Widora How-To

`by zymxjtu`

How-To OpenWrt C/C++ Development with Eclipse

1 Copyright

This How-To guide is based on the work of OpenWrt C/C++ Devopement with Eclipse by J.Kohler. Update and add some additional content.

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2 Revision history

Revision	Date	Author	Changes
v0.1	6 Aug 2016	zymxjtu	First draft

3 Introduction

With Eclipse, we are able to develop software for OpenWrt target devices in a very comfortable manner. Eclipse provides a complete development suite.

This document explains how to use Eclipse C/C++ IDE with OpenWrt's cross toolchain, how to setup remote target device source level debugging and remote access via eclipse.

It is shown how to write, compile and debug programs for OpenWrt target devices.
We can use Eclipse to develop software for OpenWRT target device.

4 Preparation

4.1 Prerequisites

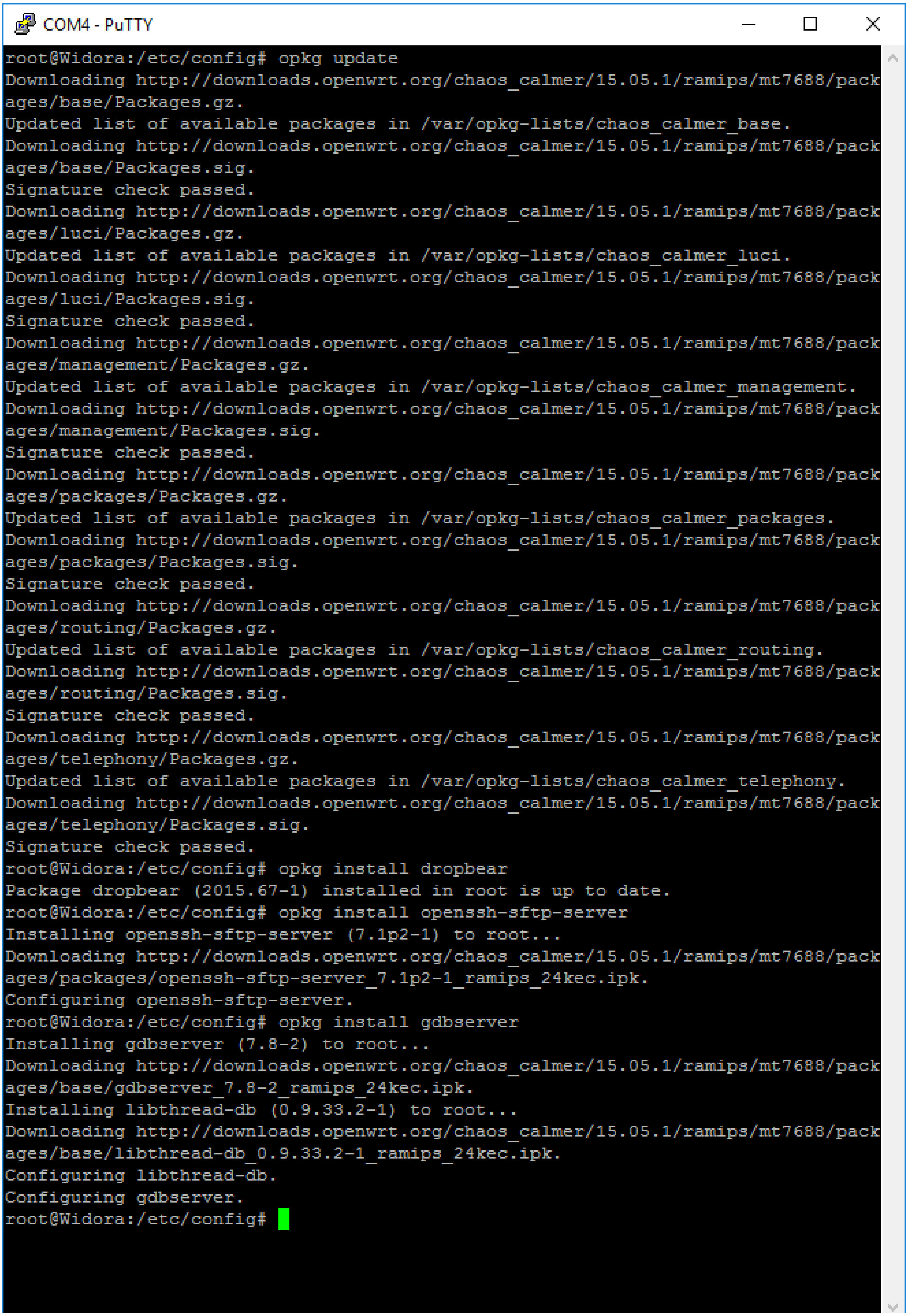
4.1.1 Target Prerequisites

The following packages are required on your target device:

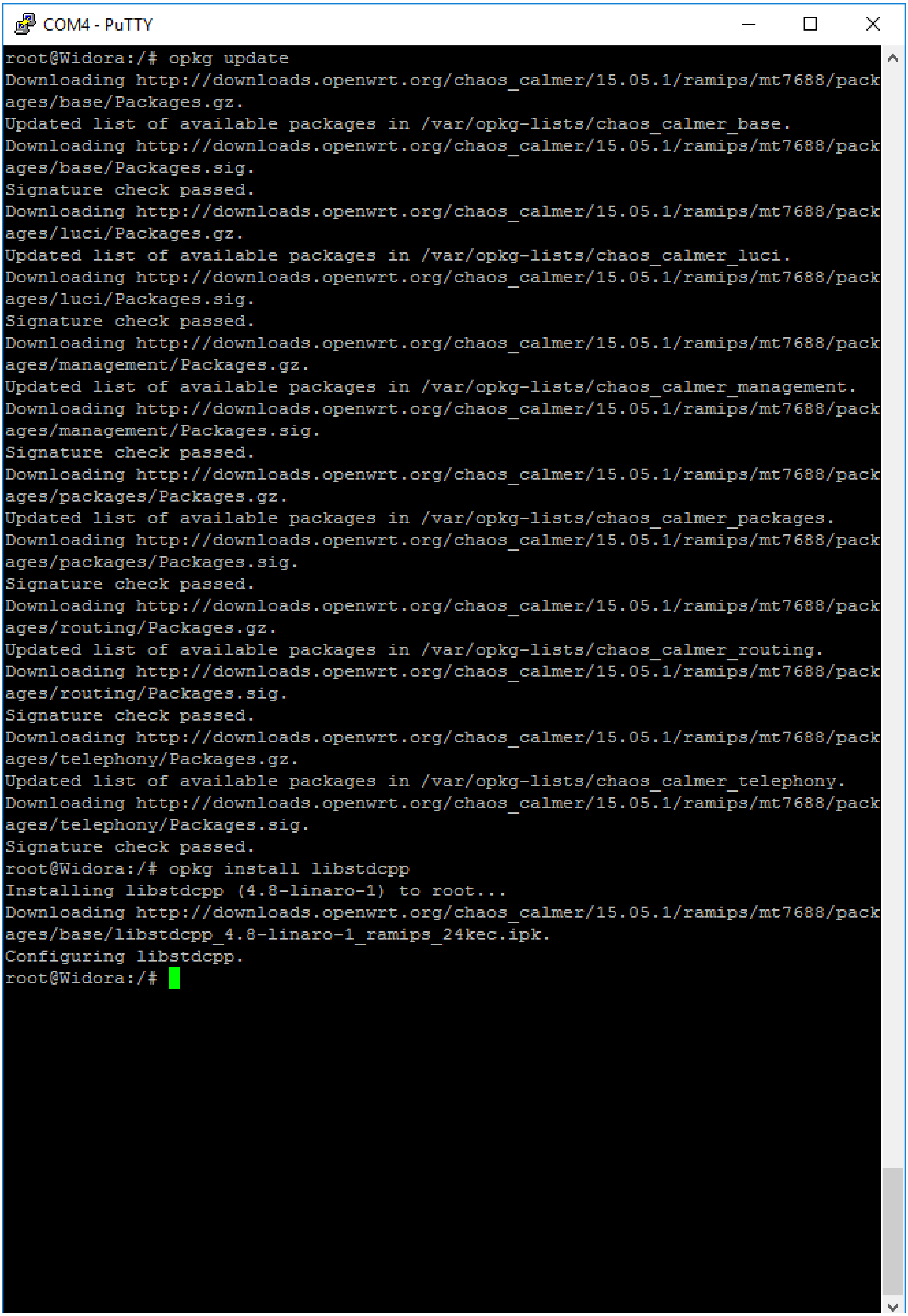
1. DropBear or OpenSSH installed & connections can be established
2. openssh-sftp-server
3. gdbserver
4. libstdcpp (optional for C++)

openssh-sftp-server and gdbserver can be pre-build inside the OpenWRT image. If they are not, can simply install them:

1. SSH to OpenWRT. (Or for Widora, use onboard Serial Terminal, check `"Widora_User_Guide_1_Before_Getting_Started"`)
2. Execute `opkg update` and then `opkg install libstdcpp`
3. Execute `opkg update` and then `opkg install openssh-sftp-server`
4. Execute `opkg install gdbserver` to install gdbserver.



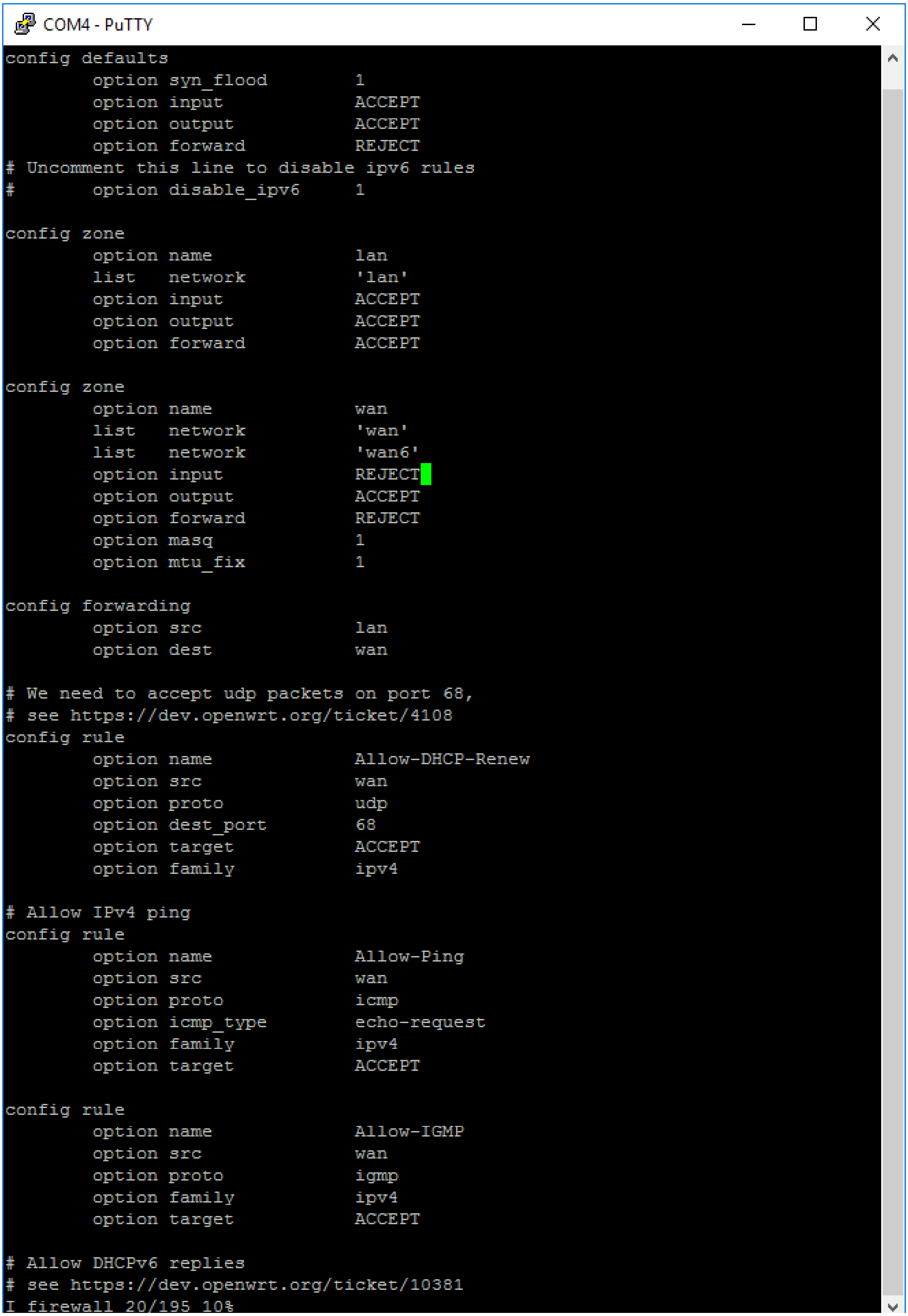
```
root@Widora:/etc/config# opkg update
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/base/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_base.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/base/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/luci/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_luci.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/luci/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/management/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_management.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/management/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/packages/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_packages.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/packages/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/routing/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_routing.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/routing/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/telephony/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_telephony.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/telephony/Packages.sig.
Signature check passed.
root@Widora:/etc/config# opkg install dropbear
Package dropbear (2015.67-1) installed in root is up to date.
root@Widora:/etc/config# opkg install openssh-sftp-server
Installing openssh-sftp-server (7.1p2-1) to root...
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/packages/openssh-sftp-server_7.1p2-1_ramips_24kec.ipk.
Configuring openssh-sftp-server.
root@Widora:/etc/config# opkg install gdbserver
Installing gdbserver (7.8-2) to root...
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/base/gdbserver_7.8-2_ramips_24kec.ipk.
Installing libthread-db (0.9.33.2-1) to root...
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/base/libthread-db_0.9.33.2-1_ramips_24kec.ipk.
Configuring libthread-db.
Configuring gdbserver.
root@Widora:/etc/config#
```



```
root@Widora:/# opkg update
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/base/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_base.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/base/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/luci/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_luci.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/luci/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/management/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_management.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/management/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/packages/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_packages.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/packages/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/routing/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_routing.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/routing/Packages.sig.
Signature check passed.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/telephony/Packages.gz.
Updated list of available packages in /var/opkg-lists/chaos_calmer_telephony.
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/telephony/Packages.sig.
Signature check passed.
root@Widora:/# opkg install libstdcpp
Installing libstdcpp (4.8-linaro-1) to root...
Downloading http://downloads.openwrt.org/chaos_calmer/15.05.1/ramips/mt7688/pack
ages/base/libstdcpp_4.8-linaro-1_ramips_24kec.ipk.
Configuring libstdcpp.
root@Widora:/#
```

For Widora, in the case that Widora is connect to an AP(Router), and our host computer is also connected to the same AP and not connected to Widora directly, and in order to be able to SSH to Widora remotely, instead of directly SSH to Widora default 192.168.1.1, we need to modify Widora configuration file `/etc/config/firewall` to unblock it. Modify config zone wan, set option input to `ACCEPT`, instead of `REJECT`, and after saving the modification, reboot the Widora:

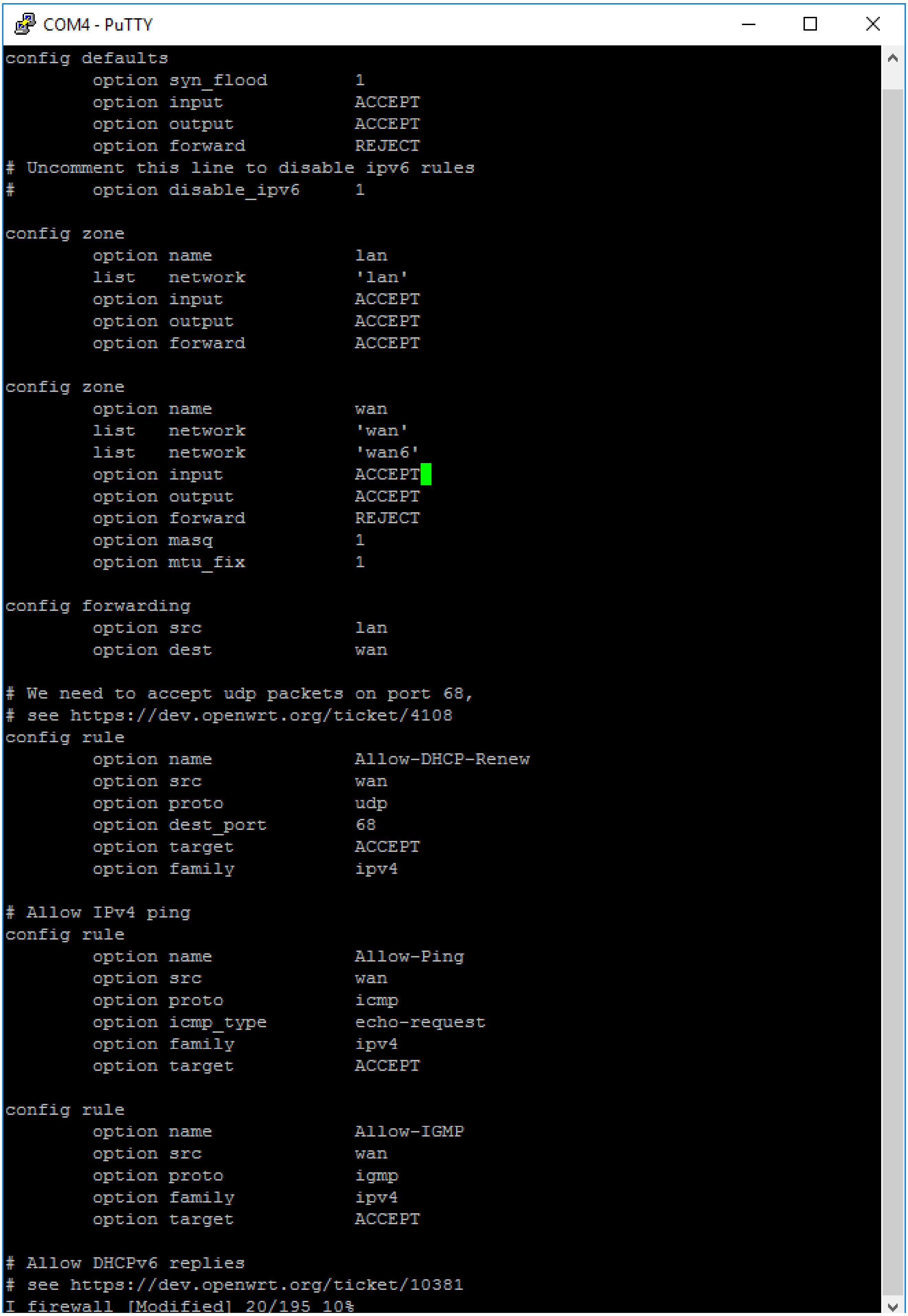
Original:



```
config defaults
        option syn_flood        1
        option input            ACCEPT
        option output           ACCEPT
        option forward          REJECT
# Uncomment this line to disable ipv6 rules
#       option disable_ipv6     1

config zone
        option name             lan
        list   network          'lan'
        option input            ACCEPT
        option output           ACCEPT
        option forward          ACCEPT

config zone
        option name             wan
        list   network          'wan'
        list   network          'wan6'
        option input            REJECT
        option output           ACCEPT
        option forward          REJECT
        option masq             1
        option mtu_fix          1

config forwarding
        option src              lan
        option dest             wan

# We need to accept udp packets on port 68,
# see https://dev.openwrt.org/ticket/4108
config rule
        option name             Allow-DHCP-Renew
        option src              wan
        option proto            udp
        option dest_port        68
        option target           ACCEPT
        option family           ipv4

# Allow IPv4 ping
config rule
        option name             Allow-Ping
        option src              wan
        option proto            icmp
        option icmp_type        echo-request
        option family           ipv4
        option target           ACCEPT

config rule
        option name             Allow-IGMP
        option src              wan
        option proto            igmp
        option family           ipv4
        option target           ACCEPT

# Allow DHCPv6 replies
# see https://dev.openwrt.org/ticket/10381
I firewall 20/195 10%
```

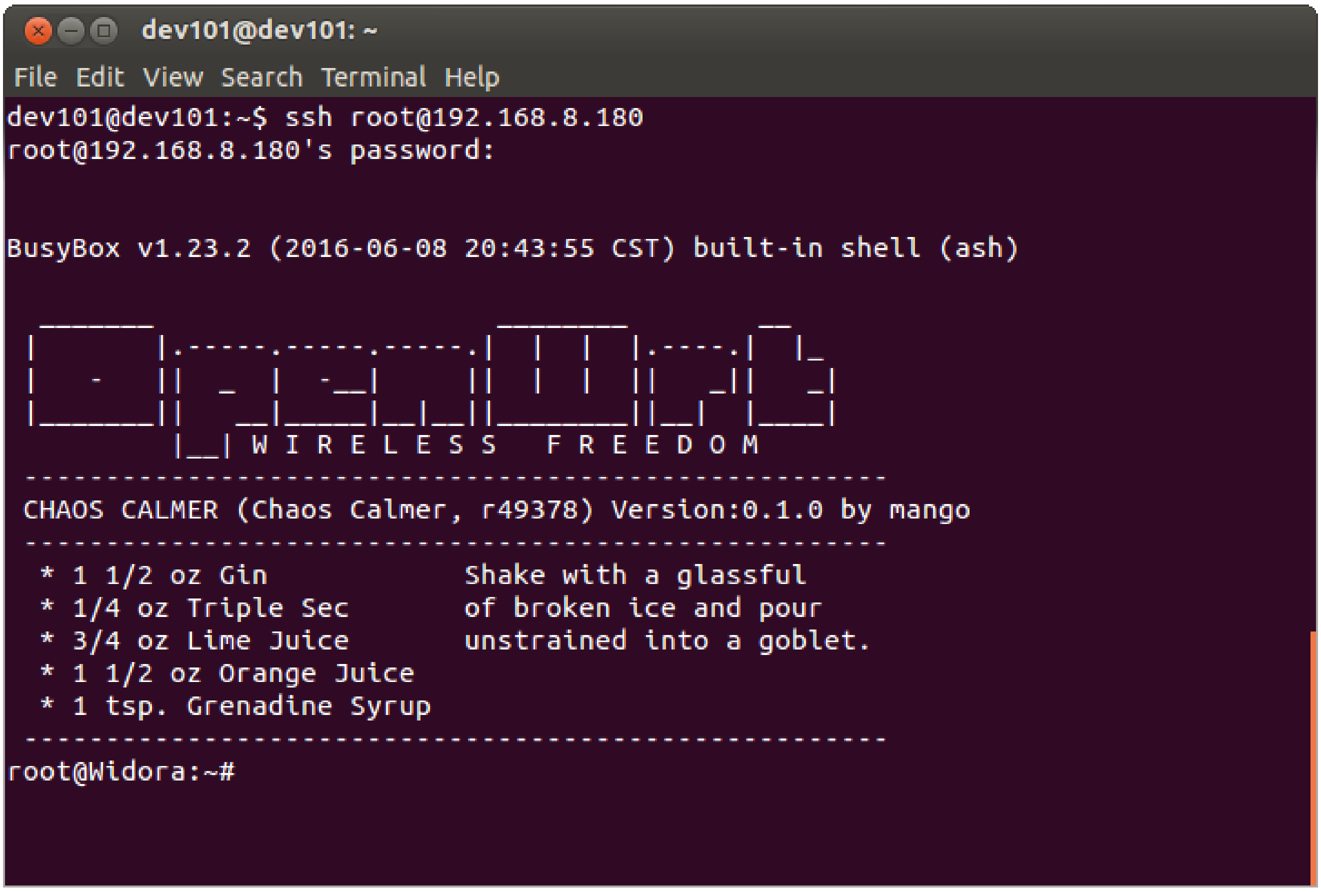
[redacted]

Modified:



```
config defaults
        option syn_flood        1
        option input            ACCEPT
        option output           ACCEPT
        option forward          REJECT
# Uncomment this line to disable ipv6 rules
#       option disable_ipv6     1

config zone
        option name             lan
        list   network          'lan'
        option input            ACCEPT
        option output           ACCEPT
        option forward          ACCEPT

config zone
        option name             wan
        list   network          'wan'
        list   network          'wan6'
        option input            ACCEPT
        option output           ACCEPT
        option forward          REJECT
        option masq             1
        option mtu_fix          1

config forwarding
        option src              lan
        option dest             wan

# We need to accept udp packets on port 68,
# see https://dev.openwrt.org/ticket/4108
config rule
        option name             Allow-DHCP-Renew
        option src              wan
        option proto            udp
        option dest_port        68
        option target           ACCEPT
        option family           ipv4

# Allow IPv4 ping
config rule
        option name             Allow-Ping
        option src              wan
        option proto            icmp
        option icmp_type        echo-request
        option family           ipv4
        option target           ACCEPT

config rule
        option name             Allow-IGMP
        option src              wan
        option proto            igmp
        option family           ipv4
        option target           ACCEPT

# Allow DHCPv6 replies
# see https://dev.openwrt.org/ticket/10381
I firewall [Modified] 20/195 10%
```

And verified it (SSH to Widora(192.168.8.180 in this case) remotely):



```
dev101@dev101:~$ ssh root@192.168.8.180
root@192.168.8.180's password:


BusyBox v1.23.2 (2016-06-08 20:43:55 CST) built-in shell (ash)

  _______                     ________        __
 |       |.-----.-----.-----.|  |  |  |.----.|  |_
 |   -   ||  _  |  -__|     ||  |  |  ||   _||   _|
 |_______||   __|_____|__|__||________||__|  |____|
          |__| W I R E L E S S   F R E E D O M
 -----------------------------------------------------
 CHAOS CALMER (Chaos Calmer, r49378) Version:0.1.0 by mango
 -----------------------------------------------------
  * 1 1/2 oz Gin            Shake with a glassful
  * 1/4 oz Triple Sec       of broken ice and pour
  * 3/4 oz Lime Juice       unstrained into a goblet.
  * 1 1/2 oz Orange Juice
  * 1 tsp. Grenadine Syrup
 -----------------------------------------------------
root@Widora:~#
```

