

For simple C applications in GE863-PRO3 1vv0300775a Rev. 2 - 10/09/08



Making machines talk.



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Applicable Products

Product	Part Number
GE863-PRO ³	3990250691



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1 Introduction

1.1 Scope

This guide will explain how to develop and extend your first application on the GE863-PRO³.

In the following sections, the term "host" will refer to the computer where the development environment is running, while we'll refer to the GE863-PRO³ as the target.

1.2 Audience

This User Guide is intended for software developers who develop applications on the ARM processor of the module.

1.3 Contact Information, Support

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

For general contact, technical support, report documentation errors and to order manuals, contact Telit's Technical Support Center at:

<u>TS-EMEA@telit.com</u> or <u>http://www.telit.com/en/products/technical-support-center/contact.php</u> Telit appreciates feedback from the users of our information.

1.4 Open Source Licenses

Telit Development Environment is made up of different Open Source Software licensed as follows.

1.4.1 Yagarto

- Yagarto GNU ARM toolchain: some of the software falls under the GNU General Public License (GPL).
- Integrated Development Environment: all of the software like the Eclipse Platform Runtime Binary, Eclipse CDT and the GDB embedded plugin falls unter the Eclipse Public License.
- Open On Chip Debugger: some of the software falls under the GNU General Public License (GPL). Some packages of the OpenOCD installer have their own version of a license.

1.4.2 OOCDLink

License information: <u>http://www.joernonline.de/dw/doku.php?id=projects:oocdlink:2_oocdlinks</u>.



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1.5 Product Overview

The GE863-PRO³ module contains a fully featured GSM/GPRS communications section, compatible with the other Telit GSM/GPRS modules, but also incorporates a standalone ARM9 CPU and memories, dedicated to user applications.

This eliminates the need for an external host CPU in many applications, bringing true real-time and multi tasking capabilities to an embedded module.

1.6 Document Organization

This manual contains the following chapters:

- "Chapter 1, Error! Reference source not found." provides a scope for this manual, target audience, technical contact information, and text conventions
- "Chapter Error! Reference source not found., Error! Reference source not found." describes the general information on how to install development environment that will be used.
- "Chapter 3, Error! Reference source not found." describes how to start a project in C or import an existing project, including examples, where relevant.
- "Chapter 4, Error! Reference source not found." provides info on how to setup and use the debugging environment for OOCDLink and JTAG emulator SAM-ICE
- "Chapter 5, **Error! Reference source not found.**" provides instructions on how to use the Uboot to start or flash the application. All U-boot commands definitions can be found in U-Boot Software User Guide.

1.7 Text Conventions

This section lists the paragraph and font styles used for the various types of information presented in this user guide.

Format	Content
Courier	Example commands and responses from U-Boot.

1.8 Related Documents

The following documents are related to this user guide:

- [1] TelitGE863PRO3 Bootloader Recovery Application Note 80000nt10012a
- [2] TelitGE863PRO3 U-Boot Software User Guide 1VV0300777
- [3] TelitGE863PRO3 EVK User Guide 1vv0300776
- [4] TelitGE863PRO3 Hardware User Guide 1vv0300773a
- [5] TelitGE863PRO3 Software User Guide 1vv0300784
- [6] TelitGE863PRO3 Product Description 80285ST10036a



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All documentation can be downloaded from Telit's official web site <u>www.telit.com</u> if not otherwise indicated.

1.9 Document History

Revision	Date	Changes
ISSUE #0	25/01/07	First release
ISSUE #1	23/04/08	Added SAM-ICE is a JTAG emulator description in paragraph 4.2 Memory map paragraph moved to SW User Guide
ISSUE #2	10/09/08	New setup environment description



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2 Installing the Development Environment

In order to set up the development environment the following steps should be taken:

- Go to <u>http://www.telit.com/</u> \rightarrow Download Zone,
- LOGIN with user and password provided by Telit.
- Click on Software Tools GSM/GPRS,
- Click on GE863-PRO³
 Click on the ZIP_DOWNLOAD of the Telit_GE863-PRO3_nonOSDevEnvironment.zip
- Save it in a path like C:\Documents and Settings\user\Desktop.
- UnZip Telit_GE863-PRO3_nonOSDevEnvironment.zip, the unzip creates the file TelitGE863PRO3nonOSDevEnvironment.exe
- Run the installation of the development environment by clicking twice on the file:



• TelitGE863PRO3nonOSDevEnvironment.exe:



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Click Install

😚 Telit GE863-PRO3 nonOS Setup	
Installing Please wait while Telit GE863-PRO3 nonOS is being installed.	
Execute: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c++_n	l-1.16.0_g
Output folder: C:\Program Files\TelitnonOSDevEnv Extract: yagarto-bu-2.18_gcc-4.2.2-c-c++_nl-1.16.0_gi-6.8.50_20080408.exe Extract: yagarto-ide-20071227-setup.exe 100% Extract: openocd-r592-20080419.exe 100% Execute: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c++_	. 1 _nl
Nullsoft Install System v2.34	Cancel



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			1vv03	00775a Rev. 2 -	10/09/08
😚 YAGARTO 4.2.2 Se	tup				
	License Agreeme Please review the l	nt icense terms be	fore installing YAC	SARTO 4.2.2.	
Press Page Down to se	e the rest of the agreeme	nt.			
GNU GENE Version 3	RAL PUBLIC LICENSE 3, 29 June 2007				
Copyright (C) 2007 Fr Everyone is permitted of this license docume	ee Software Foundation, to copy and distribute ve nt, but changing it is not a	Inc. < <u>http://fsf</u> rbatim copies allowed.	<u>.org/</u> >		
Prear	nble			~	
If you accept the terms agreement to install YA	of the agreement, select GARTO 4.2.2. Click Next	t the first option to continue.	i below. You must	accept the	
 I accept the terms i I do not accept the 	n the License Agreement terms in the License Agre	ement			
YAGARTO 4.2.2 - 200804(< <u>B</u> ack	<u>N</u> ext >	Cancel	

Carefully read the information and click: I accept the terms in the License Agreement, then click Next.



