



# **IwIP for CrossCore<sup>®</sup> Embedded Studio Rel.2.6.0 Release Notes**

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# 1 What is lwIP – Lightweight TCP/IP Stack for CrossCore Embedded Studio

lwIP (Lightweight TCP/IP Stack) is a widely accepted TCP/IP stack for embedded platforms supporting most of the networking protocols in the TCP/IP suite. It offers BSD-alike socket application programming interface which facilitates easy migration of existing network or socket applications to your embedded platform.

This is a port of the lwIP TCP/IP stack to the Analog Devices Blackfin® and ADSP-SC5xx SHARC® processor families. All supported Ethernet drivers are provided by CrossCore Embedded Studio. It seamlessly integrates with CrossCore Embedded Studio and provides a user interface for configuring the stack.

Analog Devices lwIP TCP/IP stack for CrossCore Embedded Studio requires a real-time operating system (RTOS). lwIP examples and application software is based on  $\mu$ C/OS-III™ Real-Time Kernel for CrossCore® Embedded Studio.

lwIP for CrossCore Embedded Studio supports the following protocols:

- IP: Internet Protocol, including packet forwarding over multiple network interfaces
- ICMP: Internet Control Message Protocol, for network maintenance and debugging
- UDP: User Datagram Protocol, including experimental UDP-lite extensions
- DHCP: Dynamic Host Configuration Protocol
- TCP: Transmission Control Protocol, with congestion control, RTT estimation and fast recovery/fast retransmit
- ARP: Address Resolution Protocol, for Ethernet
- Optional Berkeley-alike (BSD) socket AP

lwIP information links are given below:

- lwIP project page (latest sources, releases): <http://savannah.nongnu.org/projects/lwip/>
- lwIP Wiki: [http://lwip.wikia.com/wiki/LwIP\\_Wiki](http://lwip.wikia.com/wiki/LwIP_Wiki)
- lwIP license: <http://www.xfree86.org/3.3.6/COPYRIGHT2.html#5>

## 2 Getting Started with lwIP TCP/IP Stack for CrossCore

### Embedded Studio

#### 2.1 Installation

lwIP TCP/IP Stack for CrossCore® Embedded Studio requires CrossCore® Embedded Studio version 2.6.0 or later for all processors. Once a project is upgraded to work with CCES version 2.6.0 its format will be changed and may no longer build if it is opened with older versions of the toolchain.

Please be sure to close CrossCore Embedded Studio before proceeding with the installation. If CrossCore Embedded Studio is left open during the installation, it will have to be restarted after installing lwIP for CrossCore Embedded Studio v.2.6.0.

lwIP TCP/IP Stack for CrossCore Embedded Studio installs the following:

- lwIP TCP/IP Stack. Its default installation directory is *C:\Analog Devices\lwIP\_Stack-Rel2.6.0*.

Analog Devices strongly recommends installing lwIP outside of the Program Files directory to prevent possible permission issues related to UAC (User Access Control). If you have already installed the product under Program Files then we recommend that you uninstall it and re-install it in a different location.

Note: Multiple versions of the lwIP TCP/IP Stack can be installed on the same system. Only a single instance of a specific version can be installed on a system.

#### 2.2 Installation Logging

The installer does not create a log file by default. If you encounter installation issues, you can generate an installation log file by running the installer from the command prompt.