4.1.2 OpenWRT Prerequisites

Install OpenWrt Buildroot:

https://github.com/widora/openwrt_widora

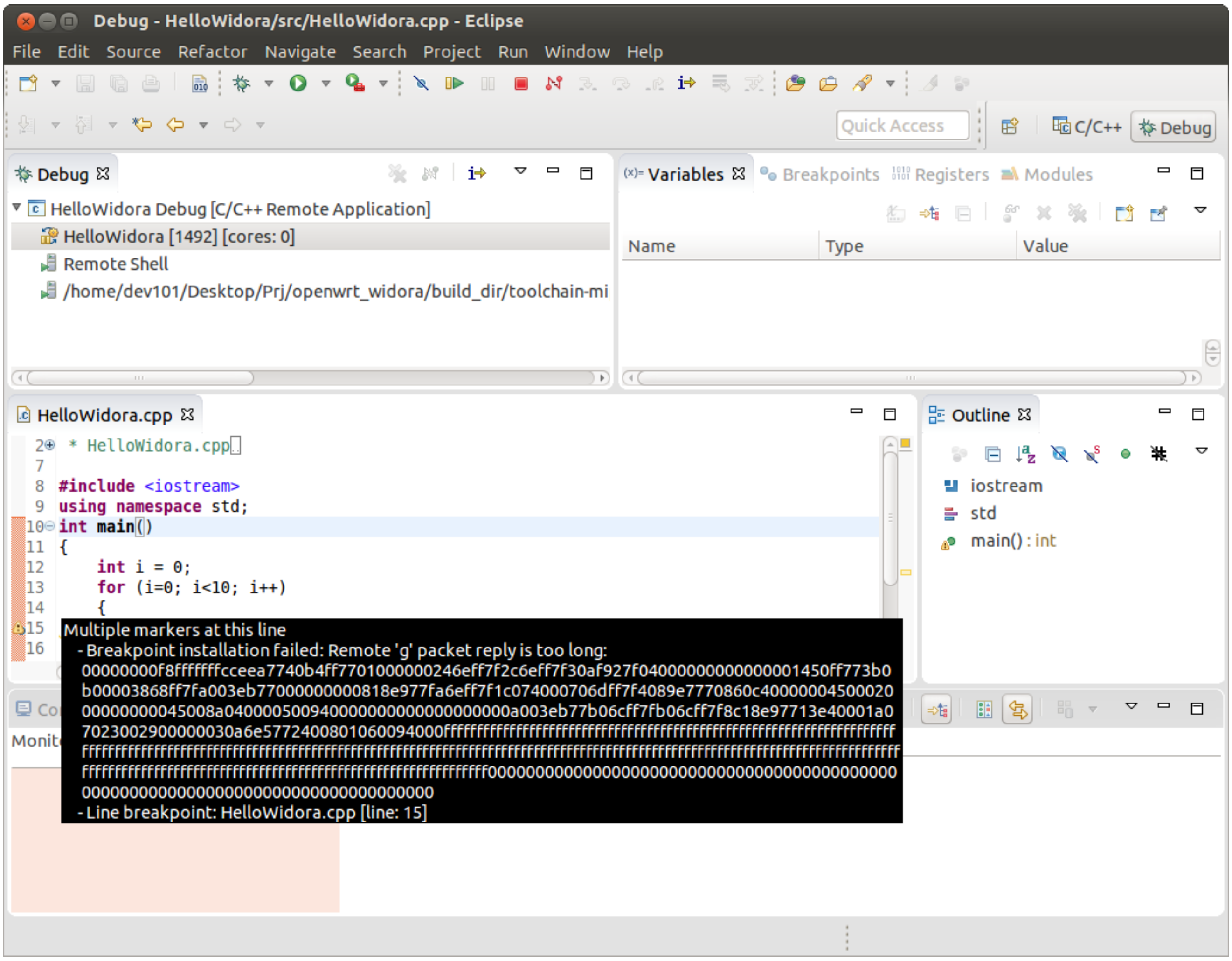
http://wiki.openwrt.org/doc/howto/buildroot.exigence

For OpenWrt Chaos Calmer which Widora is using, there is one isse with the gdb, detailed information here:

https://dev.openwrt.org/ticket/22360

https://dev.openwrt.org/changeset/46298/trunk/toolchain/gdb

This issue will cause below problem when try to debug the user program:

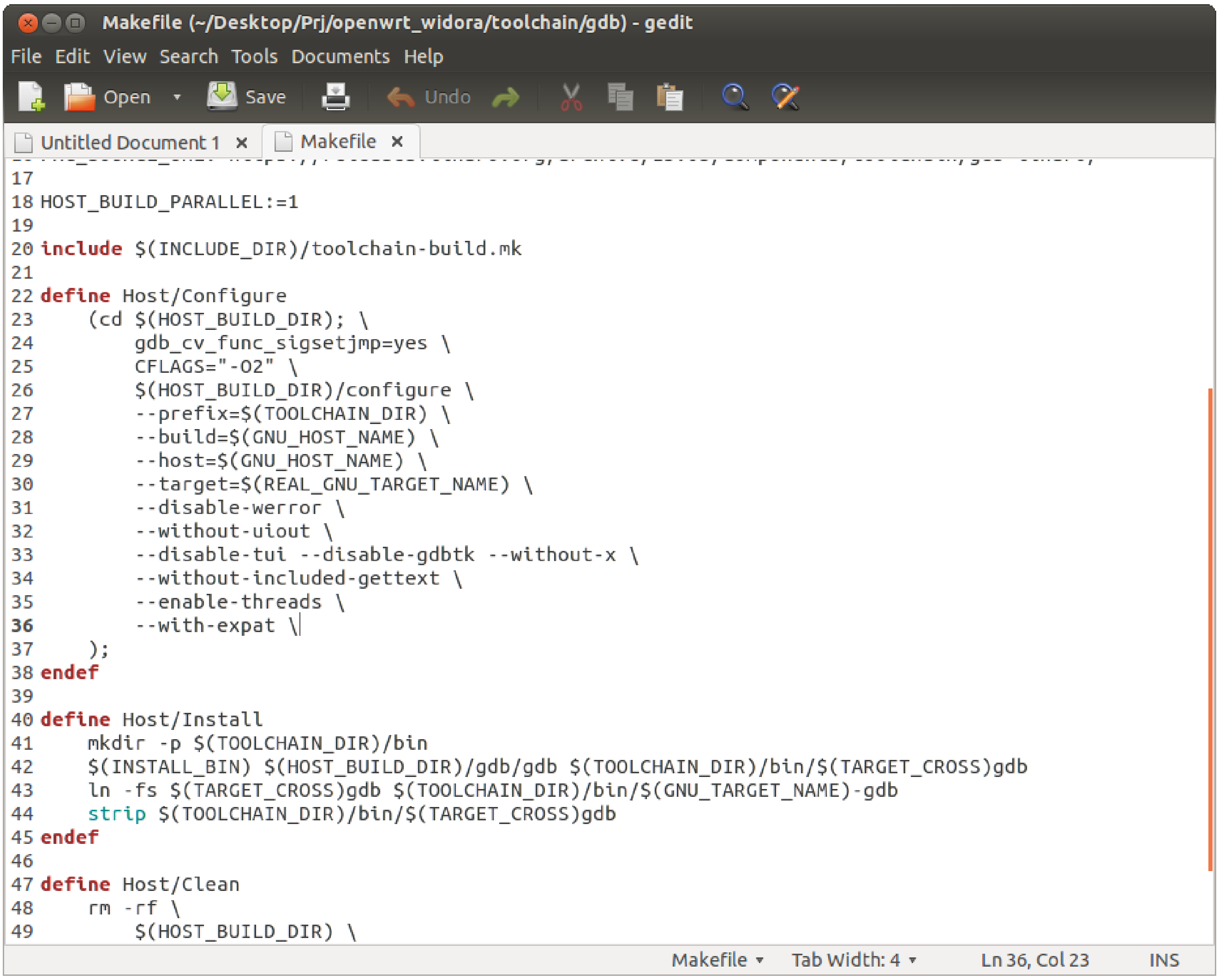


HelloWidora Debug [C/C++ Remote Application]
HelloWidora [1492] [cores: 0]
Remote Shell
/home/dev101/Desktop/Prj/openwrt_widora/build_dir/toolchain-mi

```
 * HelloWidora.cpp

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
```

```
Multiple markers at this line
  - Breakpoint installation failed: Remote 'g' packet reply is too long:
   00000000f8ffffffcceea7740b4ff7701000000246eff7f2c6eff7f30af927f0400000000000000001450ff773b0
   b00003868ff7fa003eb77000000000818e977fa6eff7f1c074000706dff7f4089e7770860c40000004500020
   00000000045008a040000500940000000000000000000a003eb77b06cff7fb06cff7f8c18e97713e40001a0
   7023002900000030a6e5772400801060094000ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff
   fffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff
   fffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff00000000000000000000000000000000000000000000
   0000000000000000000000000000000000000
  - Line breakpoint: HelloWidora.cpp [line: 15]
```

So for Widora, there is one modification need for the file `{Widora_Source_Dir}/toolchain/gdb/Makefile` (add "--with-expat \" as shown below):



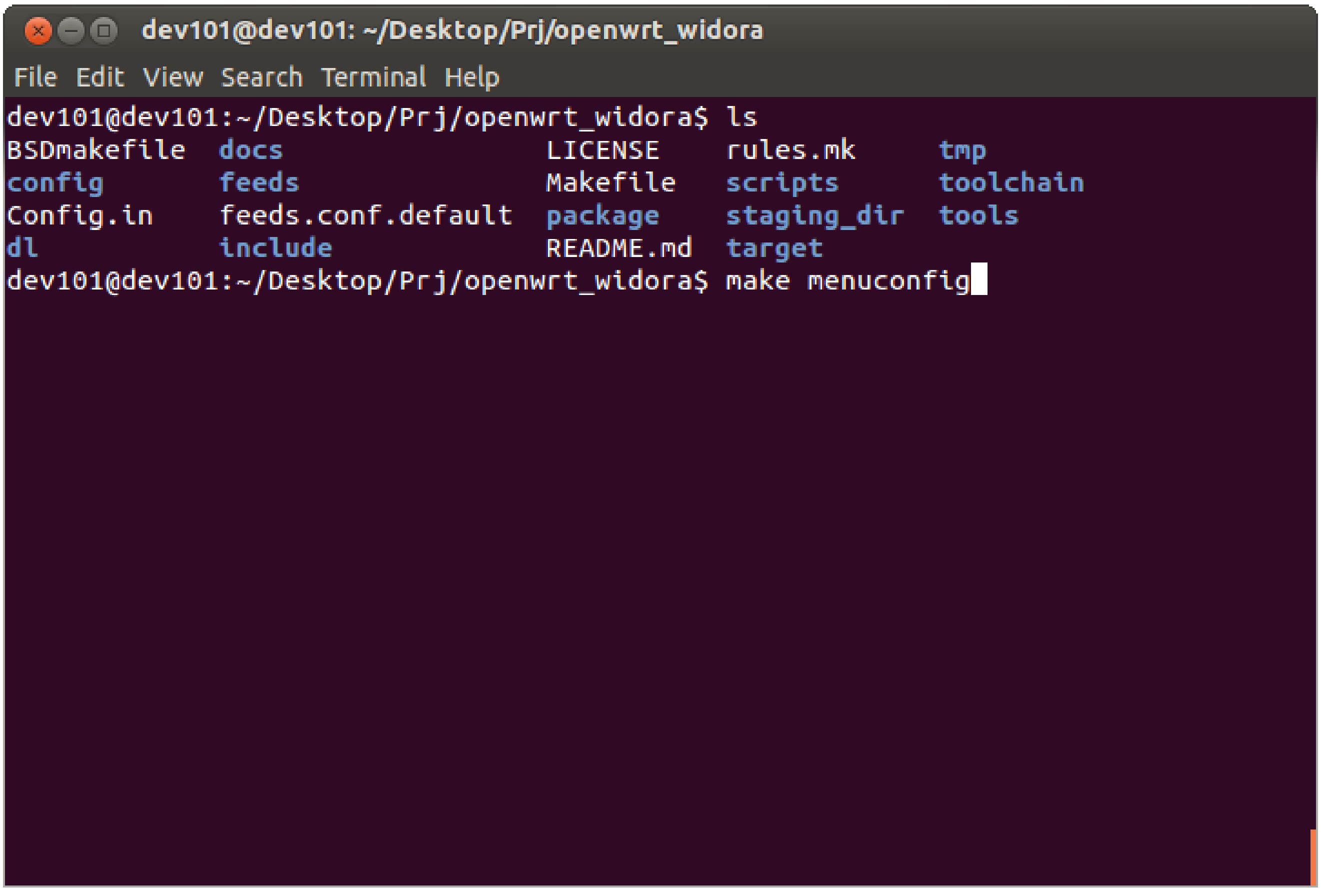
Makefile (~/Desktop/Prj/openwrt_widora/toolchain/gdb) - gedit
File Edit View Search Tools Documents Help
Open
Save
Undo
Untitled Document 1
Makefile
Makefile
Tab Width: 4
Ln 36, Col 23
INS

```

HOST_BUILD_PARALLEL:=1

include $(INCLUDE_DIR)/toolchain-build.mk

define Host/Configure
    (cd $(HOST_BUILD_DIR); \
        gdb_cv_func_sigsetjmp=yes \
        CFLAGS="-O2" \
        $(HOST_BUILD_DIR)/configure \
        --prefix=$(TOOLCHAIN_DIR) \
        --build=$(GNU_HOST_NAME) \
        --host=$(GNU_HOST_NAME) \
        --target=$(REAL_GNU_TARGET_NAME) \
        --disable-werror \
        --without-uiout \
        --disable-tui --disable-gdbtk --without-x \
        --without-included-gettext \
        --enable-threads \
        --with-expat \
    );
endef

define Host/Install
    mkdir -p $(TOOLCHAIN_DIR)/bin
    $(INSTALL_BIN) $(HOST_BUILD_DIR)/gdb/gdb $(TOOLCHAIN_DIR)/bin/$(TARGET_CROSS)gdb
    ln -fs $(TARGET_CROSS)gdb $(TOOLCHAIN_DIR)/bin/$(GNU_TARGET_NAME)-gdb
    strip $(TOOLCHAIN_DIR)/bin/$(TARGET_CROSS)gdb
endef

define Host/Clean
    rm -rf \
        $(HOST_BUILD_DIR) \
```

You also need to install "libexpat1-dev" on the build machine (compilation need this lib):

```
sudo apt-get install libexpat1-dev
```

Navigate to openwrt source code trunk/root directory, and then execute “make menuconfig”:

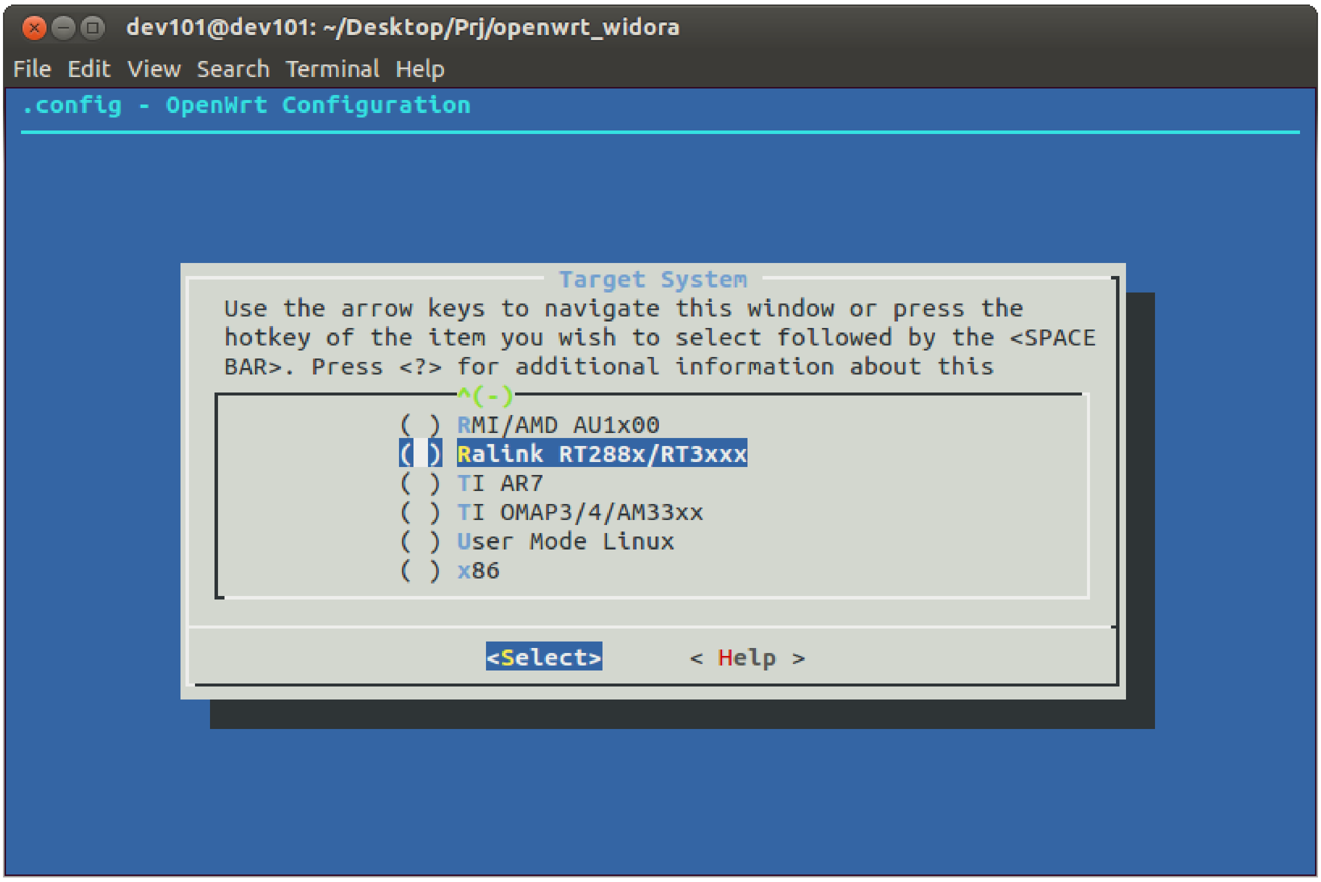


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

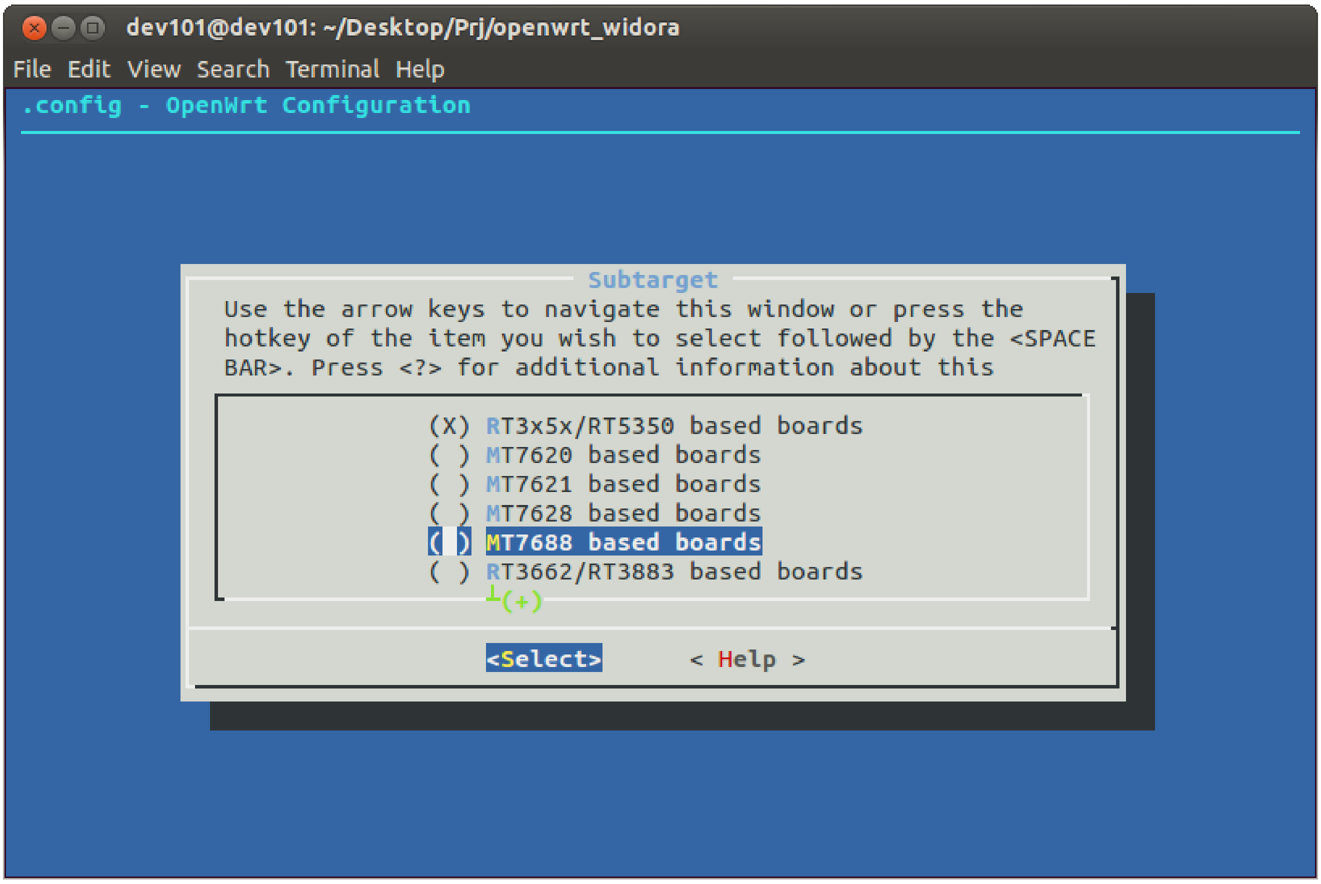
```
dev101@dev101:~/Desktop/Prj/openwrt_widora$ ls
BSDmakefile  docs                LICENSE    rules.mk     tmp
config       feeds               Makefile   scripts      toolchain
Config.in    feeds.conf.default  package    staging_dir  tools
dl           include             README.md  target
dev101@dev101:~/Desktop/Prj/openwrt_widora$ make menuconfig
```

And check:

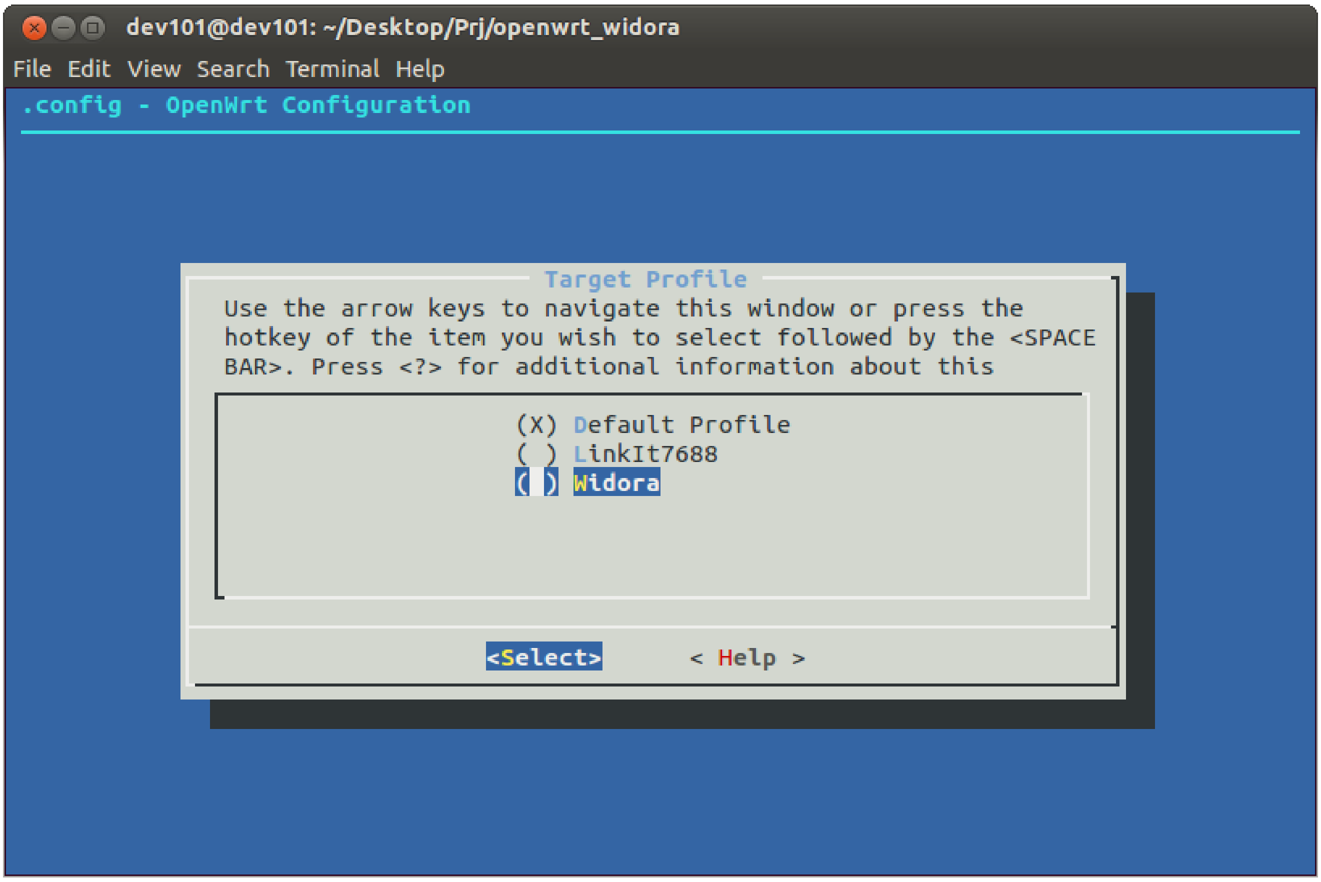
1. Set the build "Target System", "Subtarget", "Target Profile".
2. Enable [*] Build the OpenWrt SDK
3. Enable [*] Package the OpenWrt-based Toolchain
4. Enable [*] Advanced configuration options (for developers) ---> Enable [*] Toolchain Options ---> Enable [*] Build gdb
5. Save the configuration.