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	1vv0300775a Rev. 2	- 10/09/08
🐨 YAGARTO 4.2.2 Setup		
	noose Components Thoose which features of YAGARTO 4.2.2 you want to install.	
Check the components you wa install. Click Next to continue.	nt to install and uncheck the components you don't want to	
Select components to install:	 Binutils-2.18 Newlib-1.16.0 GCC-4.2.2 GDB-6.8.50 Add YAGARTO to the PATH variable 	
Space required: 262,8MB		
YAGARTO 4.2.2 - 20080408	< <u>B</u> ack <u>N</u> ext > Cancel	

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🗑 YAGARTO 4.2.2 Se	tup 📃 🗖 🔁
6	Choose Install Location Choose the folder in which to install YAGARTO 4.2.2.
Setup will install YAGAR Browse and select anoth	TO 4.2.2 in the following folder. To install in a different folder, click ner folder. Click Next to continue.
Destination Folder	igarto Browse
Space required: 262.8M Space available: 2.2GB YAGARTO 4.2.2 - 2008040	B 8 < <u>B</u> ack <u>N</u> ext > Cancel

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	1vv0300775a Rev	<u>. 2 - 10/09/08</u>
🕞 YAGARTO 4.2.2 Seti	JP 🗖 🗖	×
	Choose Start Menu Folder Choose a Start Menu folder for the YAGARTO 4.2.2 shortcuts.	
Select the Start Menu fold can also enter a name to YAGARTO	der in which you would like to create the program's shortcuts. You create a new folder.	
UTILITY WORK Tools Accessories Administrative Tools Bluetooth Business Explorer Canon Printer Uninstaller Cisco Systems VPN Client Computer Associates Daintree Networks Dell Accessories		
Do not create shortcu YAGARTO 4,2,2 - 20080408	ts < <u>B</u> ack <u>I</u> nstall Cancel	

Click Install.



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A VICINTO 4 3 3 6 .		
WAGARIO 4.2.2 Setup		
	Installation Complete Setup was completed successfully.	
Completed		
Show details		
VAGARTO 4.2.2 - 20080408		
	< <u>B</u> ack <u>N</u> ext	> Cancel

Click Next.



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Click Finish.



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🕞 YAGARTO IDE 200	071227 Setup			
6	License Agreement Please review the license terms before installing YAGAP 20071227.	RTO IDE		
Press Page Down to s	ee the rest of the agreement.			
Eclipse Public Licens	e-v1.0	^		
THE ACCOMPANYING PROGRAM IS PROVIDED UNDER THE TERMS OF THIS ECLIPSE PUBLIC LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION OR DISTRIBUTION OF THE PROGRAM CONSTITUTES RECIPIENT'S ACCEPTANCE OF THIS AGREEMENT.				
1. DEFINITIONS				
"Contribution" means	:	×		
If you accept the terr agreement to install Y	ns of the agreement, select the first option below. You must ac AGARTO IDE 20071227. Click Next to continue.	cept the		
I accept the terms	; in the License Agreement			
C I do not accept th	e terms in the License Agreement			
YAGARTO IDE 20071227				
	< <u>B</u> ack <u>N</u> ext >	Cancel		

Carefully read the information and click: I accept the terms in the License Agreement, then click Next.



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1vv03007	75a Rev.	2 - 1	0/09/08

6	Choose Components Choose which features of YAGARTO IDE 20071227 you want to install.
Check the components you v install. Click Next to continue	vant to install and uncheck the components you don't want to e.
Select components to install:	 Eclipse Platform 3.3 + CDT 4.0.2 Zylin plugin 4.1.14
Space required: 84.1MB	Position Position your mouse over a component to see its description,
YAGARTO IDE 20071227	< <u>B</u> ack <u>N</u> ext > Cancel

Click Next.



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🗑 YAGARTO IDE 2007	1227 Setup 📃 🗖 🔁
	Choose Install Location Choose the folder in which to install YAGARTO IDE 20071227.
Setup will install YAGART folder, click Browse and :	O IDE 20071227 in the following folder. To install in a different select another folder. Click Next to continue.
C:\Program Files\ya	garto ide Browse
Space required: 84.1MB	

Click Next.



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		oorrourtor. E
🐨 YAGARTO IDE 20071	227 Setup	
	Choose Start Menu Folder Choose a Start Menu folder for the YAGARTO IDE 2 shortcuts.	20071227
Select the Start Menu fold can also enter a name to o	ler in which you would like to create the program's short create a new folder.	tcuts. You
YAGARTO IDE		
UTILITY WORK Tools Accessories Administrative Tools Bluetooth Business Explorer Canon Printer Uninstaller Cisco Systems VPN Client Computer Associates Daintree Networks Dell Accessories		
🗌 Do not create shortcu	ts	
YAGARTO IDE 20071227		
	< <u>B</u> ack Install	Cancel

Click Install.



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🕞 YAGARTO IDE 20071	227 Setup	🔳 🗖 🗙
	Installation Complete Setup was completed successfu	lly.
Completed		
Show details		
VAGADIO IDE 20071227		
THANKIO IDE 200/1227	< <u>B</u> ack	Next > Cancel

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Click Finish.