Change to the directory containing downloaded installer executable and run the following from the command prompt:

```
ADI_lwIP_Stack-Rel2.6.0.exe /v"/l*v c:\temp\installer.log"
```

#### 2.3 Support and Assistance

There are several options for contacting support:

- Submit your questions online at: <http://www.analog.com/support>

- E-mail your Processor and DSP software and development tools questions from within CrossCore Embedded Studio:
- Go to “Help->E-mail Support...” This will create a new e-mail addressed to [processor.tools.support@analog.com](mailto:processor.tools.support@analog.com), and will automatically attach your CrossCore Embedded Studio version information (ProductInfo.html).
- E-mail your Processors and DSP applications and processor questions to:
  - [processor.support@analog.com](mailto:processor.support@analog.com) OR
  - [processor.china@analog.com](mailto:processor.china@analog.com) (Greater China support)
- Post your questions in the Processors and DSP online technical support community in Engineer Zone at:
  - <http://ez.analog.com/community/dsp>

## 2.4 Supported Processors

- ADSP-BF60x
- ADSP-BF518,ADSP-BF526,ADSP-BF527, ADSP-BF537
- ADSP-BF533, ADSP-BF561 (using USB\_LAN EZ-EXTENDER)
- ADSP-BF548 using off-chip SMSC LAN9218 Ethernet controller.
- ADSP-SC58x (ARM core only)
- ADSP-SC57x (ARM core only)

## 2.5 Software Requirements

lwIP TCP/IP stack for CrossCore Embedded Studio requires the following software:

- CrossCore Embedded Studio version 2.6.0 or later
- $\mu$ C/OS-III™ Real-Time Kernel for CrossCore® Embedded Studio

## 3 New and Noteworthy

### 3.1 ADSP-SC57x Processor Support Added

ADSP-SC57x processor support is added for LWIP 2.6.0. The projects are under the ARM folder inside LWIP package. Examples are provided for the same.

### 3.2 Getting Started with a Project that Uses the RTOS

#### 3.2.1 Creating a project which includes the lwIP Stack

In order to create a project you should follow the instructions provided in the CrossCore Embedded Studio help. As part of the project creation, the page *Add-in selection* contains a list of all the available add-ins for the project that you are creating based on the installed products and the project's chosen processor and type. You can see the Analog Devices lwIP TCP/IP Stack add-in in the **Middleware** section under the **TCP/IP Stack** category.

#### 3.2.2 Adding lwIP to an existing project

Every CrossCore Embedded Studio project contains a System Configuration file called `system.svc` which is located in the root of the project. The file is the IDE's interface for managing the various pre-written software components used in the "system" implemented by a project. Double-clicking any `system.svc` file in a navigation view opens that file in the System Configuration Utility which allows you to see the add-ins that you currently have in your project. Clicking on "Add" and selecting "Analog Devices lwIP TCP/IP Stack add-in" from the Middleware section under the TCP/IP Stack category adds lwIP to your project.

The lwIP add-in includes basic template code that is required for a network application to operate. It adds required include paths, libraries and template code to the project. For more details refer to CrossCore Embedded Studio help section, lwIP Ethernet Stack 2.6.0 Preparing for lwIP Applications

#### 3.2.3 Configuration

lwIP users can configure network applications with specific settings like IP address, subnet mask, MAC address etc. For more details refer to CrossCore Embedded Studio help section, lwIP Ethernet Stack 2.6.0 Configuring lwIP Applications.

### 3.3 lwIP Project Structure

When adding lwIP to a CrossCore Embedded Studio project all the lwIP specific files get placed in the `system` folder. Please do not change this organization. In the system folder the following structure gets created:

- A `lwIP` folder. This folder contains any sources and header files which are part of the lwIP TCP/IP Stack. It contains the folders:
  - `AppSources`. This folder contains a copy of the lwIP application template source and headers. Applications can modify these files, but if you remove the lwIP add-in these files also get removed.
  - `GeneratedSources`. This folder contains headers and sources generated by the product based on the GUI configurations. These files should not be modified.

### 3.4 Sketches and Examples

CrossCore Embedded Studio provides a mechanism by which small code fragments, called sketches, can be generated with parameter input provided by the user. The resulting code can then be copied and pasted to a project. The lwIP TCP/IP Stack for CrossCore Embedded Studio provides a few sketches.

lwIP for CrossCore Embedded Studio also provides some examples using lwIP TCP/IP Stack.