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

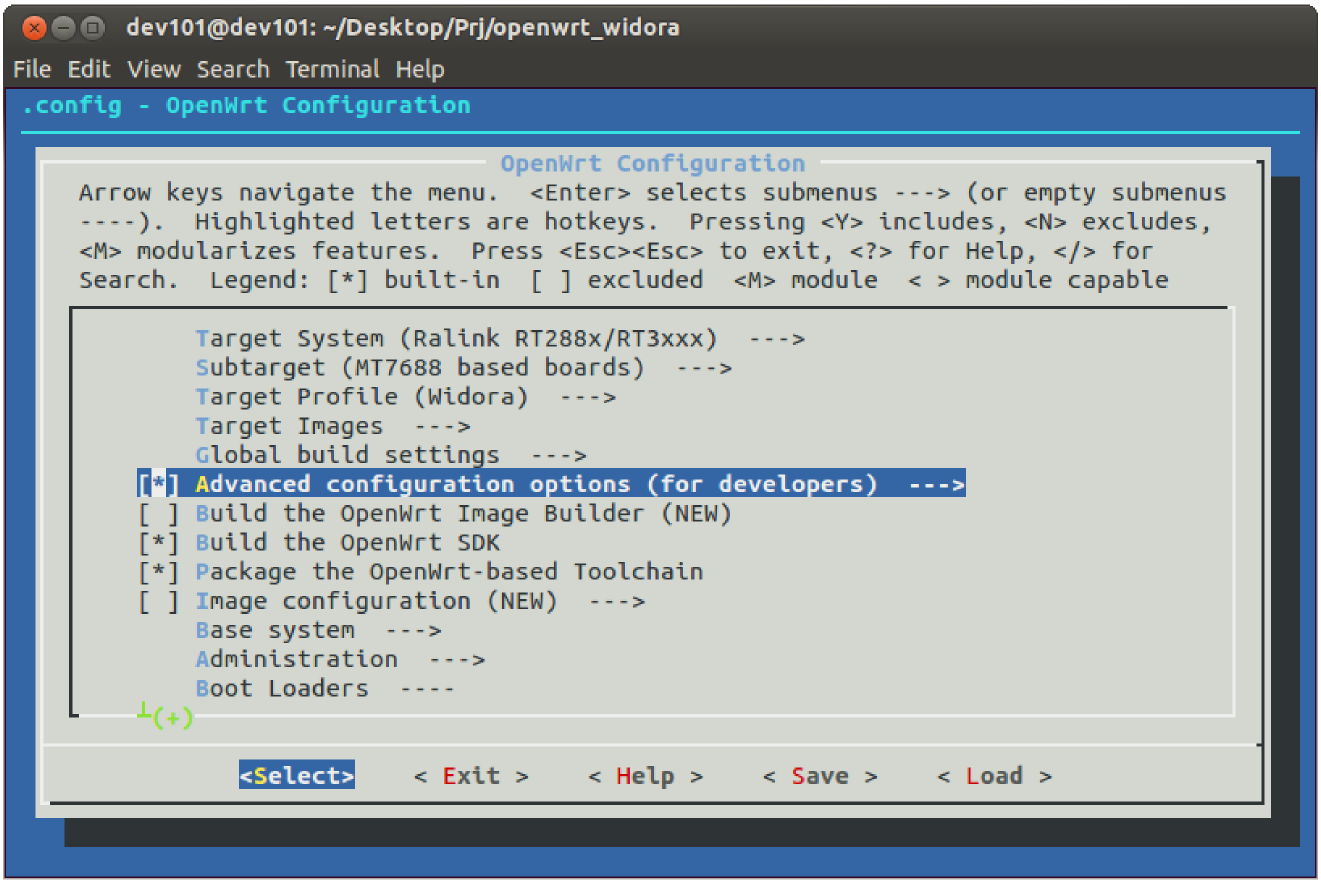
```
.config - OpenWrt Configuration

                         Target System
  Use the arrow keys to navigate this window or press the
  hotkey of the item you wish to select followed by the <SPACE
  BAR>. Press <?> for additional information about this
                        ^(-)
               ( ) RMI/AMD AU1x00
               ( ) Ralink RT288x/RT3xxx
               ( ) TI AR7
               ( ) TI OMAP3/4/AM33xx
               ( ) User Mode Linux
               ( ) x86

                   <Select>    < Help >
```


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

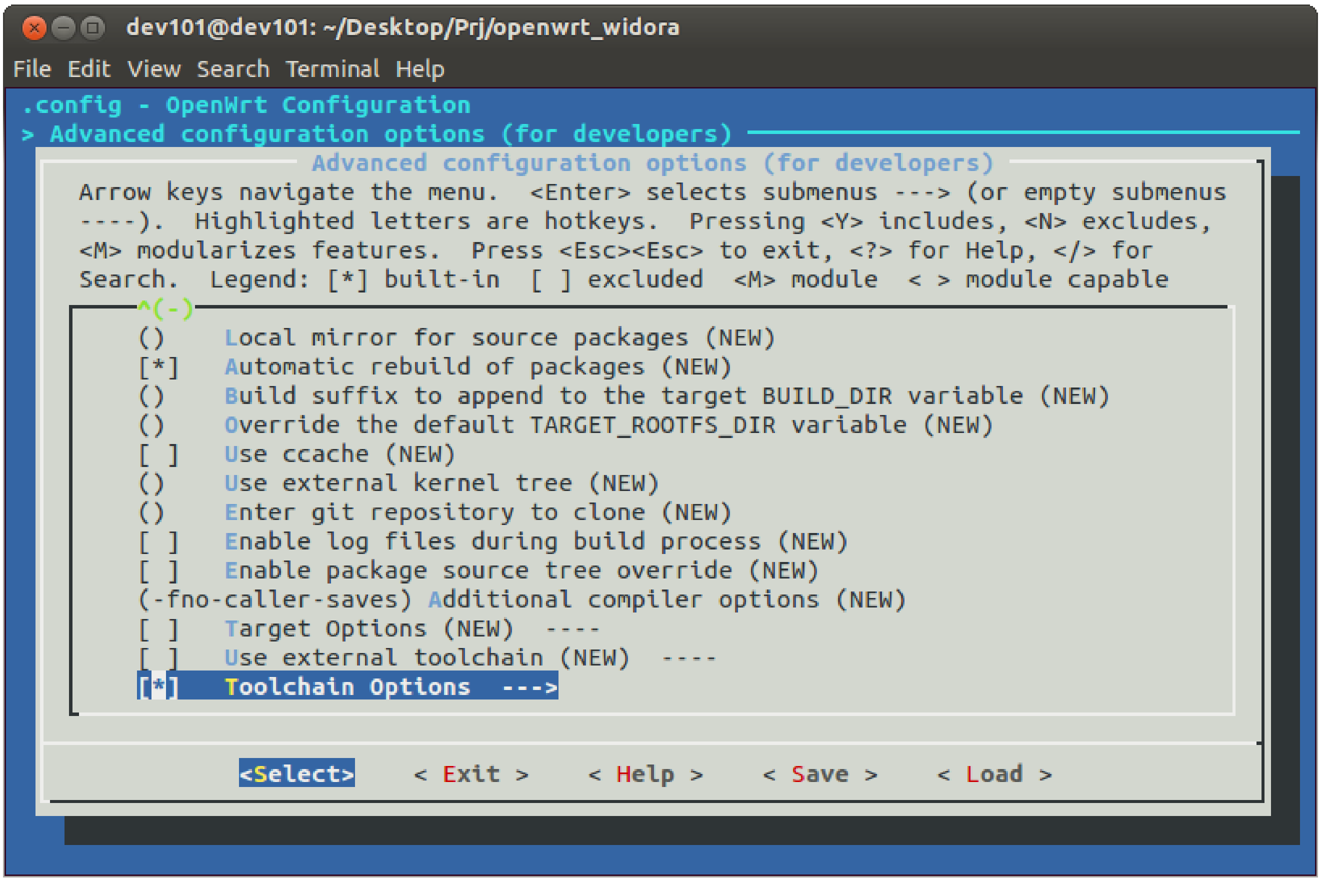
```
.config - OpenWrt Configuration

                          Subtarget
  Use the arrow keys to navigate this window or press the
  hotkey of the item you wish to select followed by the <SPACE
  BAR>. Press <?> for additional information about this

                (X) RT3x5x/RT5350 based boards
                ( ) MT7620 based boards
                ( ) MT7621 based boards
                ( ) MT7628 based boards
                ( ) MT7688 based boards
                ( ) RT3662/RT3883 based boards
                  └(+)

                   <Select>    < Help >
```


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

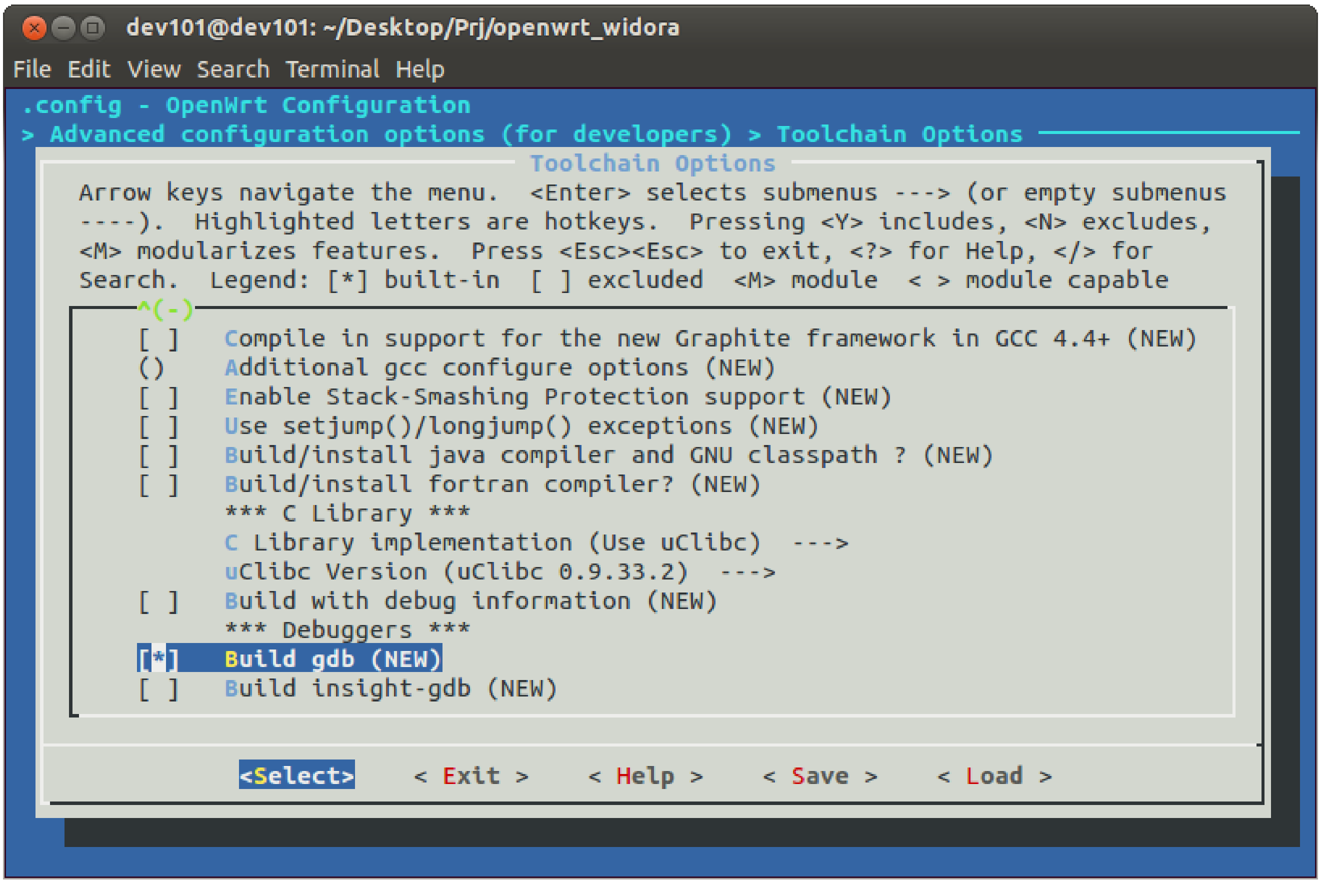
```
.config - OpenWrt Configuration

                     Target Profile
  Use the arrow keys to navigate this window or press the
  hotkey of the item you wish to select followed by the <SPACE
  BAR>. Press <?> for additional information about this

                 (X) Default Profile
                 ( ) LinkIt7688
                 ( ) Widora

            <Select>      < Help >
```


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

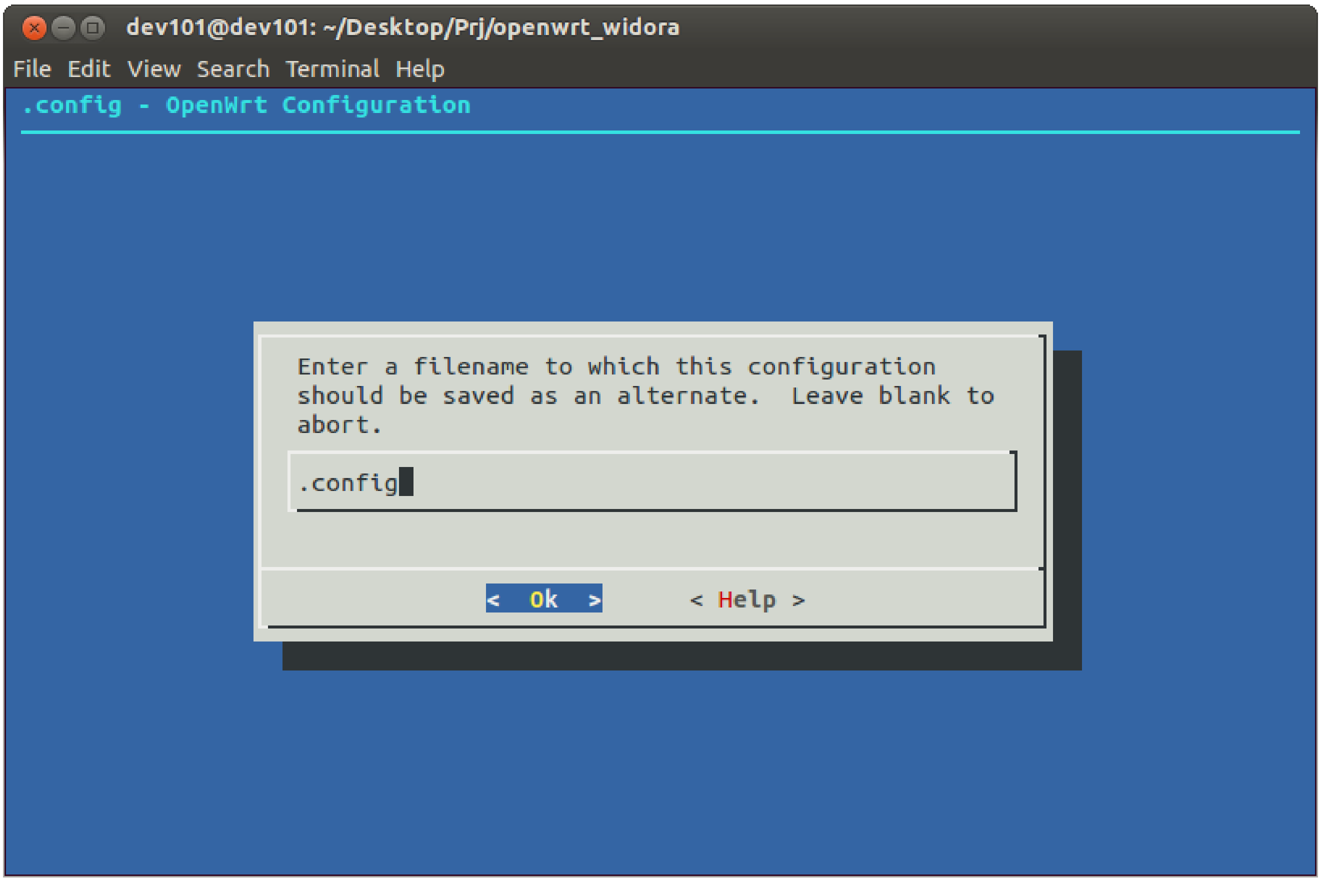
```
.config - OpenWrt Configuration

                     OpenWrt Configuration
  Arrow keys navigate the menu.  <Enter> selects submenus ---> (or empty submenus
  ----).  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for
  Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable

          Target System (Ralink RT288x/RT3xxx)  --->
          Subtarget (MT7688 based boards)  --->
          Target Profile (Widora)  --->
          Target Images  --->
          Global build settings  --->
      [*] Advanced configuration options (for developers)  --->
      [ ] Build the OpenWrt Image Builder (NEW)
      [*] Build the OpenWrt SDK
      [*] Package the OpenWrt-based Toolchain
      [ ] Image configuration (NEW)  --->
          Base system  --->
          Administration  --->
          Boot Loaders  ----
      └(+)

      <Select>    < Exit >    < Help >    < Save >    < Load >
```


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

```
.config - OpenWrt Configuration
> Advanced configuration options (for developers) ──────────────────
        Advanced configuration options (for developers)
  Arrow keys navigate the menu.  <Enter> selects submenus ---> (or empty submenus
  ----).  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for
  Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable
       ^(-)
       ()     Local mirror for source packages (NEW)
       [*]    Automatic rebuild of packages (NEW)
       ()     Build suffix to append to the target BUILD_DIR variable (NEW)
       ()     Override the default TARGET_ROOTFS_DIR variable (NEW)
       [ ]    Use ccache (NEW)
       ()     Use external kernel tree (NEW)
       ()     Enter git repository to clone (NEW)
       [ ]    Enable log files during build process (NEW)
       [ ]    Enable package source tree override (NEW)
       (-fno-caller-saves) Additional compiler options (NEW)
       [ ]    Target Options (NEW)  ----
       [ ]    Use external toolchain (NEW)  ----
       [*]    Toolchain Options  --->

             <Select>    < Exit >    < Help >    < Save >    < Load >
```


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

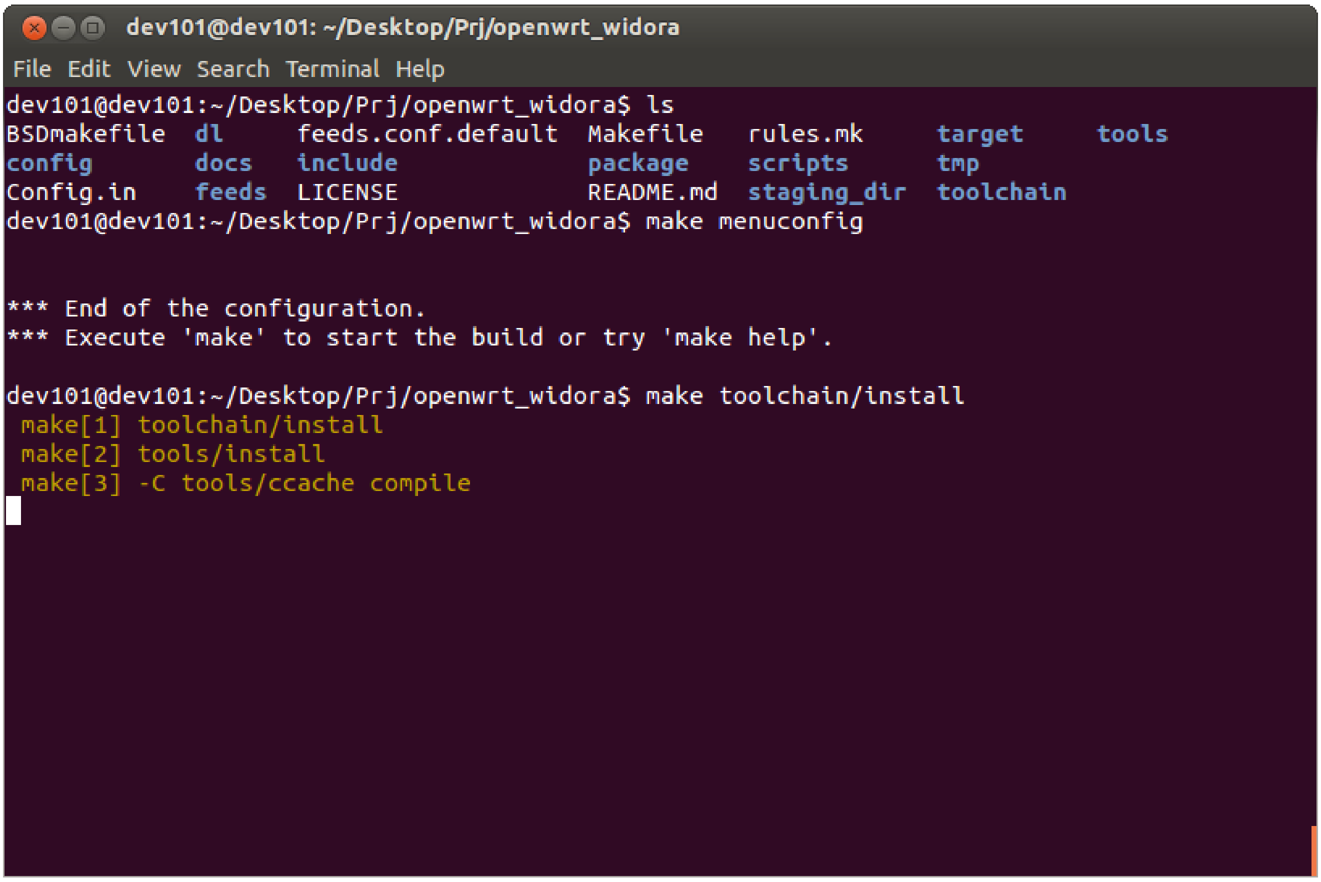
```
.config - OpenWrt Configuration
> Advanced configuration options (for developers) > Toolchain Options ──────
                        Toolchain Options
  Arrow keys navigate the menu.  <Enter> selects submenus ---> (or empty submenus
  ----).  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for
  Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable
       ^(-)
       [ ]    Compile in support for the new Graphite framework in GCC 4.4+ (NEW)
       ()     Additional gcc configure options (NEW)
       [ ]    Enable Stack-Smashing Protection support (NEW)
       [ ]    Use setjump()/longjump() exceptions (NEW)
       [ ]    Build/install java compiler and GNU classpath ? (NEW)
       [ ]    Build/install fortran compiler? (NEW)
              *** C Library ***
              C Library implementation (Use uClibc)  --->
              uClibc Version (uClibc 0.9.33.2)  --->
       [ ]    Build with debug information (NEW)
              *** Debuggers ***
       [*]    Build gdb (NEW)
       [ ]    Build insight-gdb (NEW)

             <Select>    < Exit >    < Help >    < Save >    < Load >
```



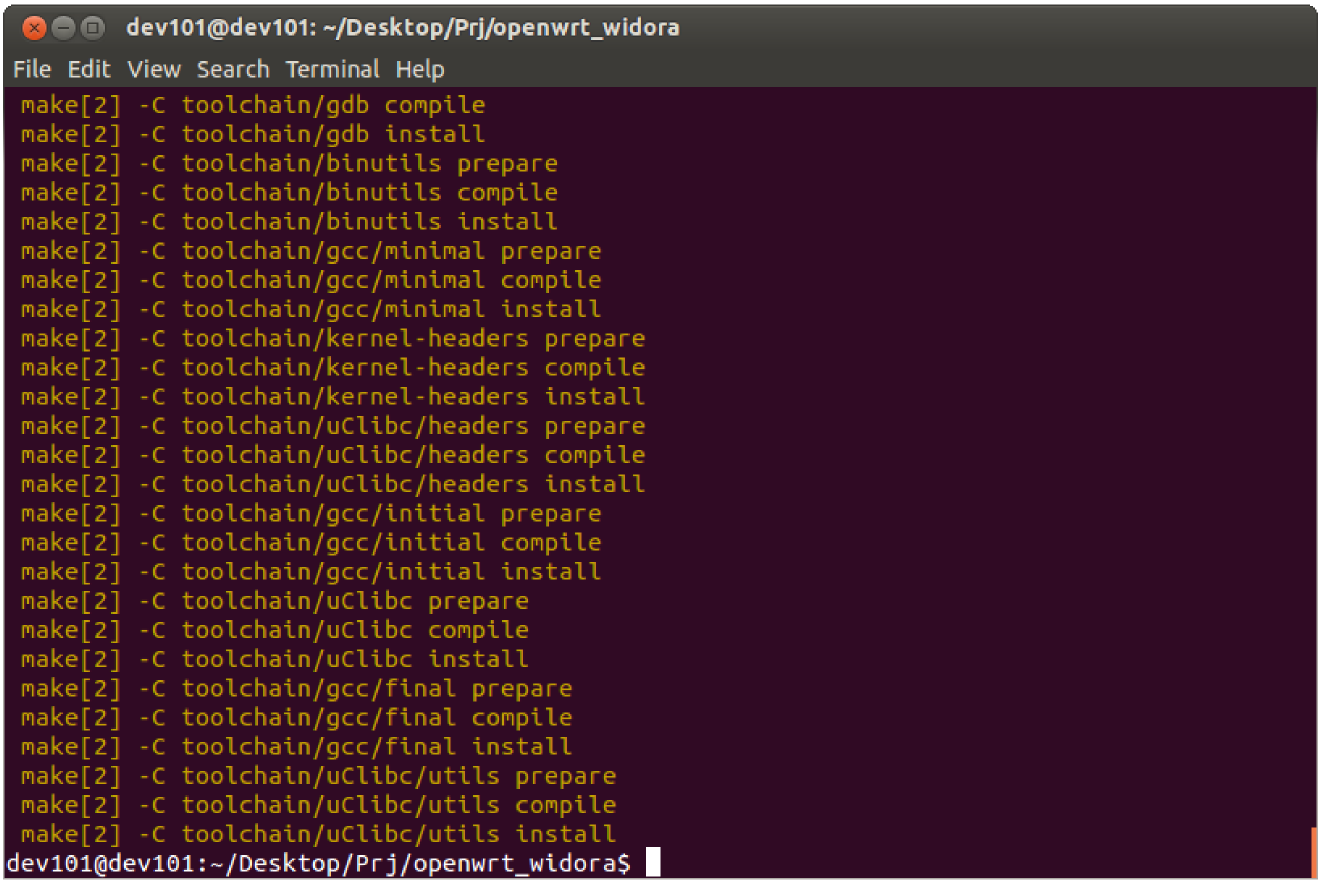
dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help
.config - OpenWrt Configuration

```
Enter a filename to which this configuration
should be saved as an alternate.  Leave blank to
abort.

.config
```

Execute “make toolchain/install” if it has not already been done. The purpose of this step is to prepare the cross compile toolchain and debugging gdb for us.


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

```
dev101@dev101:~/Desktop/Prj/openwrt_widora$ ls
BSDmakefile  dl     feeds.conf.default  Makefile   rules.mk     target     tools
config       docs   include             package    scripts      tmp
Config.in    feeds  LICENSE             README.md  staging_dir  toolchain
dev101@dev101:~/Desktop/Prj/openwrt_widora$ make menuconfig


*** End of the configuration.
*** Execute 'make' to start the build or try 'make help'.

dev101@dev101:~/Desktop/Prj/openwrt_widora$ make toolchain/install
 make[1] toolchain/install
 make[2] tools/install
 make[3] -C tools/ccache compile
```


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

```
 make[2] -C toolchain/gdb compile
 make[2] -C toolchain/gdb install
 make[2] -C toolchain/binutils prepare
 make[2] -C toolchain/binutils compile
 make[2] -C toolchain/binutils install
 make[2] -C toolchain/gcc/minimal prepare
 make[2] -C toolchain/gcc/minimal compile
 make[2] -C toolchain/gcc/minimal install
 make[2] -C toolchain/kernel-headers prepare
 make[2] -C toolchain/kernel-headers compile
 make[2] -C toolchain/kernel-headers install
 make[2] -C toolchain/uClibc/headers prepare
 make[2] -C toolchain/uClibc/headers compile
 make[2] -C toolchain/uClibc/headers install
 make[2] -C toolchain/gcc/initial prepare
 make[2] -C toolchain/gcc/initial compile
 make[2] -C toolchain/gcc/initial install
 make[2] -C toolchain/uClibc prepare
 make[2] -C toolchain/uClibc compile
 make[2] -C toolchain/uClibc install
 make[2] -C toolchain/gcc/final prepare
 make[2] -C toolchain/gcc/final compile
 make[2] -C toolchain/gcc/final install
 make[2] -C toolchain/uClibc/utils prepare
 make[2] -C toolchain/uClibc/utils compile
 make[2] -C toolchain/uClibc/utils install
dev101@dev101:~/Desktop/Prj/openwrt_widora$
```

4.1.3 Eclipse Prerequisites

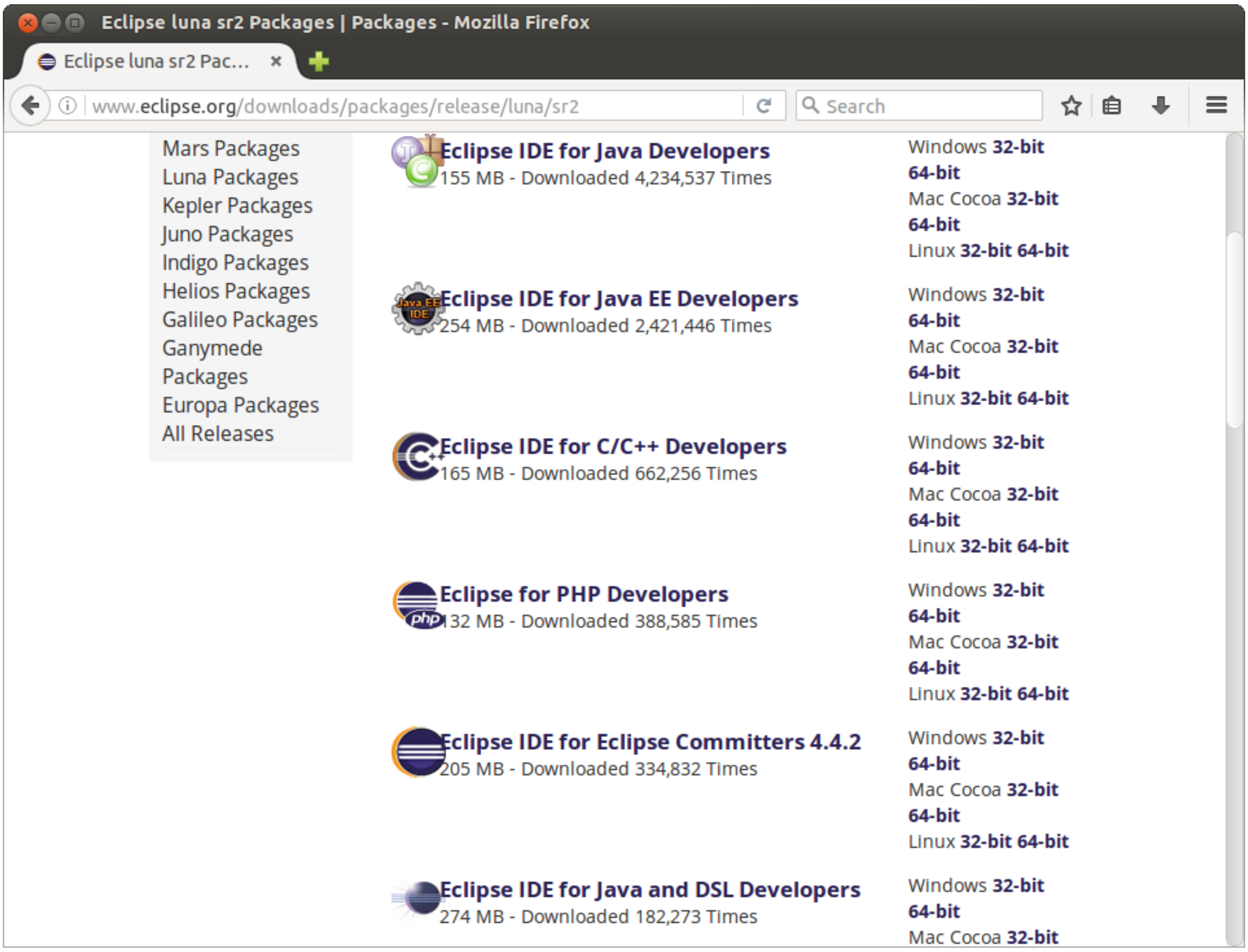
Download your desired Eclipse IDE for C/C++ Developers.