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 Image: Weight of the second second

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🕞 OpenOCD r592 Setup		
License Agreement Please review the license terms before installing Op	benOCD r592.	
Press Page Down to see the rest of the agreement.		
The OpenOCD installer contains several different other packages. Some of these packages have their own version of license, like the Amontec JTAGkey. Please take a look in the corresponding directories.		
OpenOCD is licensed under the terms of the GNU General Public License:		
GNU GENERAL PUBLIC LICENSE Version 2, June 1991	~	
If you accept the terms of the agreement, select the first option below. You must accept the agreement to install OpenOCD r592. Click Next to continue.		
 I accept the terms in the License Agreement I do not accept the terms in the License Agreement OpenOCD r592 - 20080419 		
< <u>B</u> ack <u>N</u> ext >	Cancel	

Carefully read the information and click: I accept the terms in the License Agreement, then click Next.



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🕞 OpenOCD r592 Setup	
	oose Components hoose which features of OpenOCD r592 you want to install.
Check the components you war install. Click Next to continue.	nt to install and uncheck the components you don't want to
Select components to install:	 OpenOCD Make utils ✓ Driver
Space required: 6.5MB	Description Position your mouse over a component to see its description,
OpenOCD r592 - 20080419	< <u>B</u> ack <u>N</u> ext > Cancel

Click Next.



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🕞 OpenOCD r592 Setup	
	Choose Install Location Choose the folder in which to install OpenOCD r592.
Setup will install OpenOCD Browse and select another Destination Folder	592 in the following folder. To install in a different folder, click folder. Click Next to continue.
C:\Program Files\opend	bcd-r592 Browse
Space required: 6.5MB Space available: 1.8GB	
OpenOCD r592 - 20080419	< <u>B</u> ack <u>N</u> ext > Cancel

Click Next.



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	1vv0300775a
🕏 OpenOCD r592 Setup	
6	Choose Start Menu Folder Choose a Start Menu folder for the OpenOCD r592 shortcuts.
Select the Start Menu folde can also enter a name to cr	r in which you would like to create the program's shortcuts. You reate a new folder.
OpenOCD	
UTILITY WORK Tools Accessories Administrative Tools Bluetooth Business Explorer Canon Printer Uninstaller Cisco Systems VPN Client Computer Associates Daintree Networks Dell Accessories	
Do not create shortcut: OpenOCD r592 - 20080419 —	
	<u>Sack</u> <u>I</u> nstall Cancel

Click Install.



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🕞 OpenOCD r592 Setup		
	Installation Complete Setup was completed successfully.	
Completed		
Show <u>d</u> etails		
OpenOCD #592 - 20080419		
	< <u>B</u> ack Next	t > Cancel

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Click Finish.



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	·	1vv0300775a	Rev. 2 - 10/09/08
6	Felit GE863-PRO3 nonOS Setup		
In S	stallation Complete ietup was completed successfully.		
(Completed		
	Output folder: C:\Program Files\TelitnonOSDevEnv Extract: yagarto-bu-2.18_gcc-4.2.2-c-c++_nl-1.16.0_gi-6.8.50_20080408.exe Extract: yagarto-ide-20071227-setup.exe 100% Extract: openocd-r592-20080419.exe 100% Execute: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c++ Execute: C:\Program Files\TelitnonOSDevEnv\yagarto-ide-20071227-setup.exe Execute: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c+- Delete file: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c- Delete file: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c-Delete file: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c-Delete file: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c-Delete file: C:\Program Files\TelitnonOSDevEnv\yagarto-bu-2.18_gcc-4.2.2-c-c-Delete file: C:\Program Files\TelitnonOSDevEnv\openocd-r592-20080419.exe Completed	1 ⊦_n ++_n æ	
Nulk	soft Install System v2.34 < Back Next >	Cancel	

Click Next.



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🐨 Telit GE863-PRO3 nonO	S Setup
	Completing the Telit GE863-PRO3 nonOS Setup Wizard Telit GE863-PRO3 nonOS has been installed on your computer. Click Finish to close this wizard.
Oliak Finiah	< Back Finish Cancel
Jlick Finish.	

- Open the IDE (Start menu \rightarrow All Programs \rightarrow YAGARTO IDE \rightarrow Eclipse Platform 3.3) and choose a location in the filesystem for creating the workspace

🚔 Workspace Launcher 🛛 🗙 🗙			
Select a w	orkspace		
Eclipse Platf Choose a we	orm stores your projects in a folder called a workspace. orkspace folder to use for this session.		
Workspace:	C:\Documents and Settings\user\workspace V Browse		
Use this a	s the default and do not ask again OK Cancel		

- When the workspace has been created click on the **Go to the Workbench** icon.



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- Open the menu **Window** \rightarrow **Preferences**.
- In the left column of the window expand the entry C/C++; inside it, expand the entry New CDT
 Project Wizard and select Makefile Project.
- In the right part of the window select the tab **Discovery Options** and uncheck the entry **Automate Discovery of Path and Symbols**. Click on the **Apply** button.



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Preferences		
type filter text	Makefile Project	↓ ↓ .
 General C/C++ Appearance Build Console CDT build variables Code Style Debug Editor Environment File Types Indexer Language Mappings Make New CDT project wizard Makefile Project Property Pages settings Task Tags Template Default Values Embedded CDT Help Install/Update Run/Debug Team 	Preference settings will be applie only when there were no toolcha Binary parsers C Error p Discovery profiles scope Configuration-wide Preference Configuration	d to new projects ins selected. arsers Discovery options Builder settings Behaviour Automated discovery of paths and symbols Automate discovery of paths and symbols Report path detection problems Discovery profile: GCC per project scanner info profile V
		Restore Defaults Apply
0		OK Cancel

- Select the tab **Builder Settings** and uncheck the entry **Use Default Build Command**; in the text field called **Build Command** write the path of the make executable installed with the Yagarto GNU ARM toolchain (if you have not changed the default path, it should be something like C:\Program Files\openocd-r592\utils\bin\make). Afterwards click on the **Apply** button and then click **OK**.



