial Release.	