For this guide, we are going to use Eclipse IDE for C/C++ Developers Eclipse Luna SR2 (4.4.2) Linux.

http://www.eclipse.org/downloads/packages/release/luna/sr2

Choose your preferred version and select platform type depends on you development OS type (32 Bit / 64 Bit).

Extract archive; place it to your preferred location/directory. Execute eclipse, select your preferred workspace location if being asked and enter workbench. **Note that you need Java Runtime to be able to run Eclipse.**


Eclipse luna sr2 Packages | Packages - Mozilla Firefox
Eclipse luna sr2 Pac...
www.eclipse.org/downloads/packages/release/luna/sr2
Search

Mars Packages
Luna Packages
Kepler Packages
Juno Packages
Indigo Packages
Helios Packages
Galileo Packages
Ganymede Packages
Europa Packages
All Releases

Eclipse IDE for Java Developers
155 MB - Downloaded 4,234,537 Times
Windows **32-bit** **64-bit**
Mac Cocoa **32-bit** **64-bit**
Linux **32-bit** **64-bit**

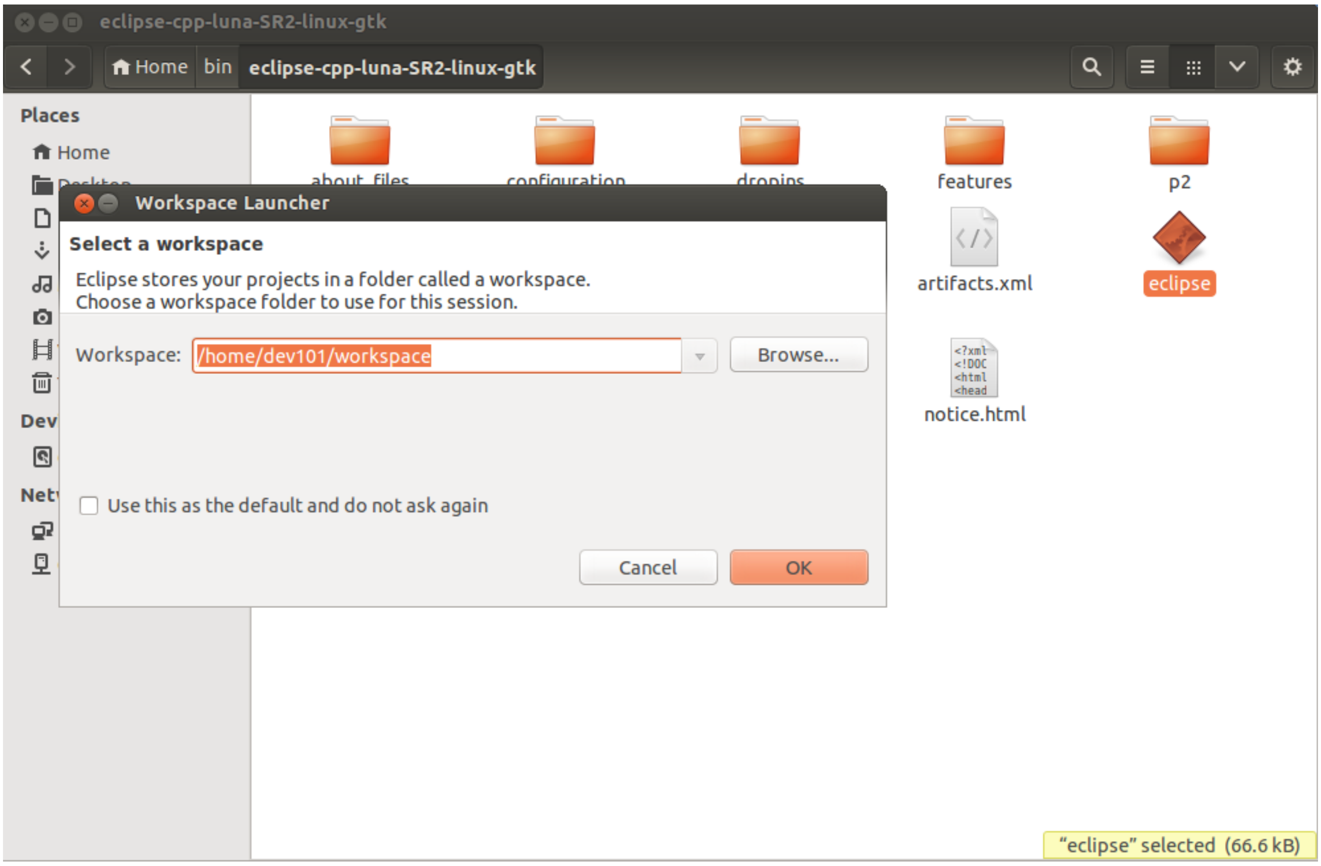
Eclipse IDE for Java EE Developers
254 MB - Downloaded 2,421,446 Times
Windows **32-bit** **64-bit**
Mac Cocoa **32-bit** **64-bit**
Linux **32-bit** **64-bit**

Eclipse IDE for C/C++ Developers
165 MB - Downloaded 662,256 Times
Windows **32-bit** **64-bit**
Mac Cocoa **32-bit** **64-bit**
Linux **32-bit** **64-bit**

Eclipse for PHP Developers
132 MB - Downloaded 388,585 Times
Windows **32-bit** **64-bit**
Mac Cocoa **32-bit** **64-bit**
Linux **32-bit** **64-bit**

Eclipse IDE for Eclipse Committers 4.4.2
205 MB - Downloaded 334,832 Times
Windows **32-bit** **64-bit**
Mac Cocoa **32-bit** **64-bit**
Linux **32-bit** **64-bit**

Eclipse IDE for Java and DSL Developers
274 MB - Downloaded 182,273 Times
Windows **32-bit** **64-bit**
Mac Cocoa **32-bit**



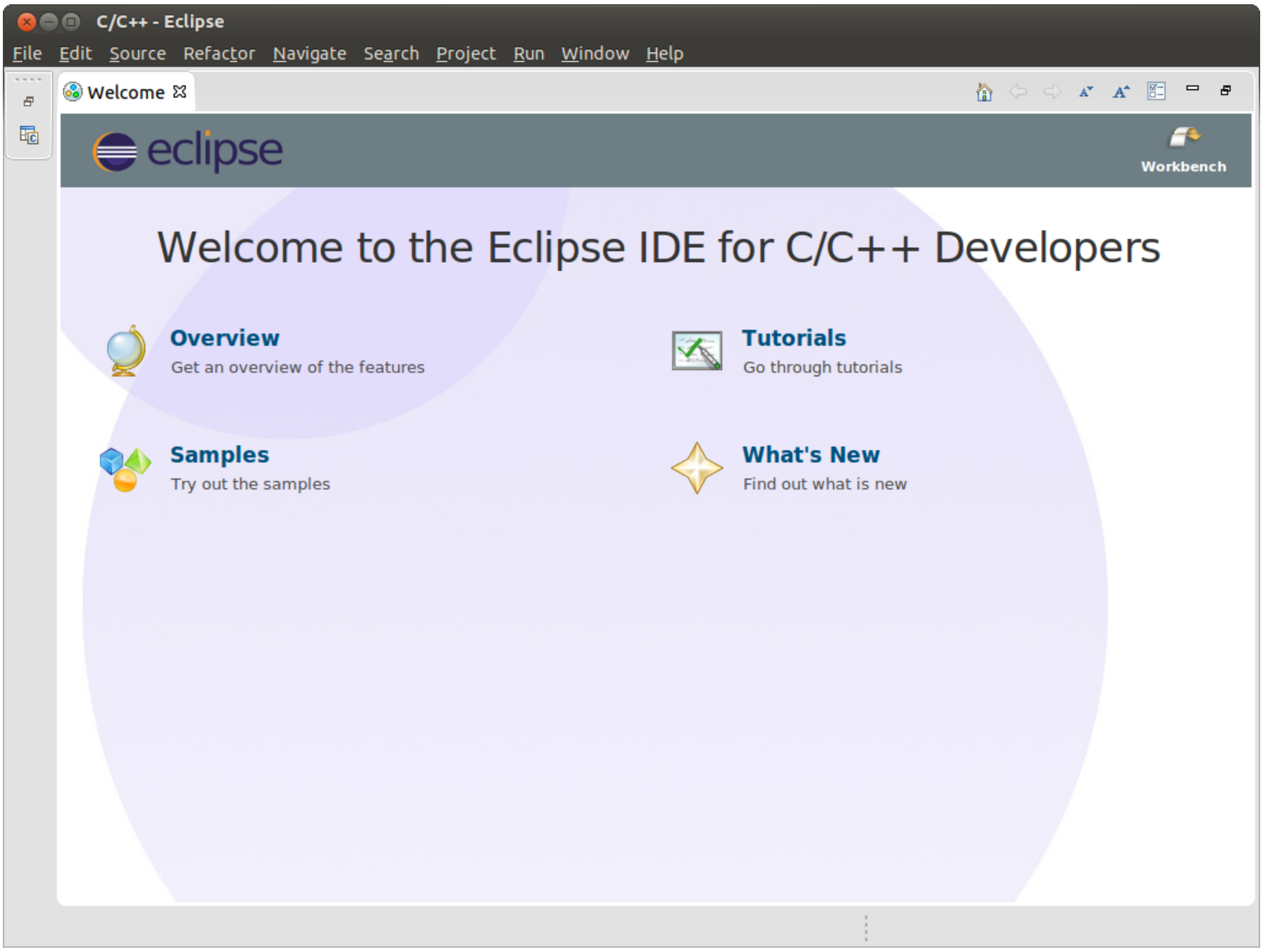
Select a workspace

Eclipse stores your projects in a folder called a workspace.
Choose a workspace folder to use for this session.

Workspace: /home/dev101/workspace

□ Use this as the default and do not ask again

“eclipse” selected (66.6 kB)



C/C++ - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Welcome
eclipse
Workbench

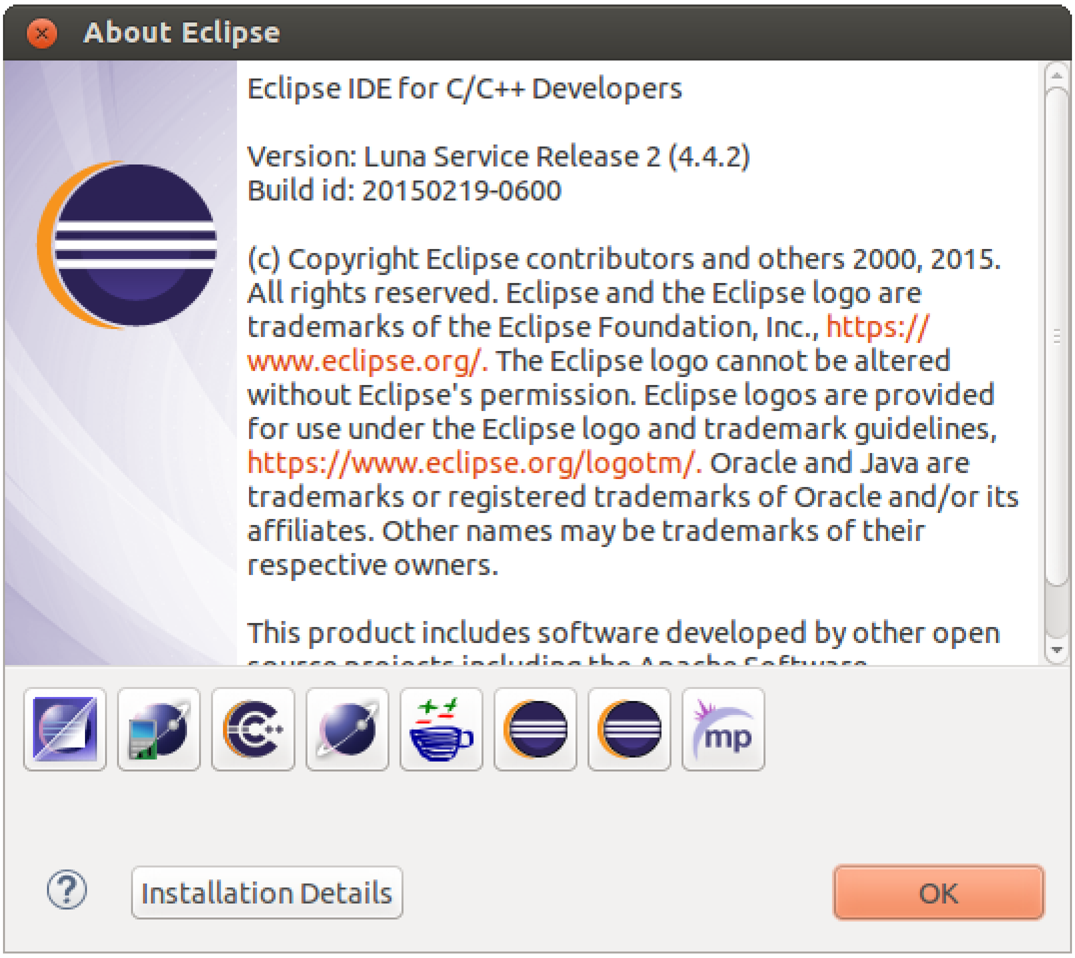
Welcome to the Eclipse IDE for C/C++ Developers

Overview
Get an overview of the features

Tutorials
Go through tutorials

Samples
Try out the samples

What's New
Find out what is new



Eclipse IDE for C/C++ Developers

Version: Luna Service Release 2 (4.4.2)
Build id: 20150219-0600

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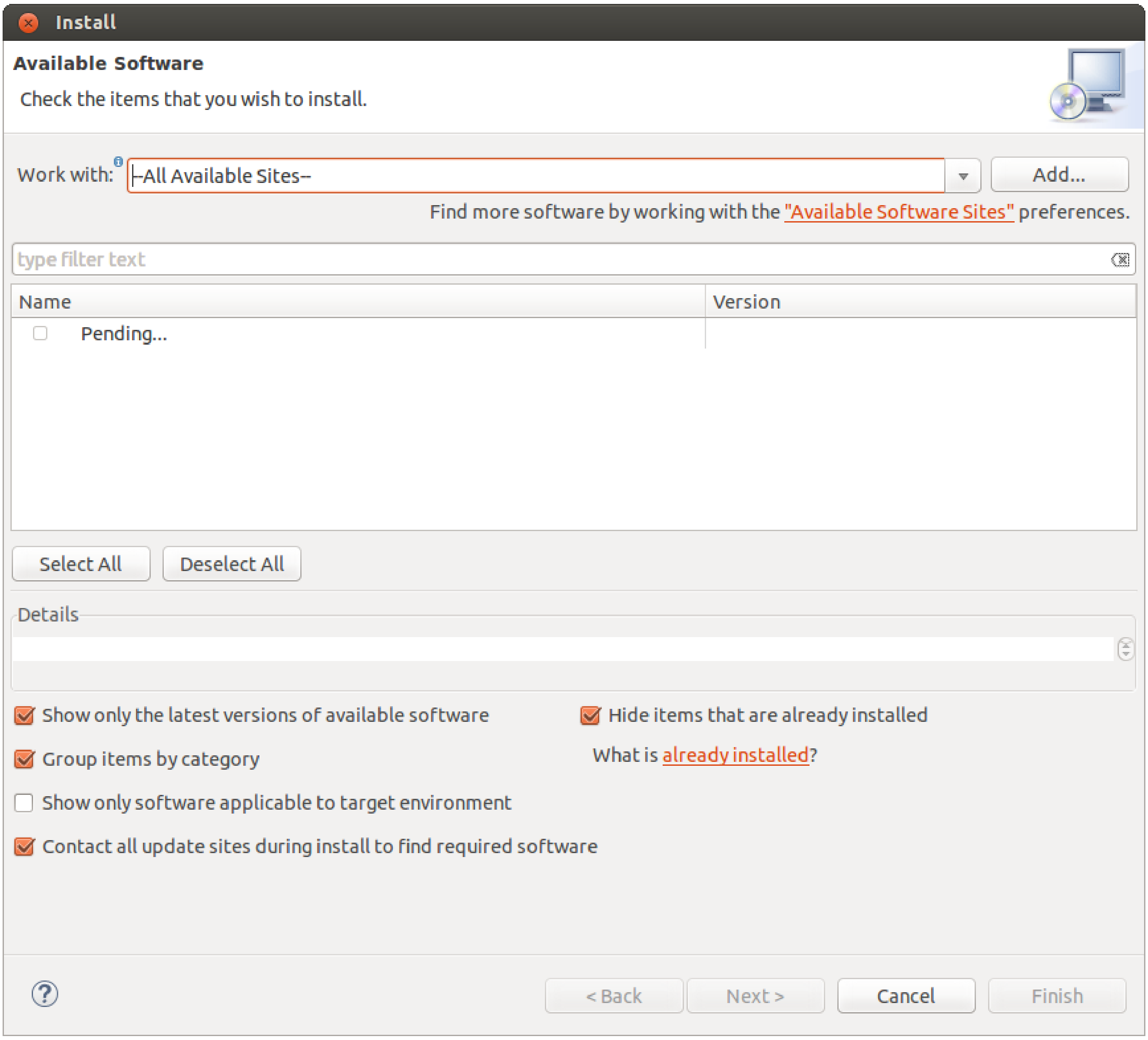
This product includes software developed by other open

We have to install additional eclipse packages: `Help → Install new Software → All Available Sites`. And select in section **“Mobile and Device Development”** packages **“C/C++ GCC Cross Compiler Support”** and **“Remote System Explorer End-User Runtime”**.

If you are using Eclipse IDE for C/C++ Developers, most likely these two packages have already been installed. If you cannot find above two packages or want to check their status, uncheck **“Hide items that are already installed”**.



Available Software

Check the items that you wish to install.

Work with: --All Available Sites--

Find more software by working with the "Available Software Sites" preferences.

type filter text

Name	Version
□ Pending...	

Details

☑ Show only the latest versions of available software

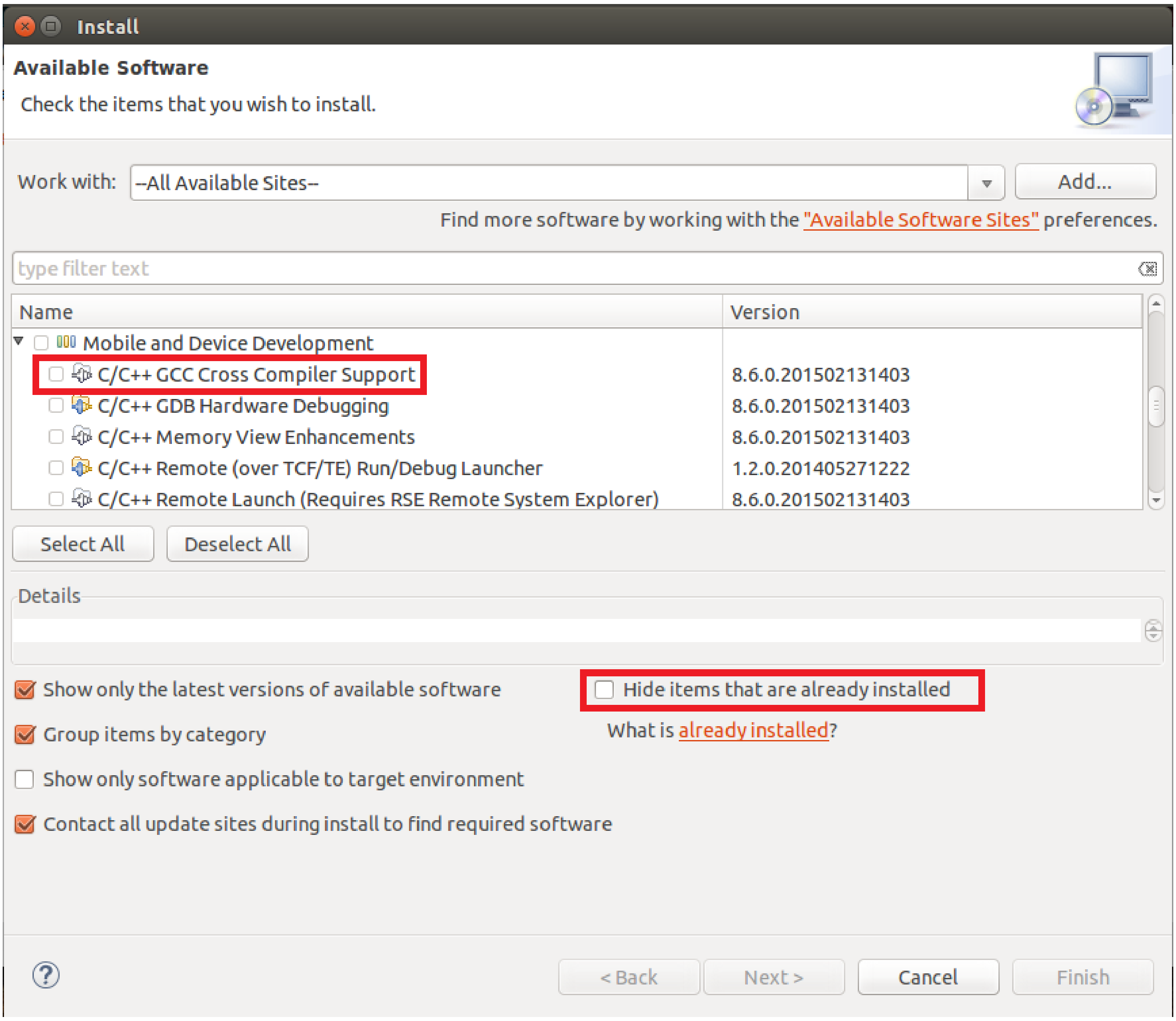
☑ Hide items that are already installed

What is already installed?

☑ Group items by category

□ Show only software applicable to target environment

☑ Contact all update sites during install to find required software



Install

Available Software

Check the items that you wish to install.

Work with: --All Available Sites--

Find more software by working with the "Available Software Sites" preferences.

type filter text

Name	Version
▾ □ Mobile and Device Development	
□ C/C++ GCC Cross Compiler Support	8.6.0.201502131403
□ C/C++ GDB Hardware Debugging	8.6.0.201502131403
□ C/C++ Memory View Enhancements	8.6.0.201502131403
□ C/C++ Remote (over TCF/TE) Run/Debug Launcher	1.2.0.201405271222
□ C/C++ Remote Launch (Requires RSE Remote System Explorer)	8.6.0.201502131403

Details

☑ Show only the latest versions of available software

☑ Group items by category

□ Show only software applicable to target environment

☑ Contact all update sites during install to find required software

□ Hide items that are already installed

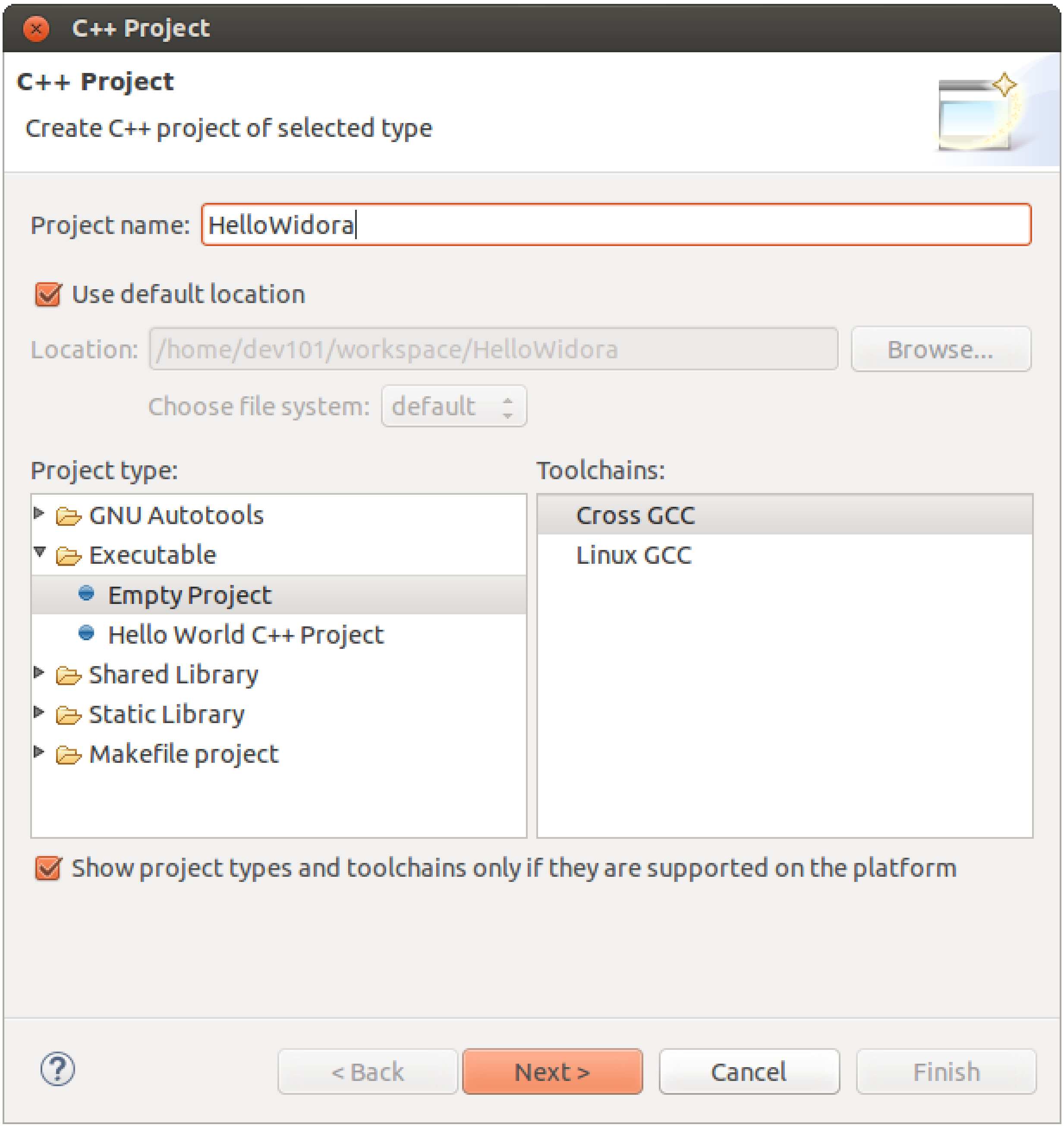
What is already installed?