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Preferences	
type filter text	Makefile Project 🗘 🗧 🗘
 General C/C++ Appearance Build Console CDT build variables Code Style Debug Editor Environment File Types Indexer Language Mappings Make New CDT project wizard Makefile Project Property Pages settings Task Tags Template Default Values XL C/C++ Compiler Embedded CDT Help Install/Update Run/Debug Team 	Preference settings will be applied to new projects only when there were no toolchains selected. Image: Binary parsers Image: External builder Builder Builder Builder Image: External builder Image: Builder Image: External builder Build command Image: External builder Build command: C:\Program Files\openocd-r592\utils\bin\make Makefile generation Image: Expand Env. Variable Refs in Makefiles Build location Image: Expand Env. Variable Refs in Makefiles Build directory Image: Imag
0	OK Cancel

Now you are ready to develop your first application for the PRO³.



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3 Creating a project

When you start creating a new project follow the steps below:

- Open the IDE (Start menu \rightarrow All Programs \rightarrow YAGARTO IDE \rightarrow Eclipse Platform).
- Open the menu File \rightarrow New \rightarrow Project.
- Open the C folder and choose the C Project entry, then click Next.

🖨 New Project		
Select a wizard Create a new C project		
Wizards:		
General		
0	< Back Next >	Finish Cancel

- Fill in the **Project Name** text field; in the **Project Types** area select the **Makefile Project** folder.



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- In the Toolchain area choose the Other Toolchain entry and then click Finish.

0	
C Project Create C project of selected type	
Project name: HelloWorldProCube Use default location Location: C:/Documents and Settings/user/wo Project types:	rkspace/HelloWorldProCube Browse
Executable Shared Library Static Library Executable (XL C/C++) Static Library(XL C/C++) Shared Library (XL C/C++) Makefile project	Other Toolchain XL C/C++ Tool Chain
Show project types and toolchains only if the	ey are supported on the platform
O < Back	Next > Finish Cancel



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- If the window entitled **Open Associated Perspective** comes up answer **Yes**. This will open the IDE's C/C++ perspective.

🗢 Open Associated Perspective? 🛛 🛛 🗙	
This kind of project is associated with the C/C++ perspective. Do you want to open this perspective now?	
Remember my decision	
Yes No	

- Now you should see the workspace with the newly created project: it will be empty because currently there are no files. The message in the panel **Problems:** *"make: *** No rule to make target `all'."* appears because at the moment in the project there are no files and it has not been yet configured the build directory.





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C/C++ - Eclipse Platform					-	
File Edit Refactor Navigate Search Run Project Window Help						
🗂 • 🔚 🗁 📾 📸 • 😂 • 🗟 • 🎯 • 🗞 • 🏵 • 🎋 • 🔘 • 🧛 •	🥭 🛷 🗄 🖬	1 🖬 i 🖢 - 🖓	- <- - <-		😭 🛅 C/C++	»
Project Explorer X 🗖 🗖				- 8	🗄 Outlin 🛛 💿 Make	
					An outline is not available.	
🖹 Problems 🛛 🧟 Tasks 📮 Console 🔲	Properties				* *	
1 error, 0 warnings, 0 infos						
	Resource	Path	Location			
The second	HelloWorldD		line 0			
make: """ No rule to make target all.	nelloworldP		line u			
i ☐ [◆] FelloWorldProCube				1		

- To start developing an application for the PRO³ you need to download the files contained in the directory GE863PRO3_default_project_example provided by Telit.
 To get them following next steps:
 - \circ go to http://www.telit.com/ \rightarrow Download Zone,
 - LOGIN with user and password provided by Telit.
 - Click on **Software Tools_GSM/GPRS**,
 - Click on GE863-PRO³
 - Click on the ZIP_DOWNLOAD of the Telit_GE863PRO3_default_project_example.zip
 - **Save** it in a path like C:\Documents and Settings\user\Desktop.
 - UnZip Telit_GE863PRO3_default_project_example.zip (the unzip creates the directory GE863PRO3_deafult_project_example)
- To start developing an application for the PRO³ you need to import the files contained in the directory GE863PRO3_deafult_project_example provided by Telit. These files supply the drivers and configurations necessary to make the system work. Moreover in the main.c there is an application which can show you how to use the serial ports. To import the directory open the menu File → Import.



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- Open the folder General and choose the entry Filesystem and then click on the Next.



- Browse to the directory containing the files to be imported and check on the folder **GE863PRO3_deafult_project_example**, then click **Finish**.



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	1000300775a Rev
🛢 Import	- 🗆 🗙
File system Import resources from the local file system.	
From directory: C:\Documents and Settings\user\Desktop\GE863PRO3_default_pr	Browse
□ □	
Filter Types Select All Deselect All	
Into folder: HelloWorldProCube	Browse
Options Overwrite existing resources without warning Create complete folder structure Create selected folders only	
O < Back Next > Finish	Cancel

Click Finish

- Now you should see the workspace with the imported folders contained in the project.



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		1vv0300775a Rev. 2 - 10/09/08
€ C/C++ - Eclipse Platform		
File Edit Refactor Navigate Search Run Project Wind	dow Help	
	• × • • • • • • • • • • • • • • • • • •	📫 🎋 Debug 🕞 C/C++ 🖒 Resource
		De Outline Make Targets 23
🗄 😕 Source		HelloworldProCube
	No consoles to display at this time.	
E Pé T ^{CC} HelloWorldProCube		
: U PhalowondProcube		1

- Before building the project it's necessary to configure the build directory. Select the project and open the menu **File** → **Properties**.
- In the left column choose the C/C++ Build entry and in the right part of the window select the tab Builder Settings. Fill in the Build Directory text field with the build directory of the HelloWorldProCube project, and then click Ok.