To view the list of lwIP sketches and examples perform the following in the CrossCore Embedded Studio:

- Go to **HelpBrowse Examples**
- In the Browse Examples UI select **Product** as **ADI lwIP v2.6.0**.
- A list of examples and sketches related to lwIP are displayed. You can double click and select a sketch or example.

Note that while sketches are not complete applications, you can use the code fragments for faster development. All lwIP examples use a custom uCOS-III library and header files present inside `<install-dir-cces>\Blackfin\include\demo` or `<install-dir-cces>\ARM\arm-none-eabi\arm-none-eabi\include\adi\cortex-a5\demo`.

### 3.5 Documentation

The lwIP User Guide has detailed information about lwIP add-in features and examples. Go to the following location in CrossCore Embedded Studio to access lwIP user manual:

- **Help Help Contents lwIP Ethernet Stack 2.6.0**

Socket documentation is available in the following location of the lwIP TCP/IP Stack installation directory. (The default installation directory is c:\Analog Devices\lwIP\_Stack-Rel2.4.0\.)

- <install-dir-lwip>\lwip\docs\socket-api\index.html

## **3.6 Integration with CrossCore Embedded Studio**

### **3.6.1 System View**

CrossCore Embedded Studio provides the System View which is used by lwIP TCP/IP Stack for CrossCore Embedded Studio. Use the “System Configuration Overview” tab to add the lwIP system add-in to a CrossCore Embedded Studio project.

To access the System Configuration Overview tab, do one of the following:

- In a navigation view, double-click the system.svc file of a project. The System Configuration utility appears with the overview tab selected.
- If the utility is already open, select the Overview tab.

As well as being able to add, remove and upgrade add-ins from this window, it also provides a list of examples and sketches associated with the selected add-in.

For more information about the System Configuration utility, see the CrossCore Embedded Studio help.

### **3.6.2 Configuration tabs**

When lwIP for CrossCore Embedded Studio gets added to a project, “lwIP Applications” configuration tab get added to the System view. “lwIP Application” configuration tab allows applications to configure static IP address, Subnet Mask, Gateway Address, MAC Address, Number of Ethernet Driver Buffers and their sizes. Refer to the following section in the help for details:

**Help Help Contents lwIP Ethernet Stack 2.6.0 lwIP Application Configuration Editor lwIP Application Configuration Page**

Advanced lwIP users can configure the lwIP library with easy to use UI configuration. Refer the following section in the help on how to configure lwIP library:

**HelpHelp Contents lwIP Ethernet Stack 2.6.0 Configuring lwIP Libraries**



## **3.7 Interaction with other CrossCore Embedded Studio Software**

### **3.7.1 System Services and Device Driver Libraries**

The lwIP for CrossCore Embedded Studio add-in uses the System Services and Ethernet device drivers that are installed with CrossCore Embedded Studio product. Ethernet device drivers are accessed through a standard API.

### **3.7.2 $\mu$ C/OS-III™ Real-Time Kernel for CrossCore Embedded Studio**

lwIP requires an RTOS component. The current distribution of the lwIP requires  $\mu$ C/OS-III RTOS. The lwIP subsystem is inherently multi-threaded, processing the packets at the task level. Various tasks get created by the subsystem to handle the stack functionality.

## **4 Known Issues**

### **4.1 Known Issues with lwIP 2.6.0 using USB-LAN EZ-Extender 1.0.1**

lwIP 2.6.0 examples for BF533/BF561 does not support USB-LAN EZ-Extender 1.0.1. The USB-LAN EZ-Extender should be upgraded to higher versions for LwIP 2.6.0.

### **4.2 Known Issues with lwIP 2.6.0 using USB-LAN EZ-Extender 1.1.0**

SMSC LAN91C111 Ethernet module for lwIP 2.6.0 examples for BF533/BF561 shows version 1.0.1 instead of 1.1.0. This is a known issue and will be corrected in the subsequent release of USB-LAN EZ-Extender.