5 Project Setup

5.1 Eclipse Cross Compiler Project Setup

5.1.1 Setup eclipse

Create a new project: `File → New C++ Project (resp. C project)`:



C++ Project

Create C++ project of selected type

Project name: HelloWidora

☑ Use default location

Location: /home/dev101/workspace/HelloWidora

Choose file system: default

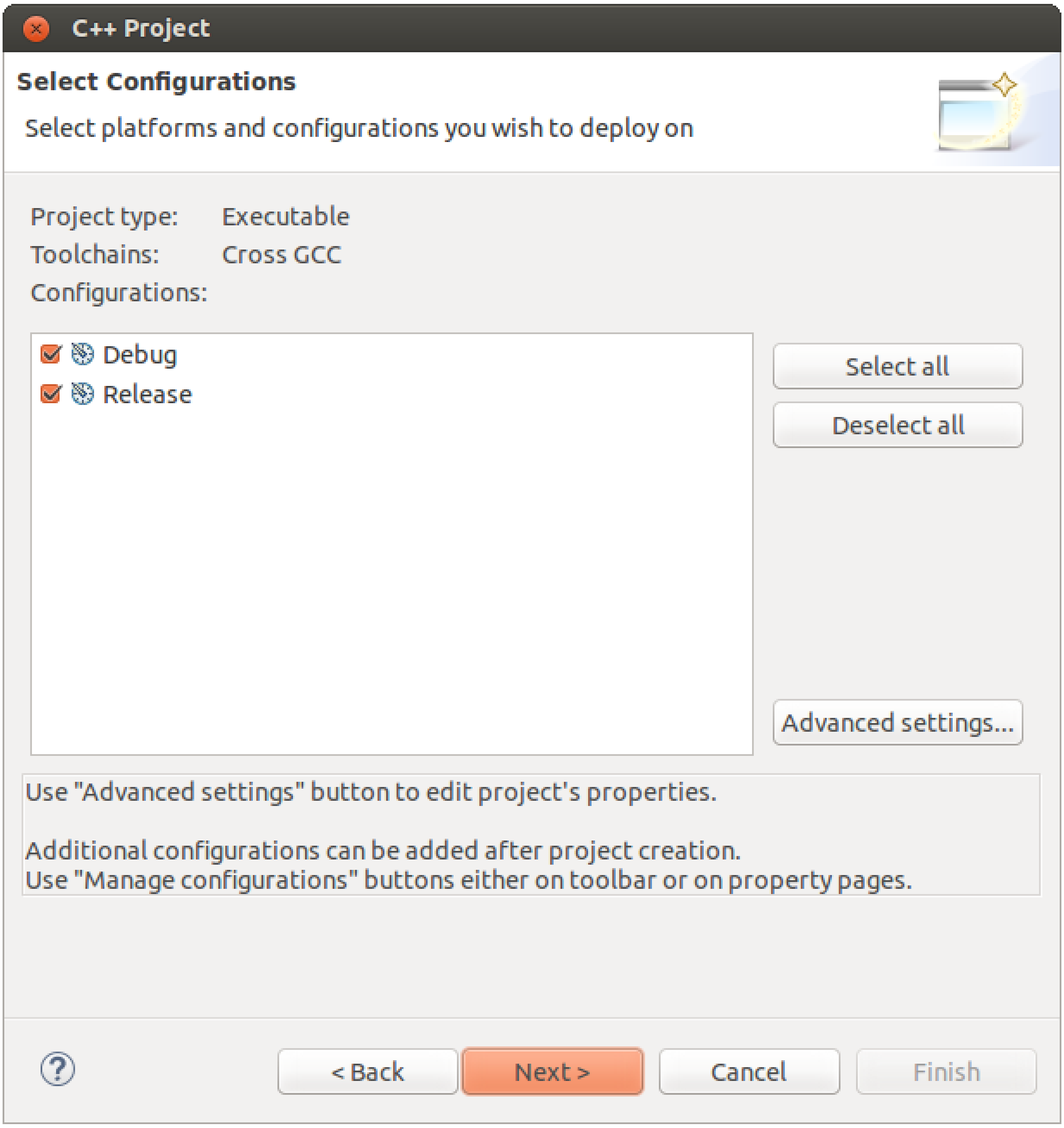
Project type:

- GNU Autotools
- Executable
  - Empty Project
  - Hello World C++ Project
- Shared Library
- Static Library
- Makefile project

Toolchains:

- Cross GCC
- Linux GCC

☑ Show project types and toolchains only if they are supported on the platform



C++ Project

Select Configurations

Select platforms and configurations you wish to deploy on

Project type: Executable

Toolchains: Cross GCC

Configurations:

☑ Debug

☑ Release

Use "Advanced settings" button to edit project's properties.

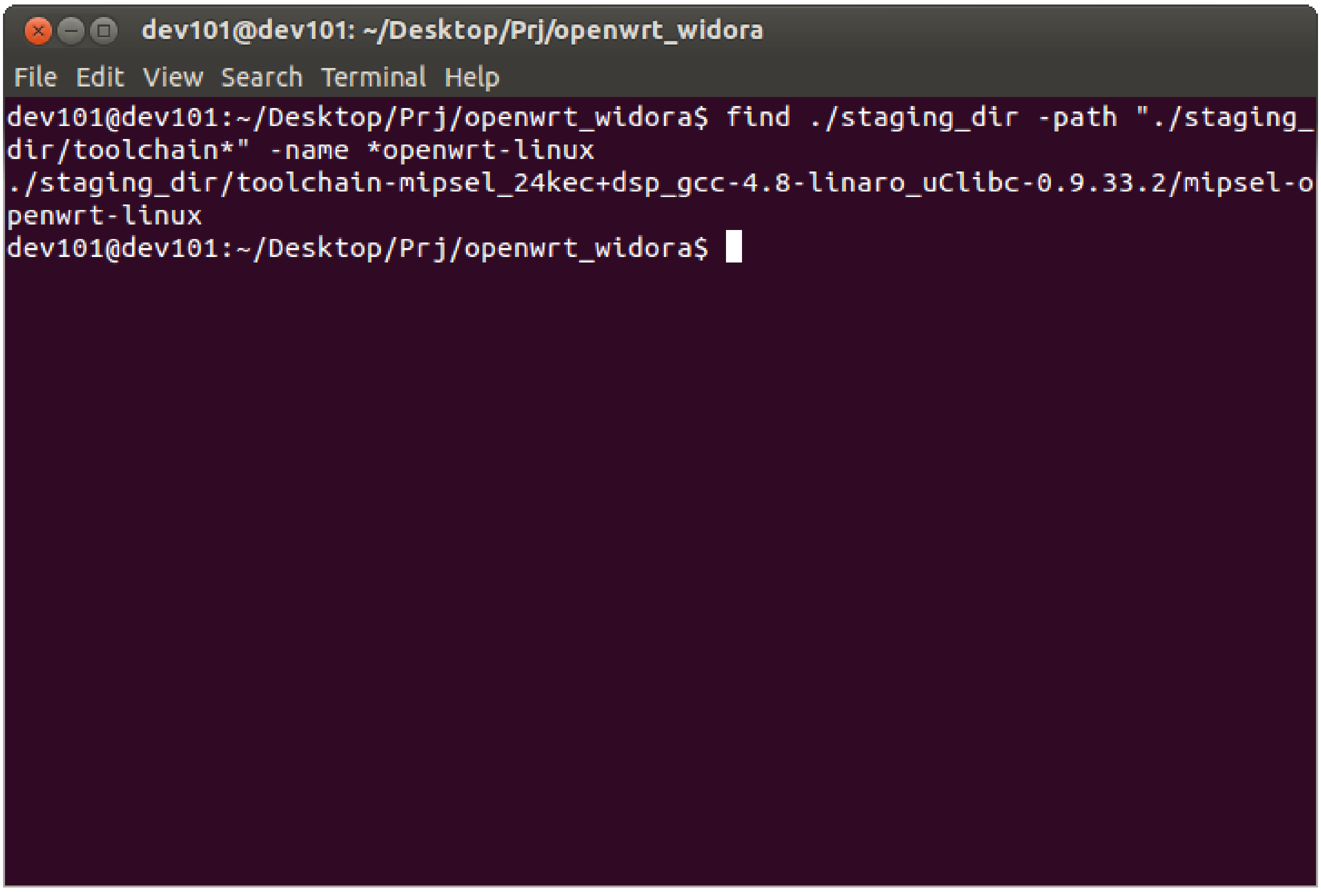
Additional configurations can be added after project creation.
Use "Manage configurations" buttons either on toolbar or on property pages.

The next settings depend on your target device and where your buildroot has been installed.

You have to evaluate your specific target settings.

You need to specify your Cross GCC path and prefix.

For this guide, we
Navigate to openwrt source code trunk/root directory, and then execute `find ./staging_dir -path "./staging_dir/toolchain*" -name *openwrt-linux`


dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

```
dev101@dev101:~/Desktop/Prj/openwrt_widora$ find ./staging_dir -path "./staging_dir/toolchain*" -name *openwrt-linux
./staging_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/mipsel-openwrt-linux
dev101@dev101:~/Desktop/Prj/openwrt_widora$ 
```

The system being used for this guide returned result of:

```
./staging_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/mipsel-openwrt-linux
```

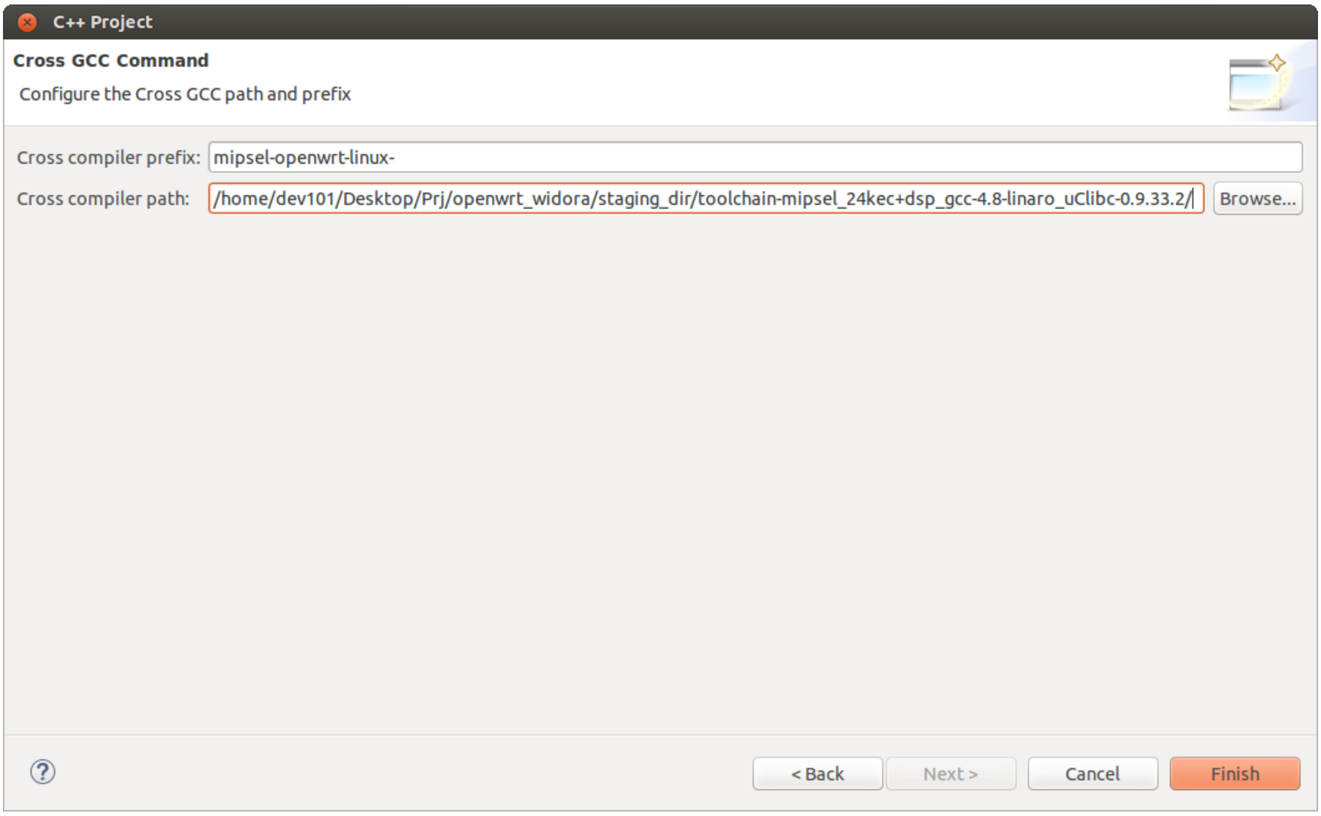
Hence for “Cross compiler prefix” we enter `mipsel-openwrt-linux-`.

We can reuse the above finding results to get the required **absolute** full path of “Cross compiler path”:

```
[YOUR_OPENWRT_TRUNK]/staging_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/
```

Don't forget to adapt these settings to YOUR specific build environment, COPY + PASTE from here may not work!

Finally enter your specific setting and press Finish button.



Cross GCC Command

Configure the Cross GCC path and prefix

Cross compiler prefix: mipsel-openwrt-linux-

Cross compiler path: /home/dev101/Desktop/Prj/openwrt_widora/staging_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/

5.1.2 Eclipse Project Settings

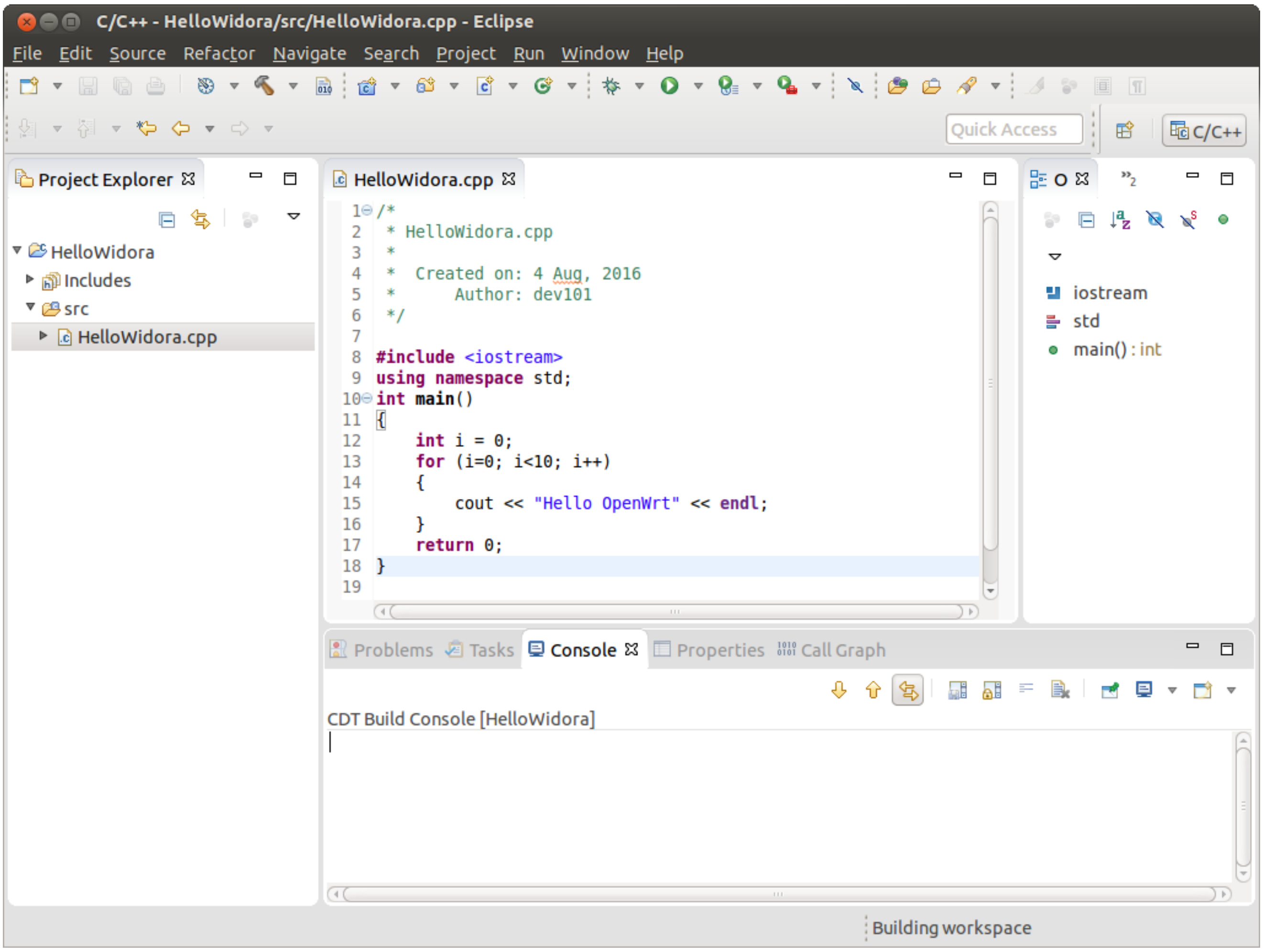
For this guide, one simple Hello World program is going to be created to show how to setup remote target device source level debugging and remote access via eclipse.

Add src folder and source file.

```
File → New Source Folder (src)
```

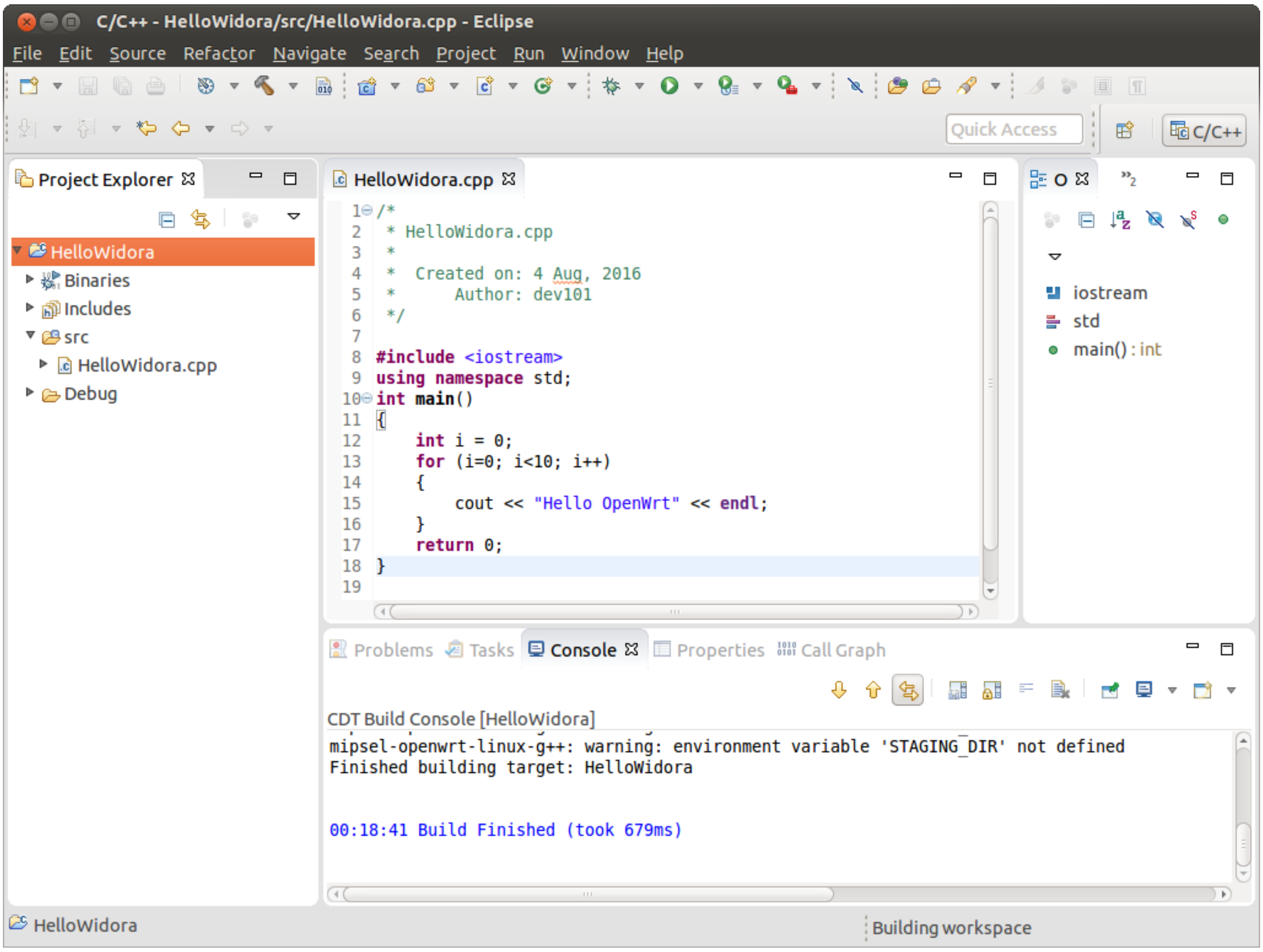
```
File → New Source File (src/HelloWidora.cpp)
```

```
#include <iostream>
using namespace std;
int main()
{
        int i = 0;
        for (i=0; i<10; i++)
        {
                cout << "Hello OpenWrt" << endl;
        }
        return 0;
}
```



```
/*
 * HelloWidora.cpp
 *
 *  Created on: 4 Aug, 2016
 *      Author: dev101
 */

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

If all was configured correctly you should be able to call `Project-Build all` without errors.
But you can't execute the created bin file on your build system; remember your binary is cross compiled.



```
/*
 * HelloWidora.cpp
 *
 *  Created on: 4 Aug, 2016
 *      Author: dev101
 */

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

CDT Build Console [HelloWidora]

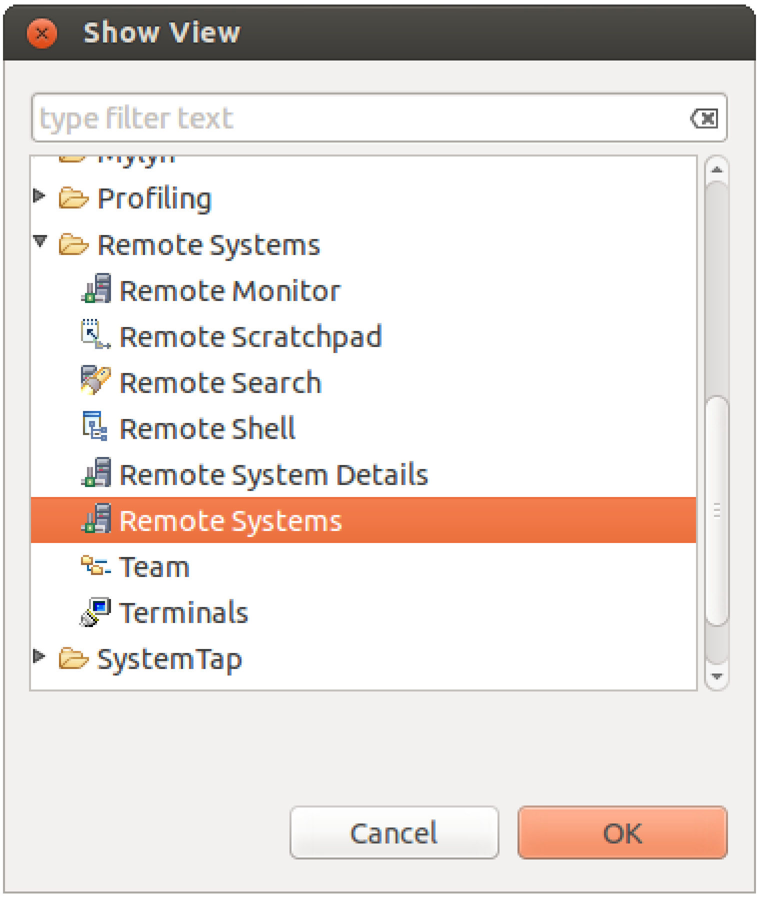
```
mipsel-openwrt-linux-g++: warning: environment variable 'STAGING_DIR' not defined
Finished building target: HelloWidora


00:18:41 Build Finished (took 679ms)
```

5.1.2.1 Remote Target Setup

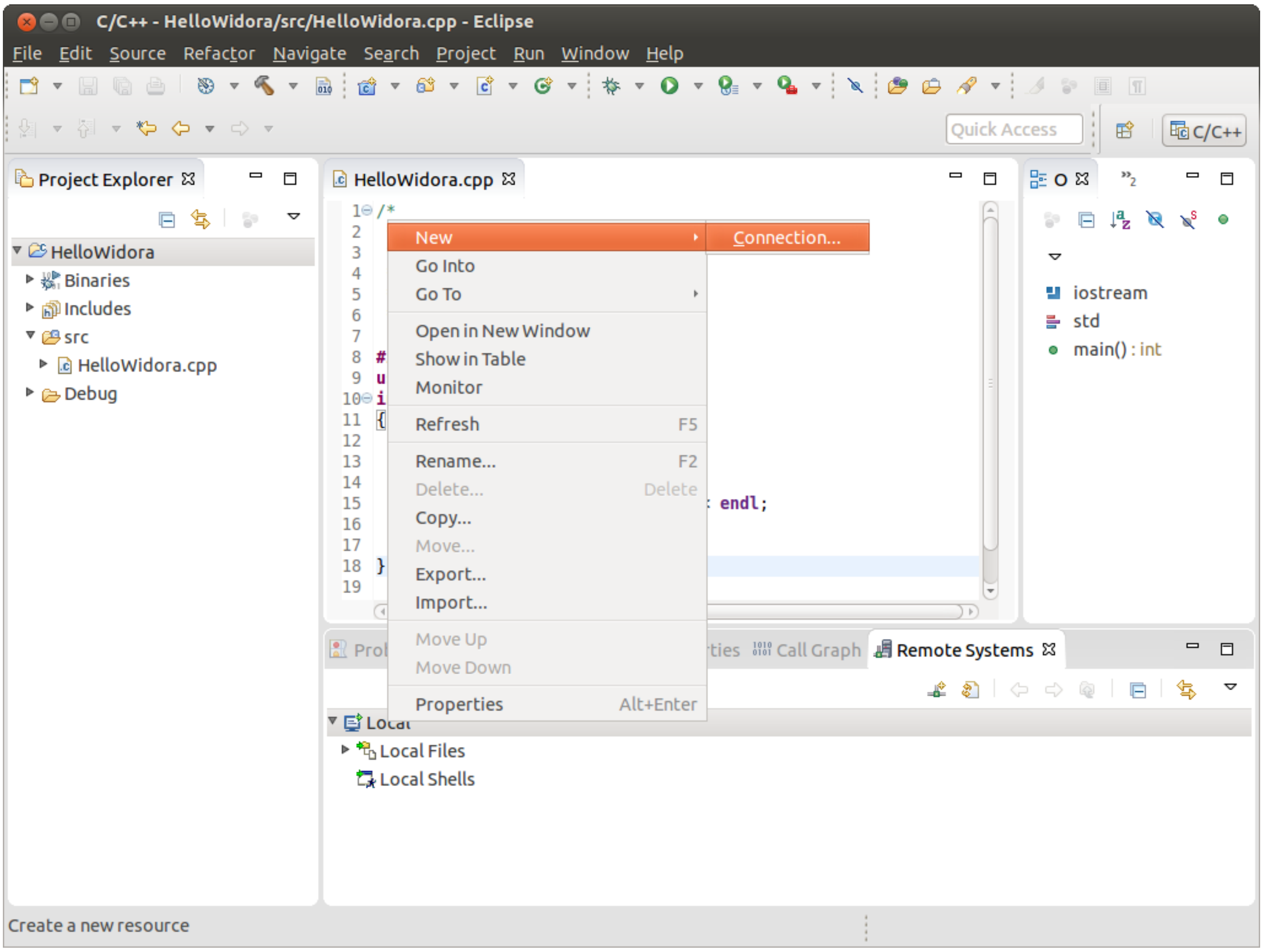
If you program was successfully compiled, you have to install it on your target device to execute it.