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	1vv0300775a Rev	. 2 - 10/09/08
Properties for HelloWorl	ldProCube	
type filter text	C/C++ Build	⇔ + ⇔ +
 Resource Builders C/C++ Build C/C++ General Project References 	Configuration: Default	anage configurations
 Refactoring History Run/Debug Settings 	Builder settings Behaviour	
	Builder Builder type External builder	~
	Use default build command	
	Build command: C:\Program Files\openocd-r592\utils\bin\make	Variables
	Generate Makefiles automatically	Refs in Makefiles
	Build location	
	Build directory C:\Documents and Settings\user\workspace\HelloWorldP	roCube\Build
	Workspace File system	. Variables
	Restore De	faults Apply
0	ОК	Cancel

- Go to **Project** \rightarrow **Build All** and, if there are no errors, you will find the binaries in the directory previously inserted in the project preferences.



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4 Using the debugger

To debug an application for the Pro³ you can use a variety of hardware emulators (for example SAM-ICE, J-Link). The software configuration depends on the type of hardware you use, but the general framework is common: there is the gdb debugger, which accepts input commands from the user (generally through Eclipse's graphical user interface) and talks to a gdb server; this server listens for requests from gdb and manages the communication with the hardware emulator, by means of a driver. Now we explain how to setup the debugging environment using two alternative emulators: OOCDLink, SAM-ICE and their toolkit.

Depending on the emulator you will use, you need some files which are used by the debugger to establish a connection to the gdb server and initialize the target to debug your application.

These files, which offer two distinct possibilities to debug an application, as will be explained later, contain a sequence of commands which must be executed by gdb to setup a debugging session.

4.1 How to use OOCDLink

To setup the debugging environment for using OOCDLink follow these steps:

- Download the OOCDLink drivers provided by Telit.
 To get them following next steps:
 - \circ go to <u>http://www.telit.com/</u> → Download Zone,
 - o LOGIN with user and password provided by Telit.
 - Click on Software Tools_GSM/GPRS,
 - o Click on GE863-PRO³
 - Click on the **ZIP_DOWNLOAD** of the **oocd_link_driver.zip**.
 - **Save** it in a path like C:\Documents and Settings\user\Desktop.
 - UnZip **oocd_link_driver.zip** (the unzip creates the directory **oocd_link_treiber**)
- Plug the USB connection cable of OOCDLink in the host system; you will be asked for the drivers: click on the **No, not this time** option button and then **Next**.



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- Select the **Install from a list or specific location (Advanced)** option button and then click **Next**.





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- Check the **Include this location in the search** box and browse to the directory where you previously unzipped the drivers archive, then click **Next**.

Found New Hardware Wizard
Please choose your search and installation options.
 Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM)
Include this location in the search:
C:\Documents and Settings\user\Desktop\oocd_lin 🐱 🛛 Browse
O Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back Next > Cancel

- In the pop-up window entitled Hardware Installation click on Continue Anyway.



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Har dwa	re Installation
<u>1</u>	The software you are installing for this hardware: OOCDLink (Channel A) has not passed Windows Logo testing to verify its compatibility with Windows XP. (<u>Tell me why this testing is important</u> .) Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
	Continue Anyway

- Click **Finish** in the last window. Now the same wizard will restart asking you for other drivers: repeat the steps you have just followed.





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In the host system create a directory called Ge863Pro3\Debug and copy in it the files: GE863-PRO3_debug_commands.script, GE863-PRO3_debug_commands_boot.script and GE863-PRO3_ft2232.cfg provided in the Telit package Telit_GE863-PRO3_nonOS_Environment_config_files.zip (it is not mandatory to put the files in that directory, but if you choose another directory you will have to modify some paths referred to in the rest of this section).

To get those files following next steps:

- go to <u>http://www.telit.com/</u> → Download Zone,
- LOGIN with user and password provided by Telit.
- Click on **Software Tools_GSM/GPRS**,
- Click on GE863-PRO³
- Click on the **ZIP_DOWNLOAD** of the:
- Telit_GE863-PRO³_nonOS_Environment_config_files.zip
- **Save** it in a path like C:\Documents and Settings\user\Desktop.
- UnZip Telit_GE863-PRO³_nonOS_Environment_config_files.zip (the unzip creates the directory GE863-PRO3nonOS_Environment_config_files)
- Copy the files in **GE863-PRO3nonOS_Environment_config_files\OOCDLink**:
 - GE863-PRO3_ft2232.cfg
 - GE863-PRO3_debug_commands.script
 - GE863-PRO3_debug_commands_boot.script

in the directory Ge863Pro3\Debug previus created.

The first file will serve to configure the gdb server while the other two offer two different possibilities to debug an application, as will be explained later.

 Now we have to configure the IDE in order to start the gdb server with the correct parameters; this server listens for requests from the gdb debugger and manages the communication with the drivers.

Open the IDE (Start menu \rightarrow All Programs \rightarrow YAGARTO IDE \rightarrow Eclipse Platform 3.3) and go to the menu Run \rightarrow External Tools \rightarrow Open External Tools Dialog.

- On the left column of the window select the entry **Program** and click on the **New Launch Configuration** icon.



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	•	1vv0300775a Rev. 2 - 10/09/08
🖨 External Tools		
Create, manage, and run cor Run a program	nfigurations	
New launch configuration	Configure launch settings from this dialog: Press the 'New' button to create a configuration of the selected type. Press the 'Duplicate' button to copy the selected configuration. Press the 'Delete' button to remove the selected configuration. Press the 'Filter' button to configure filtering options. Edit or view an existing configuration by selecting it. Configure launch perspective settings from the Perspectives preference page	
Filter matched 1 of 1 items		
0		Run Close

- Fill in the text field called **Name** with the value "Open On Chip Debugger"; select the tab **Main** and fill in the text field **Location** with the executable of the gdb server installed with the package Open On Chip Debugger. Fill in the text field **Working Directory** with the previously created directory (C:\Documents and Settings\user\Desktop\Ge863Pro3\Debug); fill in the text box **Arguments** with the following line:

-f GE863-PRO3 ft2232.cfg

First Click on the **Apply** and then click on **Close**.