At this point Eclipse will help with nice features of remote access and remote debug, to setup remote target:

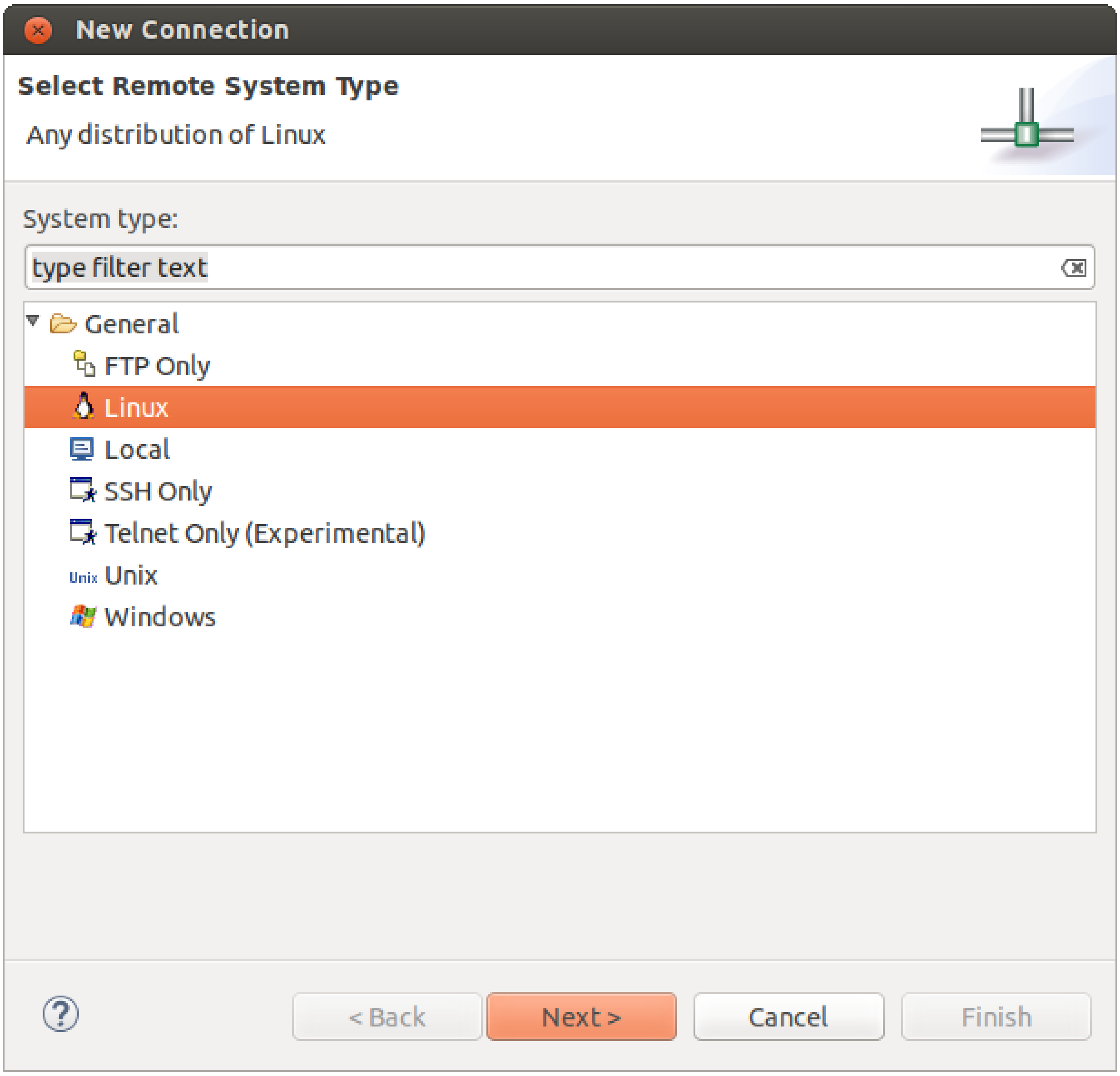
Go to `Window → Show View → Other… → Remote Systems`



And we create a new connection:



Select Linux and “Next >”:



New Connection

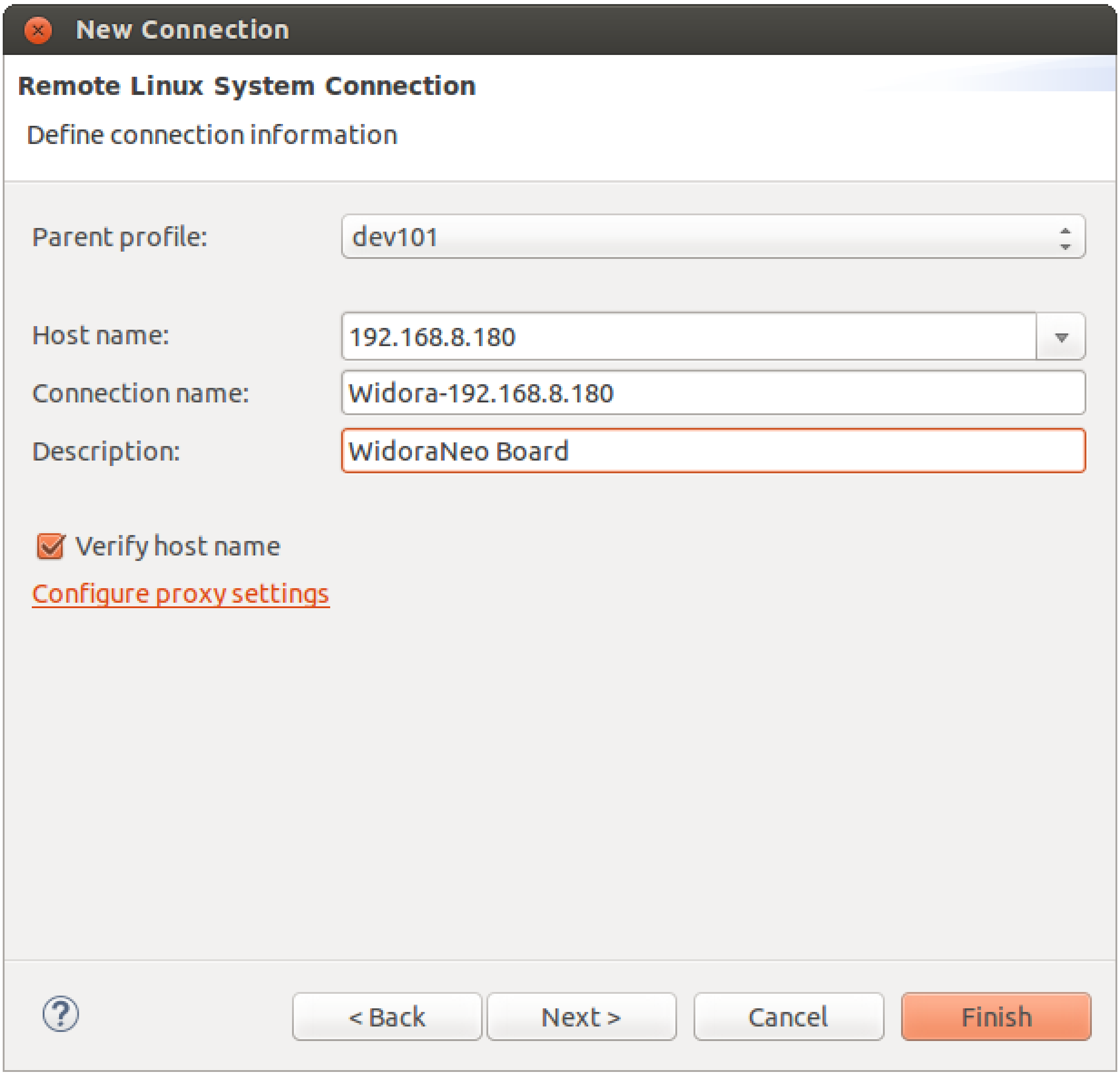
Select Remote System Type

Any distribution of Linux

System type:

type filter text

Now enter the target device's IP address resp. hostname and “Next >”.



Remote Linux System Connection

Define connection information

Parent profile: dev101

Host name: 192.168.8.180

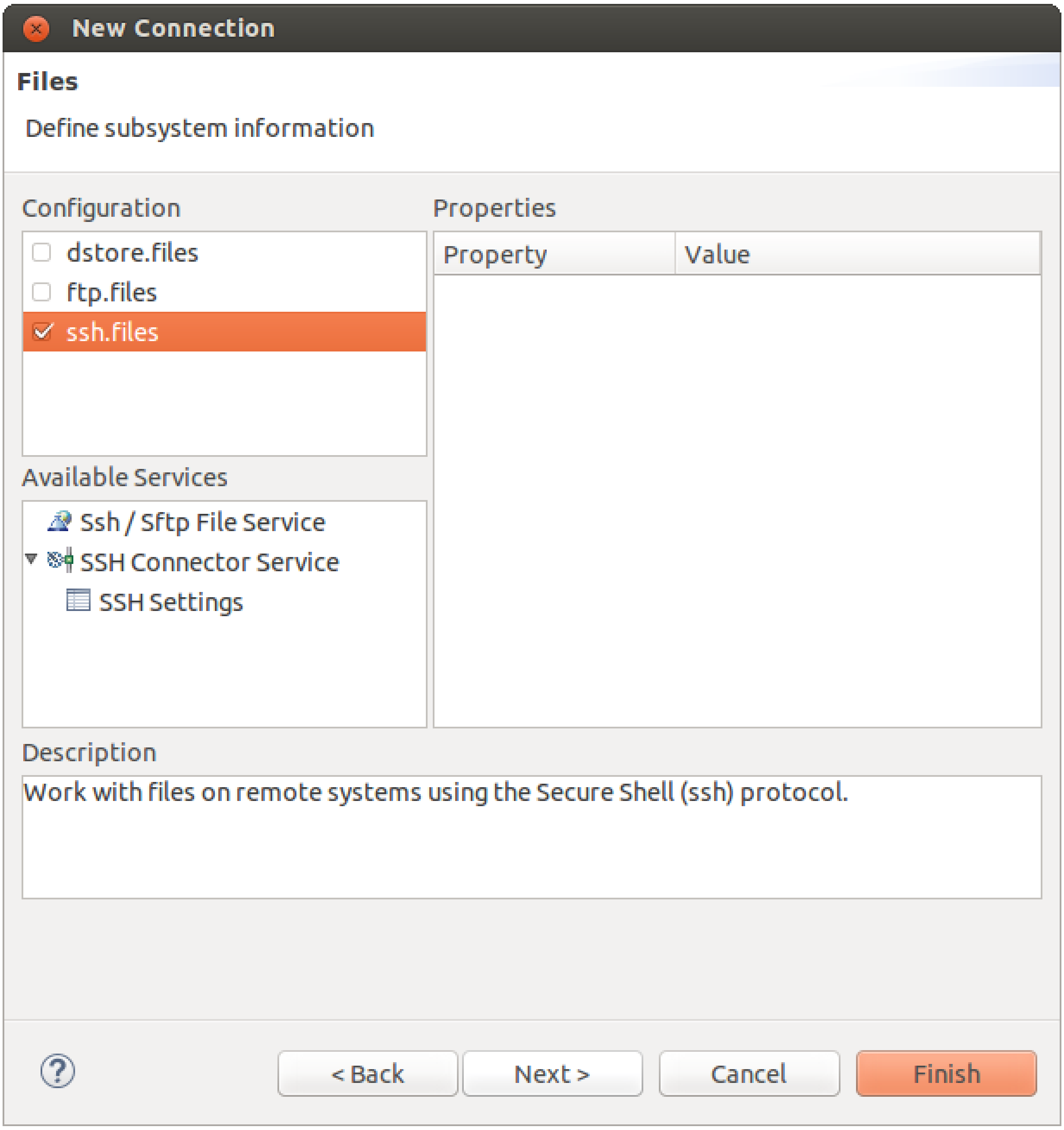
Connection name: Widora-192.168.8.180

Description: WidoraNeo Board

☑ Verify host name

Configure proxy settings

Select “ssh.files” and “Next >”.



Files

Define subsystem information

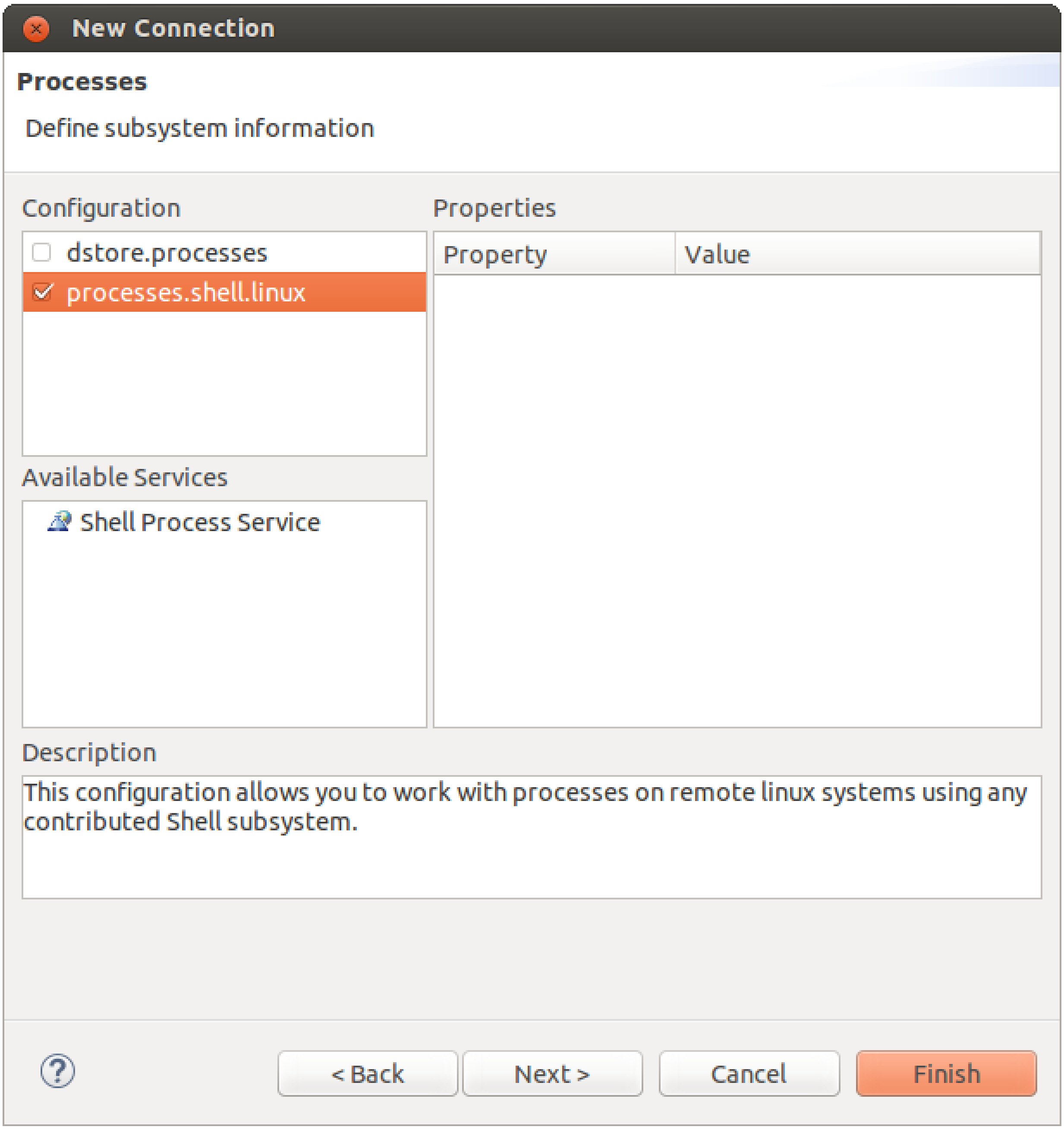
Configuration

- □ dstore.files
- □ ftp.files
- ☑ ssh.files

Description

Work with files on remote systems using the Secure Shell (ssh) protocol.

Select “processes.shell.linux” and “Next >”.



New Connection

Processes

Define subsystem information

Configuration

□ dstore.processes

☑ processes.shell.linux

Available Services

Shell Process Service

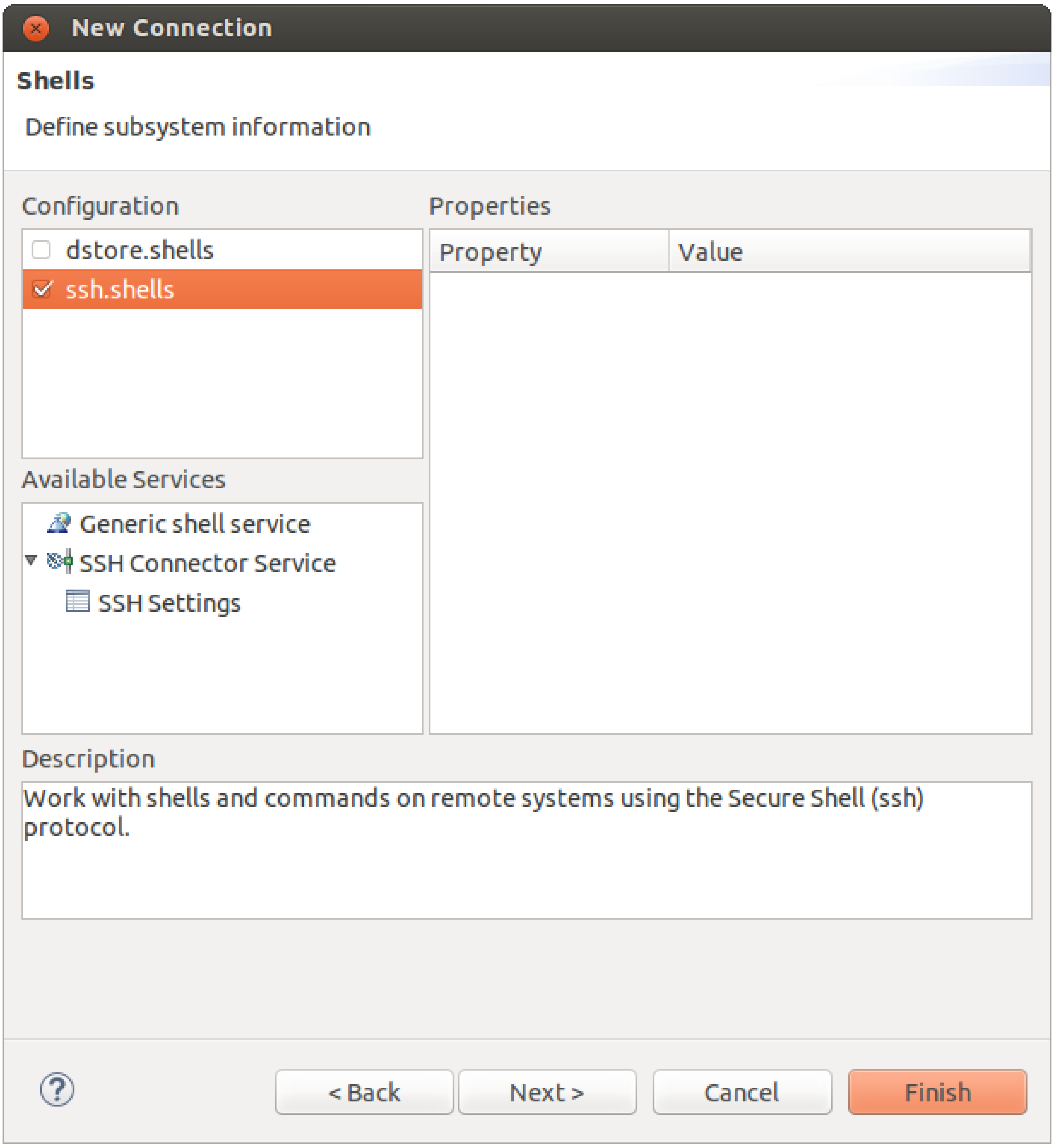
Properties

Property	Value

Description

This configuration allows you to work with processes on remote linux systems using any contributed Shell subsystem.

Select “ssh.shells” and “Next >”. And then “Finish”.



New Connection

Shells

Define subsystem information

Configuration

- □ dstore.shells
- ☑ ssh.shells

Properties

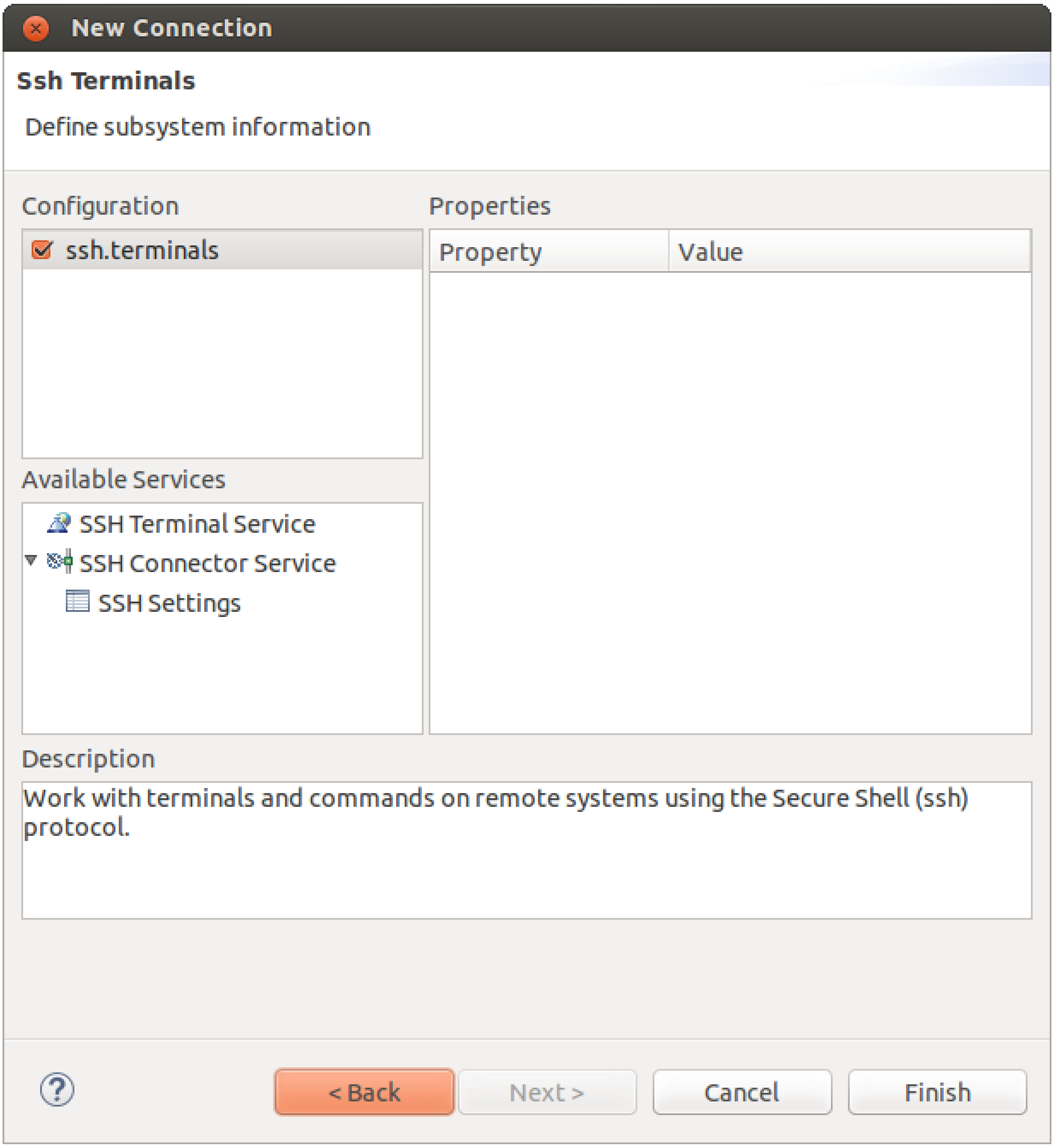
Property	Value

Available Services

- Generic shell service
- SSH Connector Service
  - SSH Settings

Description

Work with shells and commands on remote systems using the Secure Shell (ssh) protocol.



Ssh Terminals

Define subsystem information

Configuration

☑ ssh.terminals

Properties

Property	Value

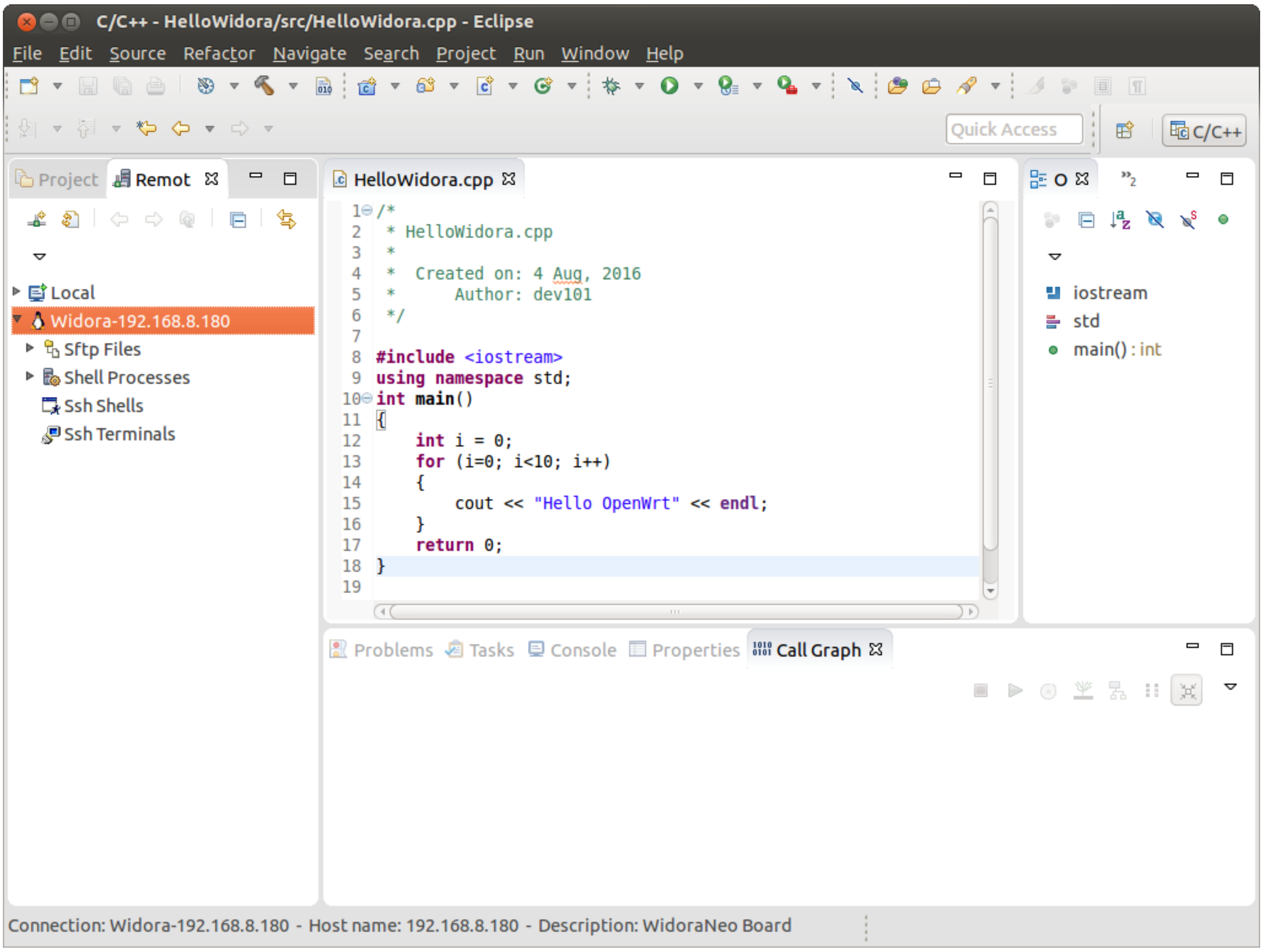
Available Services

- SSH Terminal Service
- SSH Connector Service
  - SSH Settings

Description

Work with terminals and commands on remote systems using the Secure Shell (ssh) protocol.

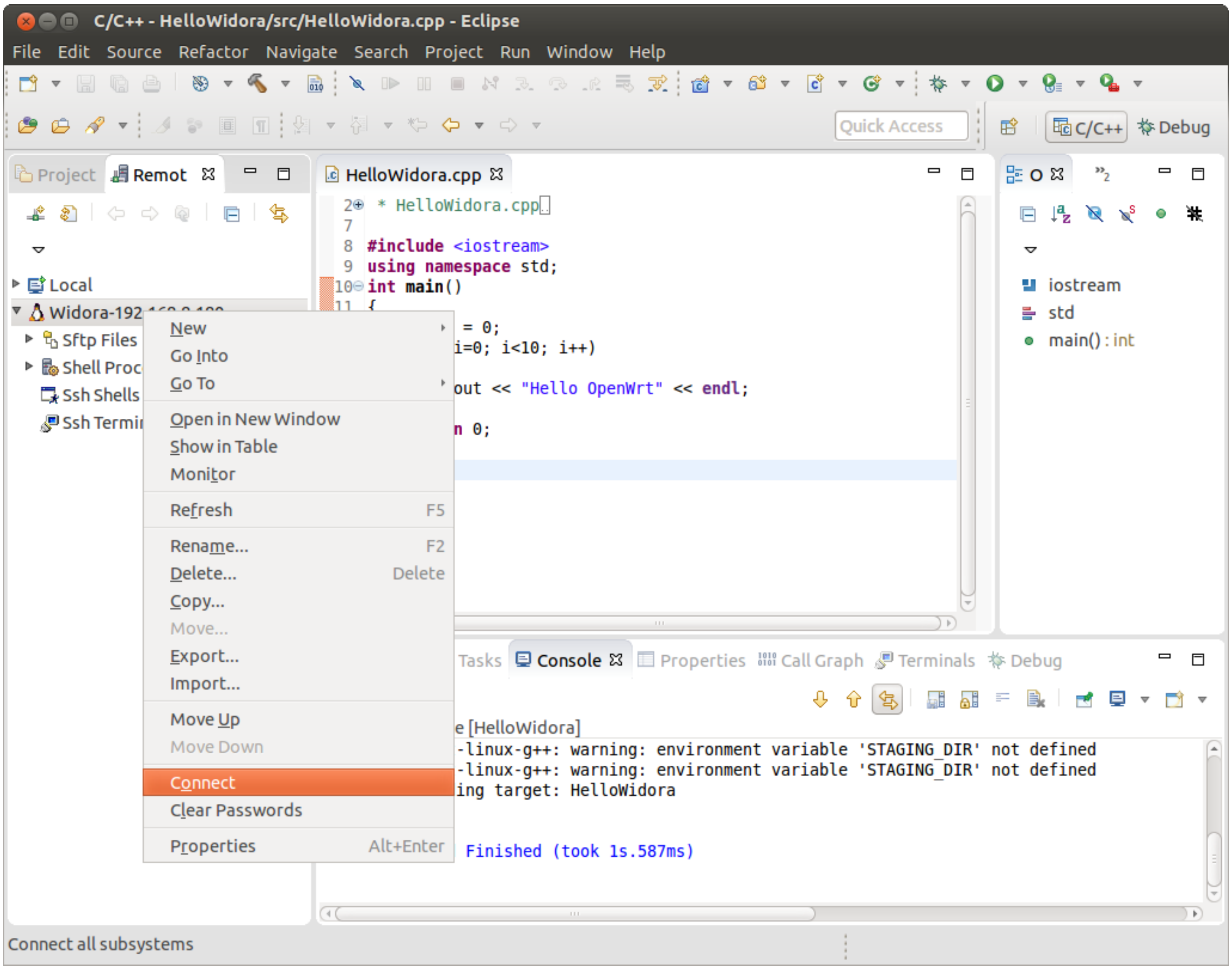
Your IDE will look similar to this:



```
/*
 * HelloWidora.cpp
 *
 *  Created on: 4 Aug, 2016
 *      Author: dev101
 */

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

Connection: Widora-192.168.8.180 - Host name: 192.168.8.180 - Description: WidoraNeo Board

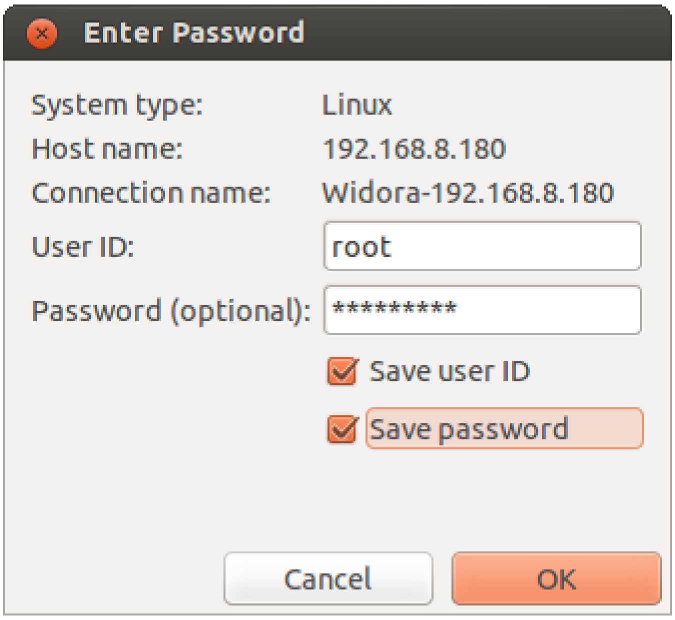
5.1.2.2 Browse Your Target Device



```
 * HelloWidora.cpp

#include <iostream>
using namespace std;
int main()
{
 = 0;
i=0; i<10; i++)

out << "Hello OpenWrt" << endl;

n 0;
```

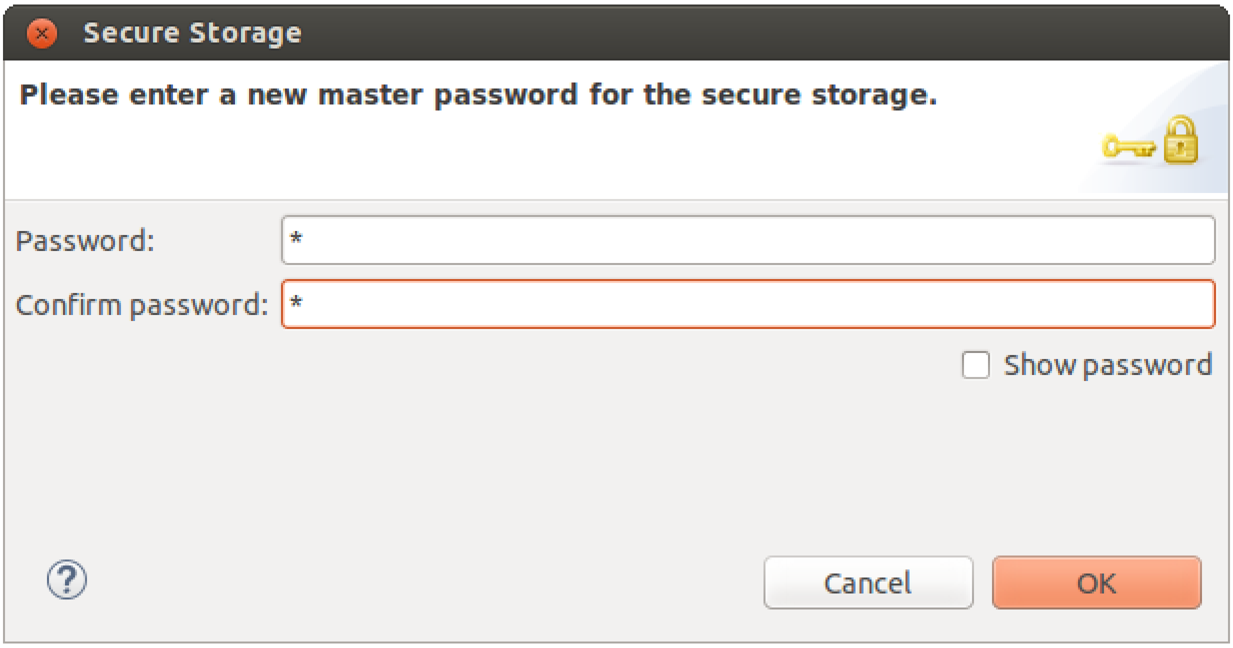
```
e [HelloWidora]
-linux-g++: warning: environment variable 'STAGING_DIR' not defined
-linux-g++: warning: environment variable 'STAGING_DIR' not defined
ing target: HelloWidora

 Finished (took 1s.587ms)
```

Enter user name + password for the target device:



System type: Linux
Host name: 192.168.8.180
Connection name: Widora-192.168.8.180
User ID: root
Password (optional): *********
☑ Save user ID
☑ Save password

For the first time, Eclipse may ask for Secure Storage master password, set your own master password and continue:



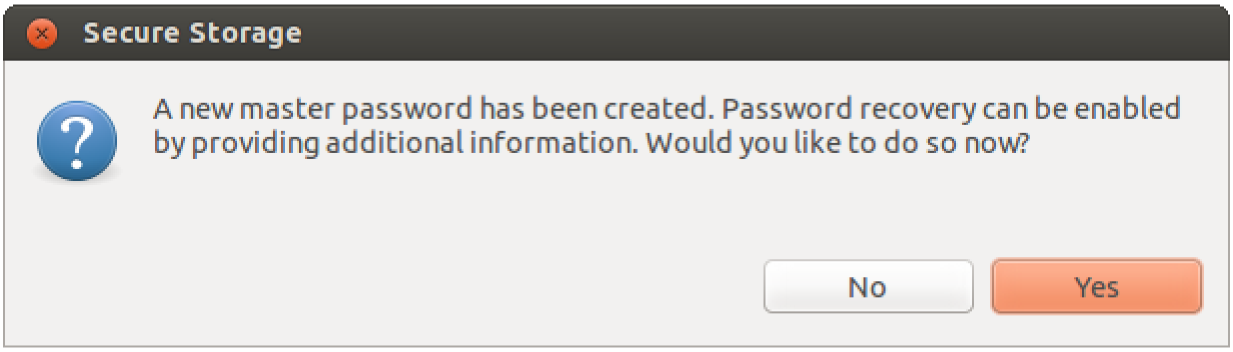
Secure Storage

Please enter a new master password for the secure storage.

Password: *

Confirm password: *

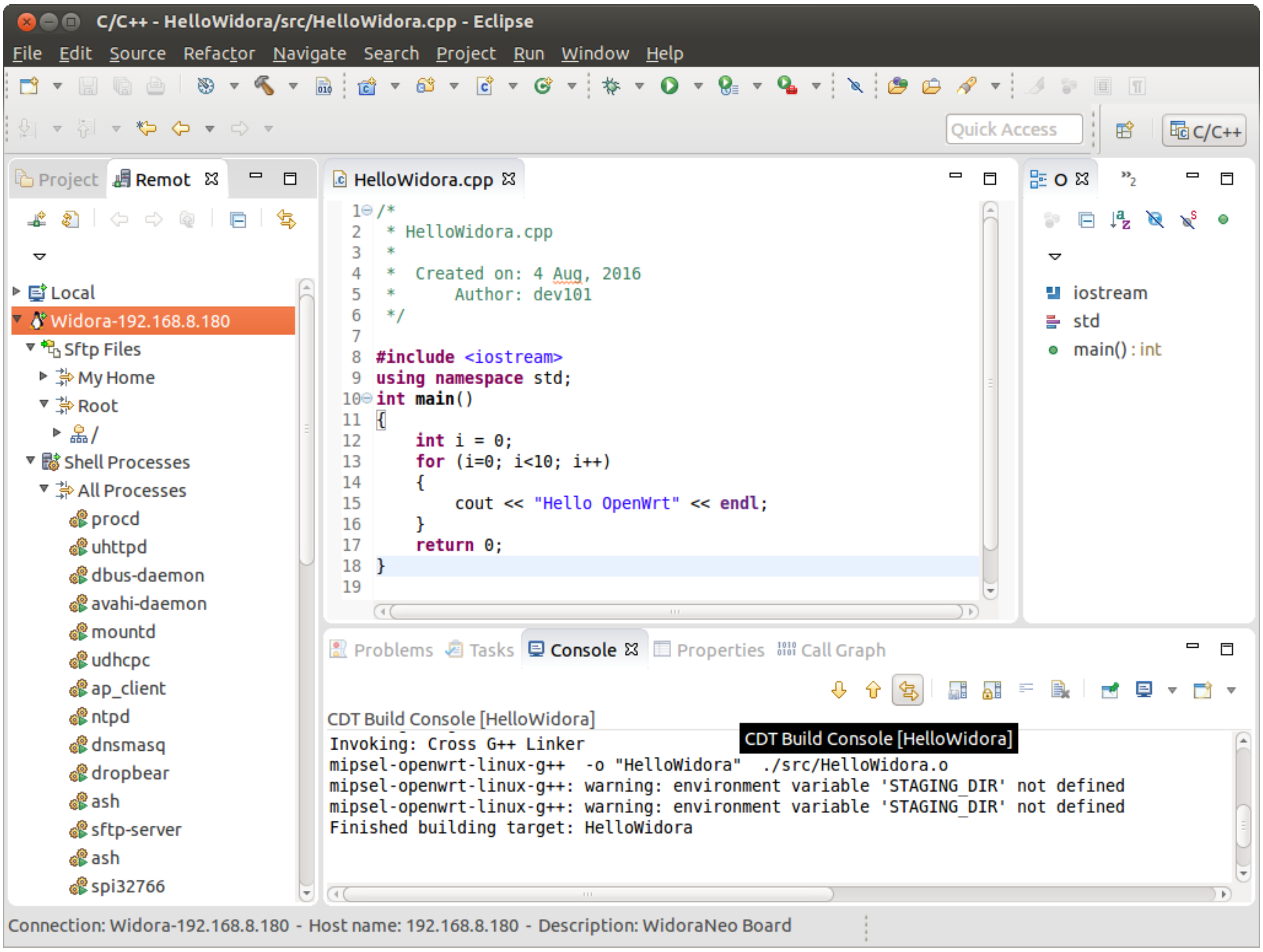
□ Show password



Secure Storage

A new master password has been created. Password recovery can be enabled by providing additional information. Would you like to do so now?

After entering user name + password you are now able to put files on/from your target devices via drag n' drop, you can even control the target's processes:



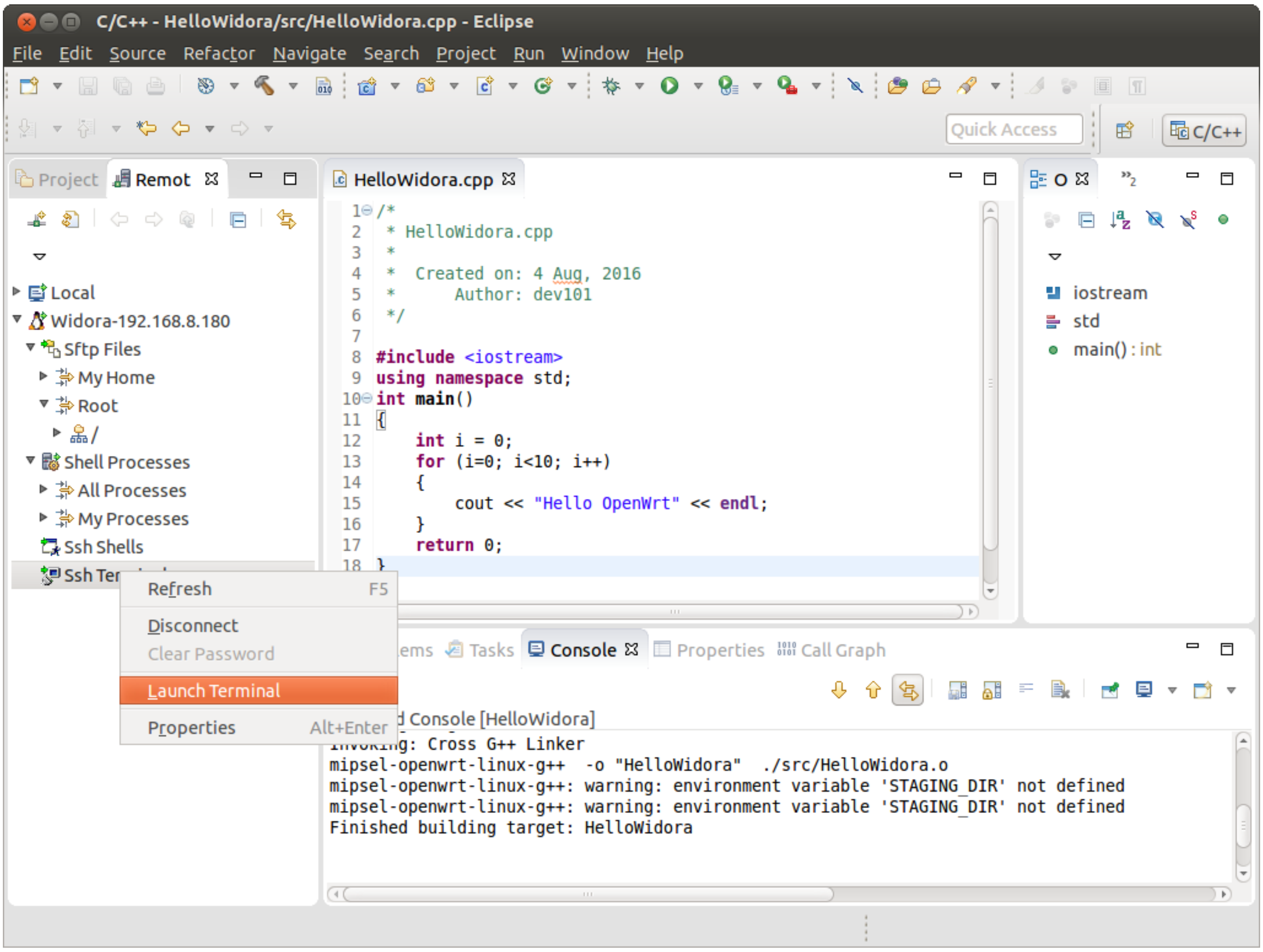
```
/*
 * HelloWidora.cpp
 *
 *  Created on: 4 Aug, 2016
 *      Author: dev101
 */

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

CDT Build Console [HelloWidora]

```
Invoking: Cross G++ Linker
mipsel-openwrt-linux-g++  -o "HelloWidora"  ./src/HelloWidora.o
mipsel-openwrt-linux-g++: warning: environment variable 'STAGING_DIR' not defined
mipsel-openwrt-linux-g++: warning: environment variable 'STAGING_DIR' not defined
Finished building target: HelloWidora
```

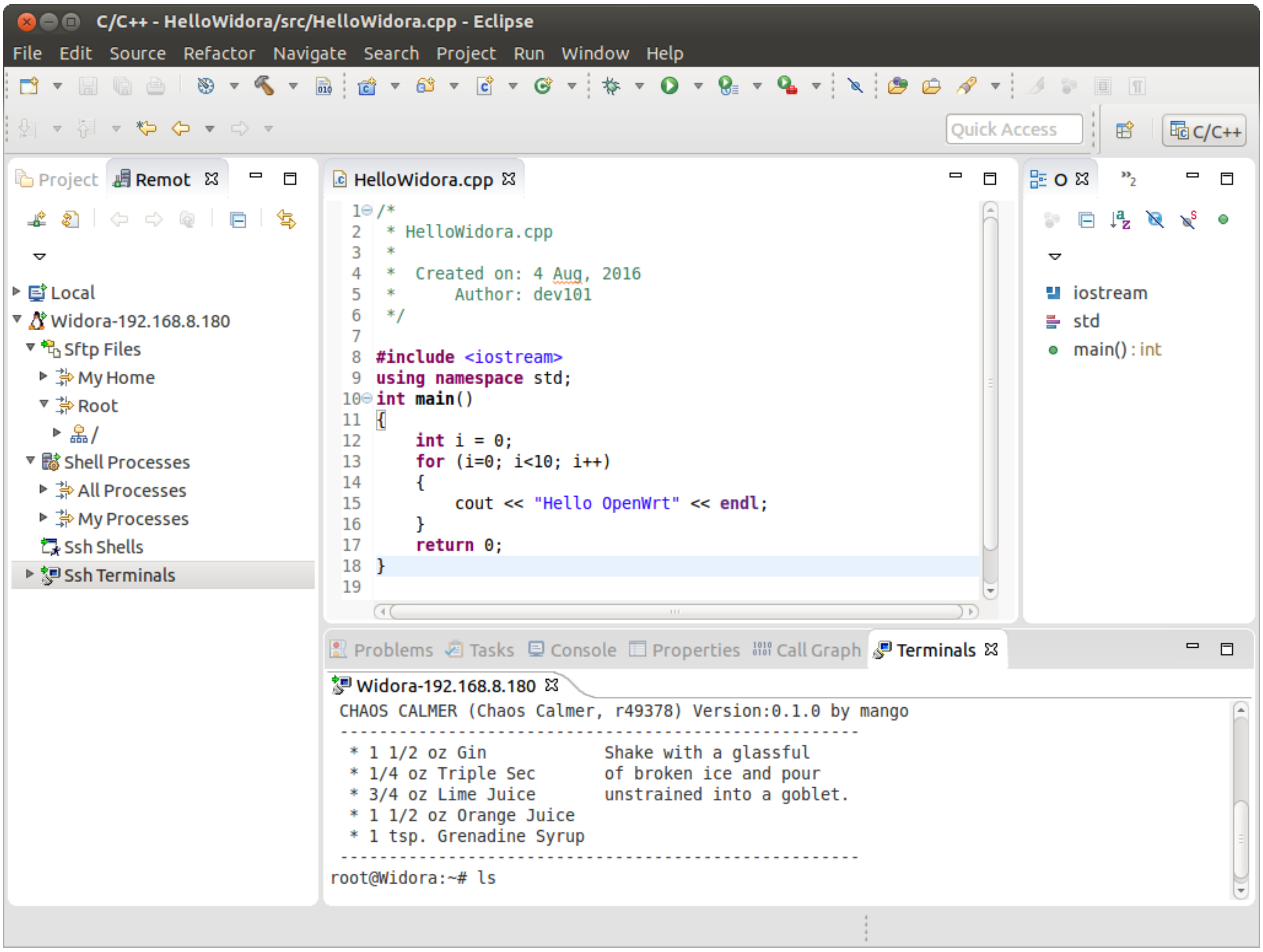
Connection: Widora-192.168.8.180 - Host name: 192.168.8.180 - Description: WidoraNeo Board

Or you can enter a ssh terminal in eclipse or copy/execute HelloOpenWrt bin file on your target device:



```
/*
 * HelloWidora.cpp
 *
 *  Created on: 4 Aug, 2016
 *      Author: dev101
 */

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

```
Invoking: Cross G++ Linker
mipsel-openwrt-linux-g++  -o "HelloWidora"  ./src/HelloWidora.o
mipsel-openwrt-linux-g++: warning: environment variable 'STAGING_DIR' not defined
mipsel-openwrt-linux-g++: warning: environment variable 'STAGING_DIR' not defined
Finished building target: HelloWidora
```

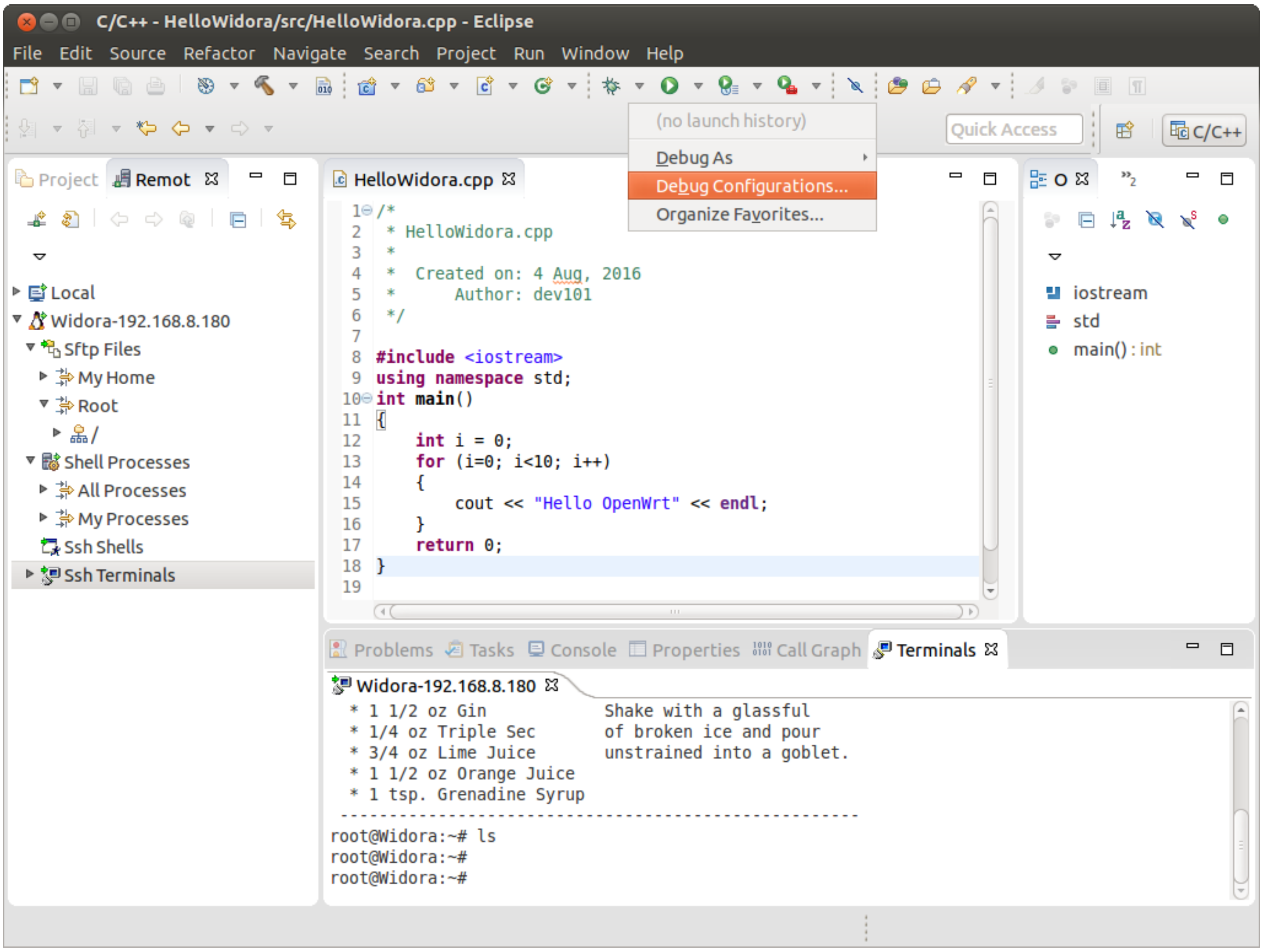