Note: the file GE863-PRO3 ft2232.cfg is necessary to instruct the gdb server to use the OOCDLink: if you have another emulator, you need to modify that file in a propriety way.



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🖨 External Tools	
Create, manage, and run cor Run a program	nfigurations Organizations
Image: Second system Image: Second system	Name: Open On Chip Debugger Main Refresh Environment Common Location: C:\Program Files\openocd-r592\bin\openocd-ftd2xx.exe Browse Workspace Browse File System Working Directory: C:\Documents and Settings\user\Desktop\Ge863Pro3\Debug Browse Workspace Browse File System Variables Arguments: -f GE863-PRO3_ft2232.cfg Variables Note: Enclose an argument containing spaces using double-quotes (").
Filter matched 2 of 2 items	
0	Run Close



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4.2 How to use SAM-ICE

SAM-ICE is a JTAG emulator from Segger that can be used to debug any AT91SAM 32-bit ARM-based microcontroller. To setup the debugging environment for using SAM-ICE follow these steps:

- In the host system create a directory called Ge863Pro3\Debug and copy in it the files: GE863-PRO3_debug_commands.script, GE863-PRO3_debug_commands_boot.script provided in the Telit package Telit_GE863-PRO3_nonOS_Environment_config_files.zip (it is not mandatory to put the files in that directory, but if you choose another directory you will have to modify some paths referred to in the rest of this section). To get those files following next steps:
 - \circ go to http://www.telit.com/ → Download Zone,
 - LOGIN with user and password provided by Telit.
 - Click on Software Tools_GSM/GPRS,
 - Click on GE863-PRO³
 - Click on the ZIP_DOWNLOAD of the: Telit_GE863-PRO³_nonOS_Environment_config_files.zip
 - **Save** it in a path like C:\Documents and Settings\user\Desktop.
 - UnZip **Telit_GE863-PRO3_nonOS_Environment_config_files.zip** (the unzip creates the directory **GE863-PRO3nonOS_Environment_config_files**)
 - Copy the files in GE863-PRO3nonOS_Environment_config_files\ SAM-ICE:
 - GE863-PRO3_debug_commands.script
 - GE863-PRO3_debug_commands_boot.script

in the directory Ge863Pro3\Debug previus created.

The first file will serve to configure the gdb server while the other offers two different possibilities to debug an application, as will be explained later.

- Install the J-Link ARM toolkit provided with the emulator, or alternatively download and install the latest release from the Segger website; this toolkit contains the USB driver and some utilities, among which the gdb server which we will refer to in the rest of this paragraph.
- Plug the USB connection cable of SAM-ICE in the host system; the operating system should identify the new device and use the J-Link driver previously installed with the toolkit.
- Now we have to configure the IDE in order to start the gdb server. Open the IDE (Start menu \rightarrow All Programs \rightarrow YAGARTO IDE \rightarrow Eclipse Platform) and go to the menu Run \rightarrow External Tools \rightarrow Open External Tools Dialog.
- On the left colum of the window select the entry **Program** and click on the **New Launch Configuration** icon.



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🖨 External Tools			
Create, manage, and run con Run a program	figurations		
New launch configuration	 Configure launch settings from this dialog: Press the 'New' button to create a configuration of the selected type. Press the 'Duplicate' button to copy the selected configuration. Press the 'Delete' button to remove the selected configuration. Press the 'Filter' button to configure filtering options. Edit or view an existing configuration by selecting it. Configure launch perspective settings from the <u>Perspectives</u> preference page. 		
Filter matched 1 of 1 items			
0		Run	Close

- Fill in the text field called **Name** with the value "Atmel SAM-ICE"; select the tab **Main** and fill in the text field **Location** with the executable of the gdb server installed with the J-Link ARM toolkit.
- Click on **Apply** and then click on **Close**.



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	100300773a Rev. 2 - 10/03/0
External Tools	
Create, manage, and run configu Run a program	arations Oracle Contractions
Image: Second system Image: Second system	Name: Atmel SAM-ICE Main Refresh Environment Location: C:\Program Files\SEGGER\JLinkARM_V380c\JLinkGDBServer.exe Browse Workspace Browse File System Working Directory: Browse Workspace Browse Workspace Browse File System Variables Variables Arguments: Image: Comparison of the system Variables Variables Variables Variables Note: Enclose an argument containing spaces using double-quotes (").
Filter matched 3 of 3 items	Apply Revert
0	Run Close



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4.3 How load and debug an application in the target's RAM

The simplest method to debug an application is to load it in the target's RAM via JTAG and debug it from there. In this way you can debug your application without having to download it manually in the target every time you make a modification in the source code. Now we will instruct the IDE to run the gdb debugger with the correct parameters in order to debug the application built in the previous section.

- Go to the menu **Run** and click on **Open Debug Dialog**.
- On the left side of the window select the entry **Embedded debug (Native)** and click on the **New Launch Configuration** icon.

🖨 Debug		
Create, manage, and run cor	figurations	1 A
New launch configuration	Configure launch settings from this dialog: [•] Press the 'New' button to create a configuration of the selected type. [•] Press the 'Duplicate' button to copy the selected configuration. [•] Press the 'Delete' button to remove the selected configuration. [•] Press the 'Delete' button to configure filtering options. - Edit or view an existing configuration by selecting it. Configure launch perspective settings from the Perspectives preference page.	
0		Debug Close





- 1vv0300775a Rev. 2 10/09/08
- Fill in the text field called **Name** with the value "NonOS_lib", select the tab **Main** and fill in the text field **Project** with the name of the project. Fill in the text field **C/C++ Application** with the path to the ELF file containing the application to debug and then click Apply.

🖨 Debug		×
Create, manage, and run configu	irations	The
		200
Image: Second system Image: Second system <td>Name: HelloWorld Main The Debugger Project: HelloWorldProCube C/C++ Application: C:\Documents and Settings\user\workspace\HelloWorldProCube\Build\HELLOWORLD.elf Search Project Application console Image: Search Project</td> <td>Browse</td>	Name: HelloWorld Main The Debugger Project: HelloWorldProCube C/C++ Application: C:\Documents and Settings\user\workspace\HelloWorldProCube\Build\HELLOWORLD.elf Search Project Application console Image: Search Project	Browse
Filter matched 7 of 7 items	Apply	Revert
0	Debug	Close

- Select the tab **Debugger**; fill in the text field **GDB Debugger** with the path to the gdb executable installed with Yagarto; delete any text contained in the text field **GDB command file**.



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		10/00/00
🖨 Debug		×
Create, manage, and run configu	irations	Ť.
Image: Second system Image: Second system Image: Second	Name: HelloWorld Main Commands Source Debugger: Embedded GDB Debugger Options Image: C:\Program Files\yagarto\bin\arm-elf-gdb.exe GDB debugger: C:\Program Files\yagarto\bin\arm-elf-gdb.exe GDB command file: .gdbinit (Warning: Some commands in this file may interfere with the startup operation of the debugger, for example GDB command set: Standard Protocol: mi Image: Verbose console mode	Advanced Browse Browse e "run".)
Filter matched 7 of 7 items	Apply	Revert
0	Debug	Close

- Select the tab **Commands** and fill in the text field **'Initialize' commands** with a line that will make gdb execute at startup the commands contained in the file GE863-PRO3_debug_commands.script.

First click on Apply and then click on Close.



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	1vv0300775a Rev. 2 - 10	/09/08
🖨 Debug		×
Create, manage, and run configu	urations	Ť.
Image: Second system Image: Second system <th>Name: HelloWorld Main Pebugger Commands 'Initialize' commands Source source C:\Documents and Settings\user\Desktop\Ge863Pro3\Debug\GE863-PRO3_debug_commands.script 'Run' commands</th> <th></th>	Name: HelloWorld Main Pebugger Commands 'Initialize' commands Source source C:\Documents and Settings\user\Desktop\Ge863Pro3\Debug\GE863-PRO3_debug_commands.script 'Run' commands	
Filter matched 7 of 7 items	Apply	Revert
0	Debug	Close

Now the debug environment is set up and you can start debugging your application.

Connect the emulator to your PC and to the JTAG port of the target.

It is convenient to open the IDE's debug perspective, so you can see which processes are running at any time. In order to do so, go to **Window** \rightarrow **Open Perspective** \rightarrow **Debug** and if you want to return to the previous perspective, just go to **Window** \rightarrow **Open Perspective** \rightarrow **C/C++**.

First, the gdb server you previously configured in the **External Tools** dialog box must be started: select the menu entry **Run** \rightarrow **External Tools** \rightarrow **Open External Tools Dialogs** \rightarrow **Open On Chip Debugger** (or whatever menu entry you have, depending on the previously made configuration) \rightarrow **Run**. You should see the related entry appear in the Debug view.

<u>Note</u>: if you chose to use the SAM-ICE emulator, when you start the relevant external tool a new window appears: on that window select **Adaptive** from the Initial JTAG speed drop-down list; also, if you want this window not to be always on top of other windows, uncheck the option **Stay on top**. These settings, along with all the other settings you may want to change, will remain stored in a configuration file, so there is no need to change them every time you launch this tool.



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		1vv0300775a Rev. 2 - 10/09/08
SEGGER J-Link GDB Server V3.8	30c	
File Help		
GDB Connected to 127.0.0.1 J-Link Connected	Initial JTAG speed Adaptive 💌 Current JTAG speed Adaptive	 Stay on top Show log window Generate logfile Cache reads
Target ARM9, Executing	3.11 V Little endian 👻	Verify download
25 KB downloaded	1 JTAG device	

Now, gdb itself must be launched: in the Eclipse window go to $\mathbf{Run} \rightarrow \mathbf{Open}$ Debug Dialog. On the left side of the window select the icon HelloWorld, corresponding to the gdb configuration you just made, and click on Debug (from now on, you can start the debugger with this configuration also selecting the related entry from the menu $\mathbf{Run} \rightarrow \mathbf{Debug}$ History). Some additional entries should appear in the Debug view showing the status of the process you just started. Wait until gdb initializes the target and loads in it the application (it may take a few seconds). The target should halt the execution at the first line of your main() function: from there, you can debug your application setting breakpoints, stepping through the code and so on. Note that if there is any optimization enabled in the compiler options, debugging can be difficult because the program may not follow the execution flow you would expect.

If you want to terminate the execution of any process you started from within the IDE, just select the related entry in the Debug view and click on $Run \rightarrow Terminate$.

4.4 How debug an application in the target's flash

In the previous paragraph we described a debugging method in which the binary image of the application is downloaded through JTAG directly in the target's RAM and executed from there. Another way to debug your application is to transfer the image (the bin file created in the Build directory of your project) into your target's flash and instruct U-Boot to load it in RAM and execute it. You can debug the application once it is started by U-Boot. With this technique you can examine your application's behavior in the same conditions as when the target executes a normal boot sequence, but you have to download manually the image into the target memory every time you modify it. Read the next section for instructions on how to flash an application and instruct U-Boot to execute it automatically at startup.

To setup the debugger, you can either modify the configuration you made in the previous paragraph, or create a new one. The only difference is that the debugger must execute a different script file at the start-up (GE863-PRO3_debug_commands_boot.script). To use the new file, you have to change the text contained in the text field 'Initialize' commands in the tab Commands of the Open Debug Dialog dialog box and click on Apply.



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	10/09/08
🖨 Debug	×
Create, manage, and run configu	arations to the second s
Yume Yume Image: Symptotic state Image: Symptotic state Image: Symptot state Image: Symptot state <	Name: HelloWorld Main Debugger Commands Source Common Initialize' commands source C:\Documents and Settings\user\Desktop\Ge863Pro3\Debug\GE863-PRO3_debug_commands_boot.script 'Run' commands
Filter matched 7 of 7 items	Apply Revert
0	Debug Close

Now you can debug your application as described in the previous paragraph. First start the gdb server (if not already started) and then start the debugger with the new configuration. In this case, if you have a terminal emulator open in the host and connected to the target (for details see the next section), when the debugger is started you should see U-Boot output messages. When U-Boot starts your application, the execution is halted at the beginning of the main() function and from there you can begin to debug the application. It is recommended to configure U-Boot to load and execute automatically your application during the boot sequence. For more detailed instructions on how to do that please read the next section.



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5 Using U-Boot

U-Boot is a popular bootloader that offers many features useful to manage an embedded system. You can load an operating system (or whatever application you want to deploy), but you can also transfer files from a remote system to the target and store these files in non volatile memory. In this chapter you will learn how to perform these tasks.

The user's interface of U-Boot is text-based and can be accessed through a terminal emulator. As an example, we will describe how to use the HyperTerminal application, which is included in the Windows operating system.

- Connect a serial port of the host system to the serial port of the target called AP DEBUG
- Go to the Windows menu Start \rightarrow All Programs \rightarrow Accessories \rightarrow Communications \rightarrow HyperTerminal to open the application.
- In the window named **Connection Description** enter a name for your connection (for example Ge863Pro3) and click on **OK**.

Connection Description
New Connection
Enter a name and choose an icon for the connection: <u>N</u> ame:
Ge863Pro3
OK Cancel

- In the window **Connect to** select the serial port of your host system (if your PC has only a serial port, it should be COM1) and than click on **OK**.



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Connect To	? 🛛
	ro3
Enter details for	the phone number that you want to dial:
<u>C</u> ountry/region:	Italy (39) 💌
Ar <u>e</u> a code:	
Phone number:	
Co <u>n</u> nect using:	СОМ1
	OK Cancel

- In the next window select 115200 bits per second, 8 data bits, no parity bit, 1 stop bit and no flow control, then click on **OK**.

COM1 Properties		? 🔀
Port Settings		
<u>B</u> its per second:	115200	~
<u>D</u> ata bits:	8	*
Parity:	None	~
<u>S</u> top bits:	1	~
Elow control:	None	
	<u>R</u> estore D	efaults
	K Cancel	



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Now that you are ready to use U-Boot reset the target and you should see U-Boot's output messages. You can save the current configuration by clicking on **File** \rightarrow **Save** and the next time you will want to use HyperTerminal, you can retrieve this configuration by clicking on the Windows menu item **Start** \rightarrow **All Programs** \rightarrow **Accessories** \rightarrow **Communications** \rightarrow **HyperTerminal** \rightarrow **Ge863Pro3.ht** (in case you've saved the configuration with that name).

5.1 How to flash an application

In you want to flash an application in the target using U-Boot please follow the next steps:

- Load the application with one of the load commands below:
 - loady: for loading a file with the Ymodem protocol.
 - o loadb: for loading a file with the Kermit protocol.

Issue the chosen command with the RAM Address where you want to copy the file (possible values start from 0x20012000). U-Boot is now ready to accept incoming data.

- Send the file from the host with the chosen protocol. If everything went on properly, at the end of the transfer the number of transferred bytes is displayed both in decimal and hexadecimal format in the U-Boot shell.
- Issue the cp.b command with the RAM address where you previously copied the file, the flash address where you want to store the file (possible values start from 0xD0021000) and the number of bytes to be copied.

Example: to transfer a file with size of SIZE bytes with the Ymodem protocol and store it in the flash at the virtual address 0xD0021000 (that corresponds to the 0x21000 offset from flash beginning) type the following command:

loady 0x20012000

Then click on the HyperTerminal's menu item **Transfer** \rightarrow **Send file...**; in the window that appears browse to the file you want to transfer and select the protocol Ymodem.

Send File	? 🗙
Folder: C:\Documents and	
Filename:	
C:\Documents and Settings\user\workspace\Hell	Browse
Protocol:	
Ymodem	~
Send Close	Cancel

Wait until the transfer is done, then type the following command to store the file in flash:



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cp.b 0x20012000 0xD0021000 SIZE

5.2 How to start an application

Since the connection between the ARM processor and the flash memory is achieved through a serial interface, the target cannot execute the application directly from the flash. So, the binary image has to be loaded in RAM and executed from there. To launch an application in the target using U-Boot follow these steps:

- Load the application in RAM in one of the following two ways:
 - use the loady and loadb commands as explained in the previous paragraph;
 - if you have in flash a previously stored application, load it using the cp.b command specifying the flash address where the application is stored, the RAM address where it is to be copied and the number of bytes to be copied. Example:

cp.b 0xD0021000 0x20012000 SIZE

- Issue the go command with the correct RAM address. Example:

go 0x20012000

After this command your application should start running.

5.3 How to automatically start an application from flash in the boot sequence

If you want the target to automatically start your application, U-Boot must be instructed to load the binary image from flash to RAM and execute it from there.

- In the U-Boot shell, change the environment variable bootcmd which contains the commands that must be automatically executed at startup. If we suppose to have copied an application of size SIZE bytes in the flash address 0xD0021000 we can use the following command:

setenv bootcmd cp 0xD0021000 0x20012000 SIZE\;go 0x20012000

- Save the environment in the flash with the following command: saveenv
- When you reboot the target, U-Boot waits for a timeout (by default 3 seconds) to expire, and if during this interval you don't type anything in the shell, you will see your application running.



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For further details on U-Boot usage you can refer to the home page of the project <u>http://sourceforge.net/projects/u-boot</u>.



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