```
/*
 * HelloWidora.cpp
 *
 *  Created on: 4 Aug, 2016
 *      Author: dev101
 */

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

```
 CHAOS CALMER (Chaos Calmer, r49378) Version:0.1.0 by mango
 -----------------------------------------------------
  * 1 1/2 oz Gin            Shake with a glassful
  * 1/4 oz Triple Sec       of broken ice and pour
  * 3/4 oz Lime Juice       unstrained into a goblet.
  * 1 1/2 oz Orange Juice
  * 1 tsp. Grenadine Syrup
 -----------------------------------------------------
root@Widora:~# ls
```

5.1.2.3 Remote gdb Debugger Setup

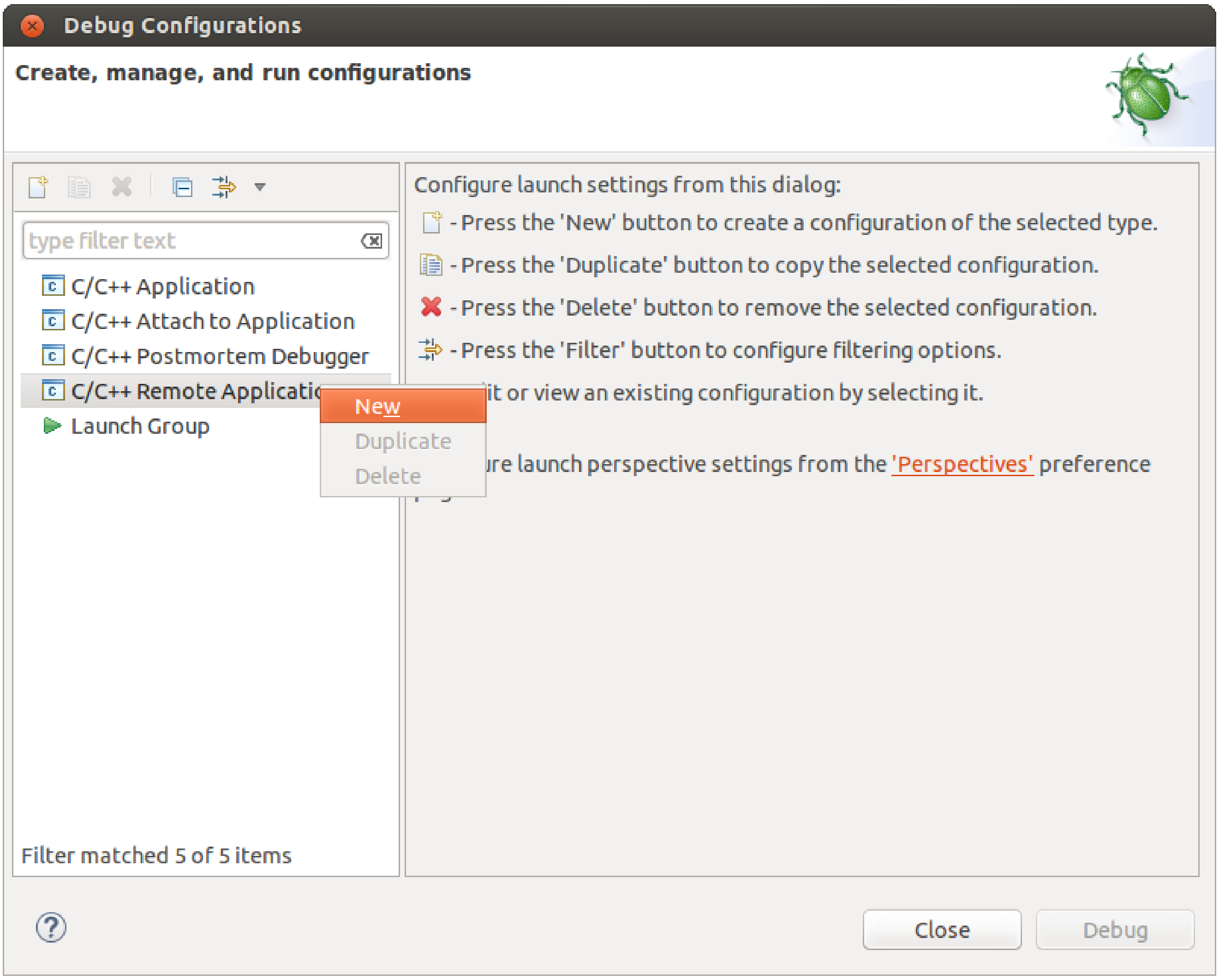
For target device remote debugging at first we have to define a debug configuration
Left click on arrow of the “bug”-button to enter “Debug Configurations”



```
/*
 * HelloWidora.cpp
 *
 *  Created on: 4 Aug, 2016
 *      Author: dev101
 */

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

```
 * 1 1/2 oz Gin            Shake with a glassful
 * 1/4 oz Triple Sec       of broken ice and pour
 * 3/4 oz Lime Juice       unstrained into a goblet.
 * 1 1/2 oz Orange Juice
 * 1 tsp. Grenadine Syrup
 -----------------------------------------------------
root@Widora:~# ls
root@Widora:~#
root@Widora:~#
```

And we create a new C/C++ Remote Application Debug Configuration:



Debug Configurations
Create, manage, and run configurations
type filter text
C/C++ Application
C/C++ Attach to Application
C/C++ Postmortem Debugger
C/C++ Remote Applicatio
Launch Group
New
Duplicate
Delete
Filter matched 5 of 5 items
Close
Debug

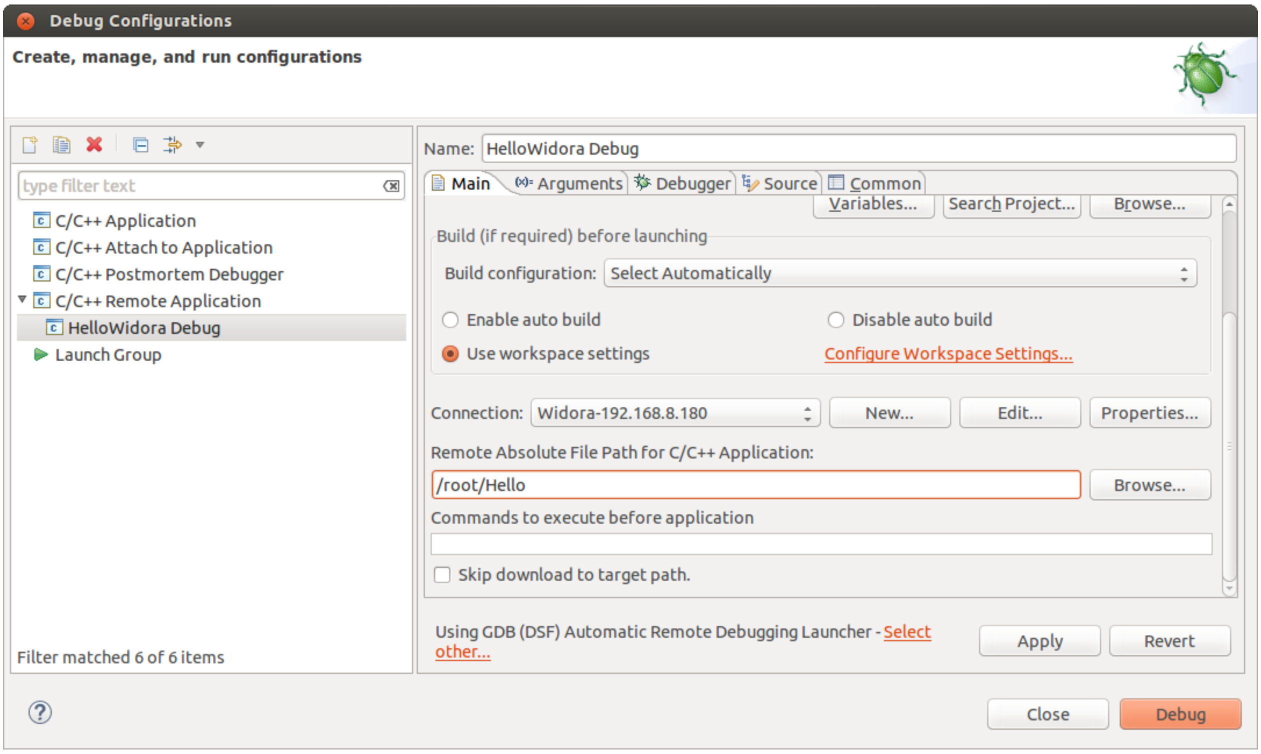
Configure launch settings from this dialog:

- 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.

it or view an existing configuration by selecting it.

ure launch perspective settings from the 'Perspectives' preference

- In “Main” at C/C++ App adapt local file path to your application.
- Change at “Connection” to your already defined target device remote connection (see Remote Target Setup).
- Don't forget to define the correct “Remote Absolute File Path for C/C++ Application”



Debug Configurations

Create, manage, and run configurations

- C/C++ Application
- C/C++ Attach to Application
- C/C++ Postmortem Debugger
- C/C++ Remote Application
  - HelloWidora Debug
- Launch Group

Filter matched 6 of 6 items

Name: HelloWidora Debug

Build (if required) before launching

Build configuration: Select Automatically

○ Enable auto build ○ Disable auto build

● Use workspace settings Configure Workspace Settings...

Connection: Widora-192.168.8.180

Remote Absolute File Path for C/C++ Application: /root/Hello

Commands to execute before application

□ Skip download to target path.

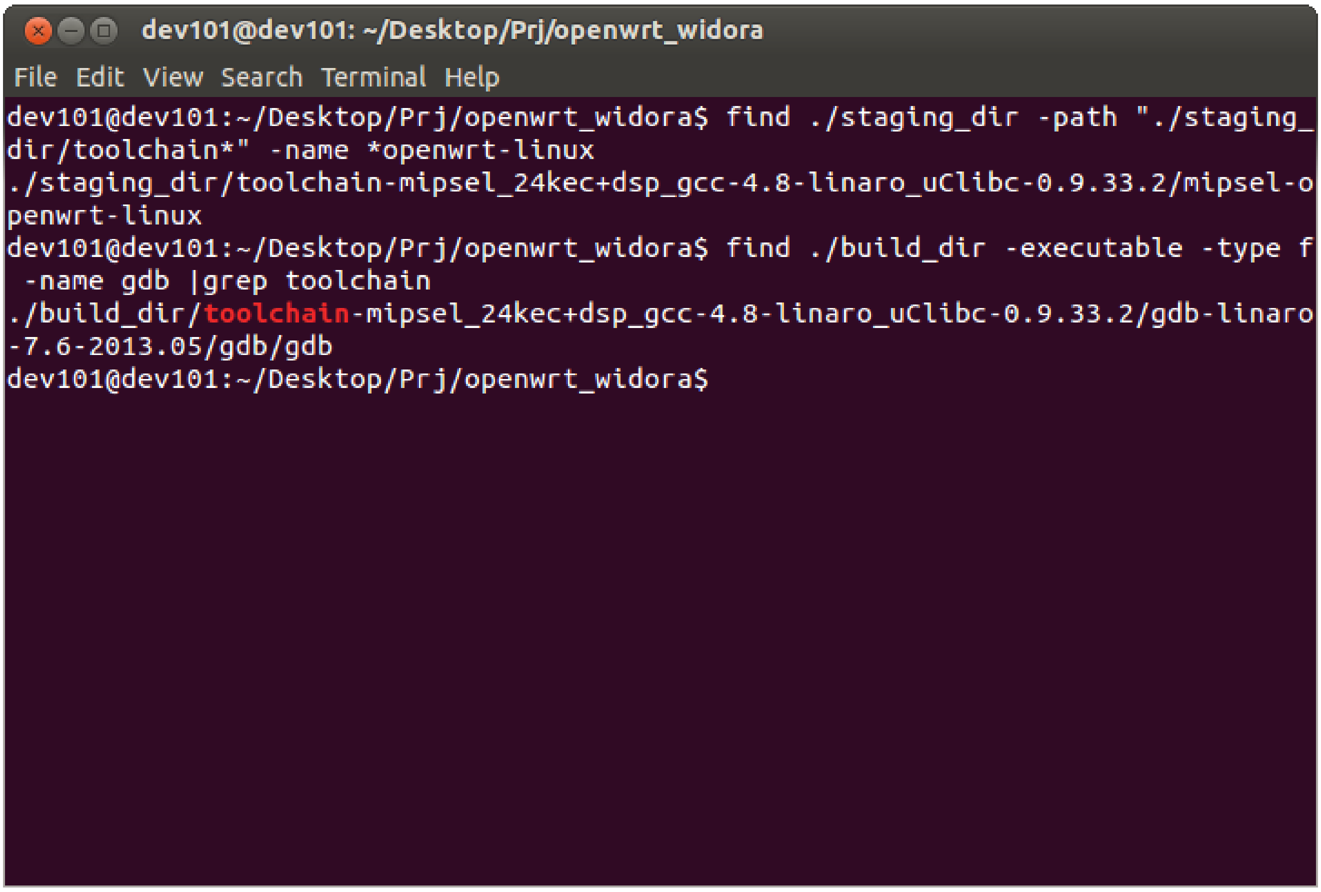
Using GDB (DSF) Automatic Remote Debugging Launcher - Select other...

Now click on “Debugger” settings to define the correct host gdb file.

As host gdb we can't use the /usr/bin/gdb provided e.g. by Ubuntu, we must use the gdb which has been built by our toolchain. As well as the tool command prefix, the location depends on your specific target settings and we evaluate it again. It is located somewhere in `./build_dir`.

Execute: `find ./build_dir -executable -type f -name gdb |grep toolchain` as shown below.

The system being used for this guide returned result of:
`./build_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/gdb-linaro-7.6-2013.05/gdb/gdb`



dev101@dev101: ~/Desktop/Prj/openwrt_widora
File Edit View Search Terminal Help

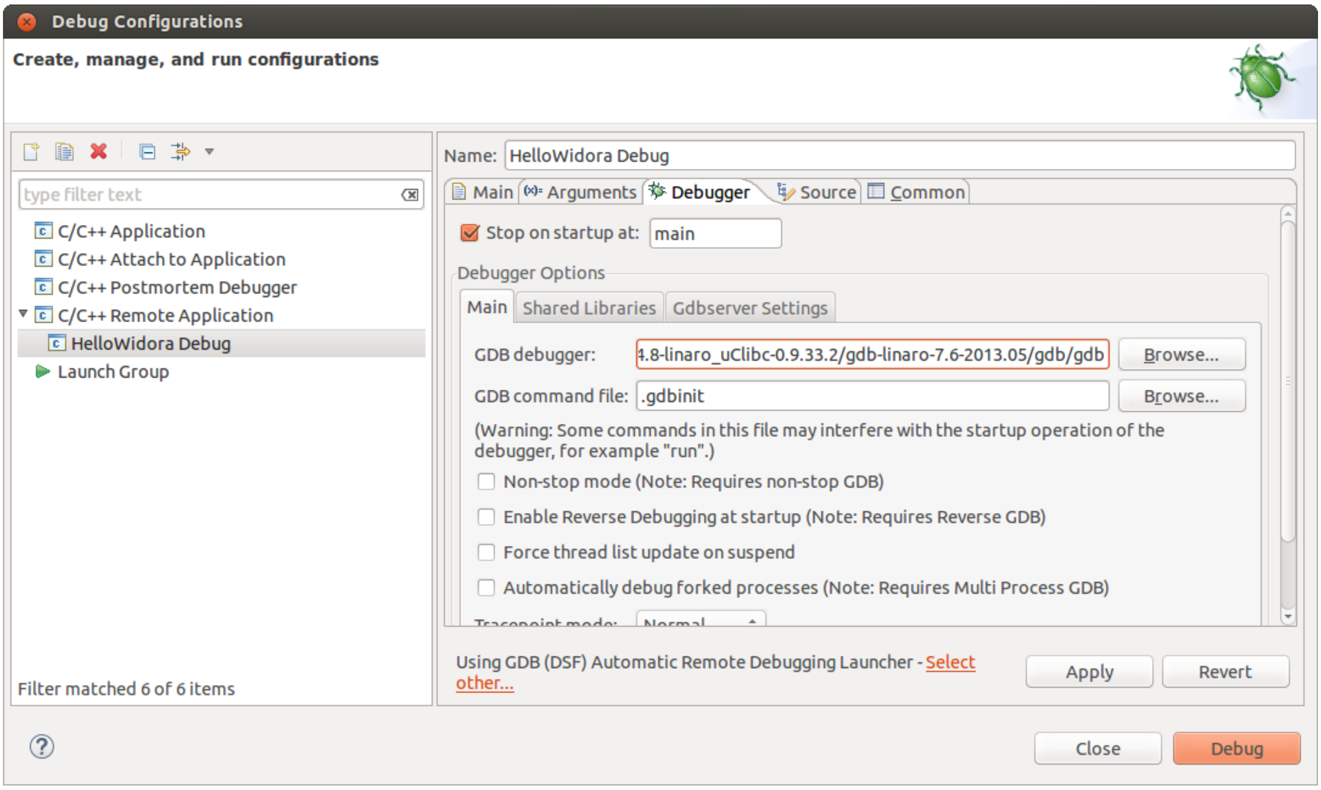
```
dev101@dev101:~/Desktop/Prj/openwrt_widora$ find ./staging_dir -path "./staging_dir/toolchain*" -name *openwrt-linux
./staging_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/mipsel-openwrt-linux
dev101@dev101:~/Desktop/Prj/openwrt_widora$ find ./build_dir -executable -type f -name gdb |grep toolchain
./build_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/gdb-linaro-7.6-2013.05/gdb/gdb
dev101@dev101:~/Desktop/Prj/openwrt_widora$
```

We have to enter the **absolute** file path at “GDB debugger”, for the system being used for this guide is:

`/home/dev101/Desktop/Prj/openwrt_widora/build_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uClibc-0.9.33.2/gdb-linaro-7.6-2013.05/gdb/gdb`

Remember these settings depend on YOUR specific build environment, COPY + PASTE from here may not work!!

Other changes are not required. Now you may press “Debug” button of the settings window.



Name: HelloWidora Debug

☑ Stop on startup at: main

Debugger Options

Main

GDB debugger: 4.8-linaro_uClibc-0.9.33.2/gdb-linaro-7.6-2013.05/gdb/gdb

GDB command file: .gdbinit

(Warning: Some commands in this file may interfere with the startup operation of the debugger, for example "run".)

□ Non-stop mode (Note: Requires non-stop GDB)

□ Enable Reverse Debugging at startup (Note: Requires Reverse GDB)

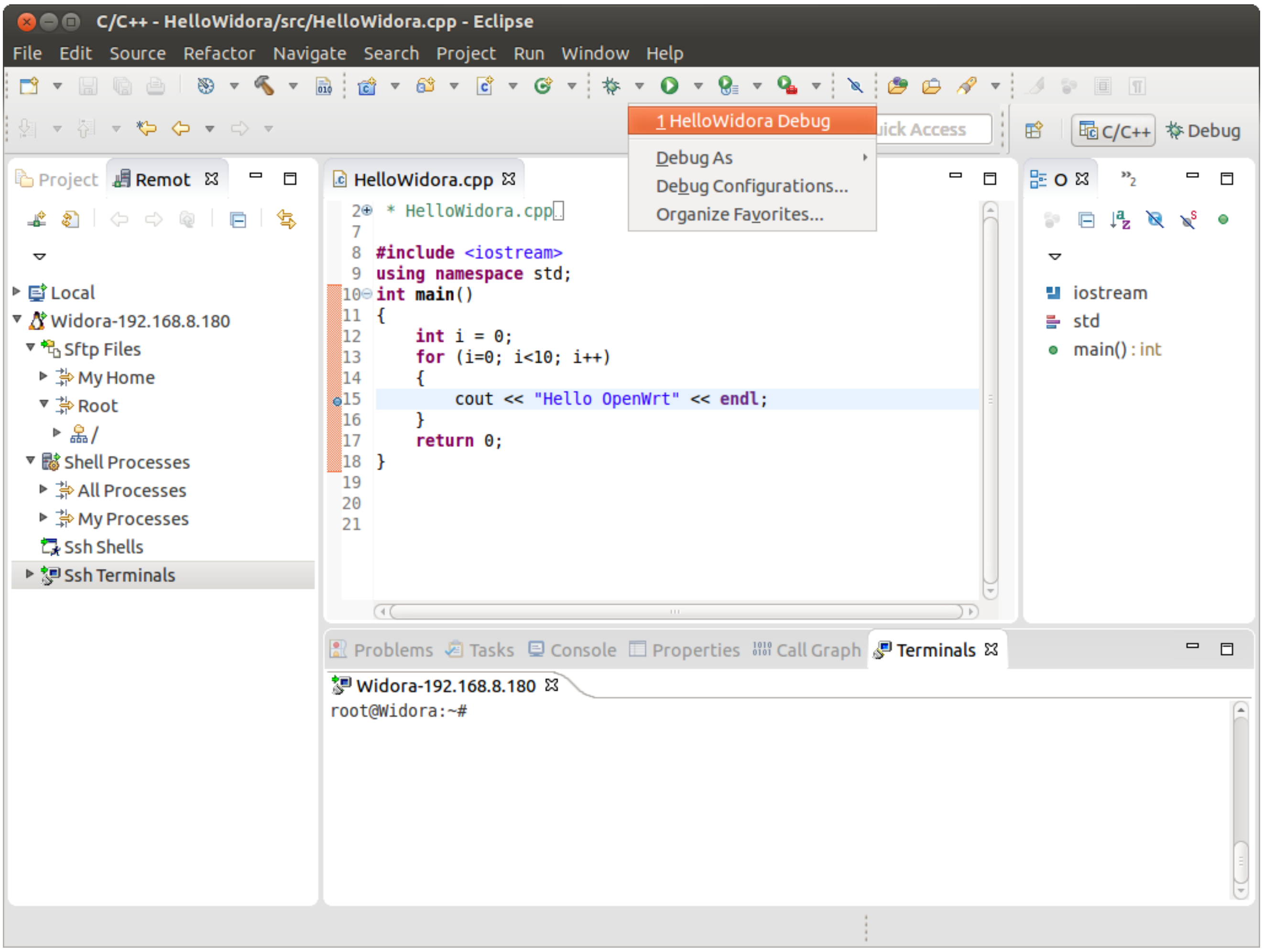
□ Force thread list update on suspend

□ Automatically debug forked processes (Note: Requires Multi Process GDB)

Tracepoint mode: Normal

Using GDB (DSF) Automatic Remote Debugging Launcher - Select other...

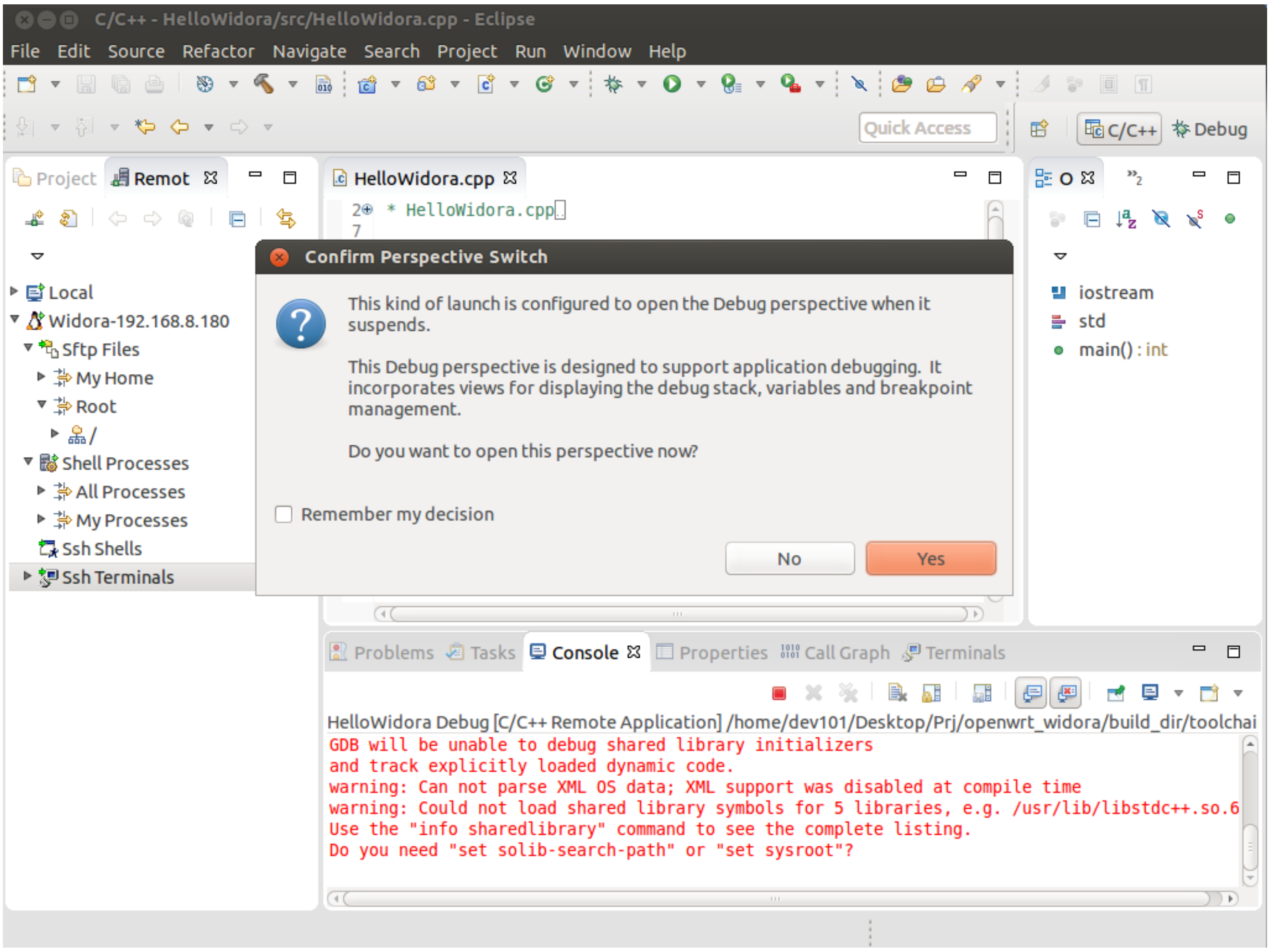
5.1.2.4 Remote Debugging Example



```
 * HelloWidora.cpp

#include <iostream>
using namespace std;
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

```
root@Widora:~#
```

When you launch Debug the Debug View of eclipse will be opened:



Confirm Perspective Switch

This kind of launch is configured to open the Debug perspective when it suspends.

This Debug perspective is designed to support application debugging. It incorporates views for displaying the debug stack, variables and breakpoint management.

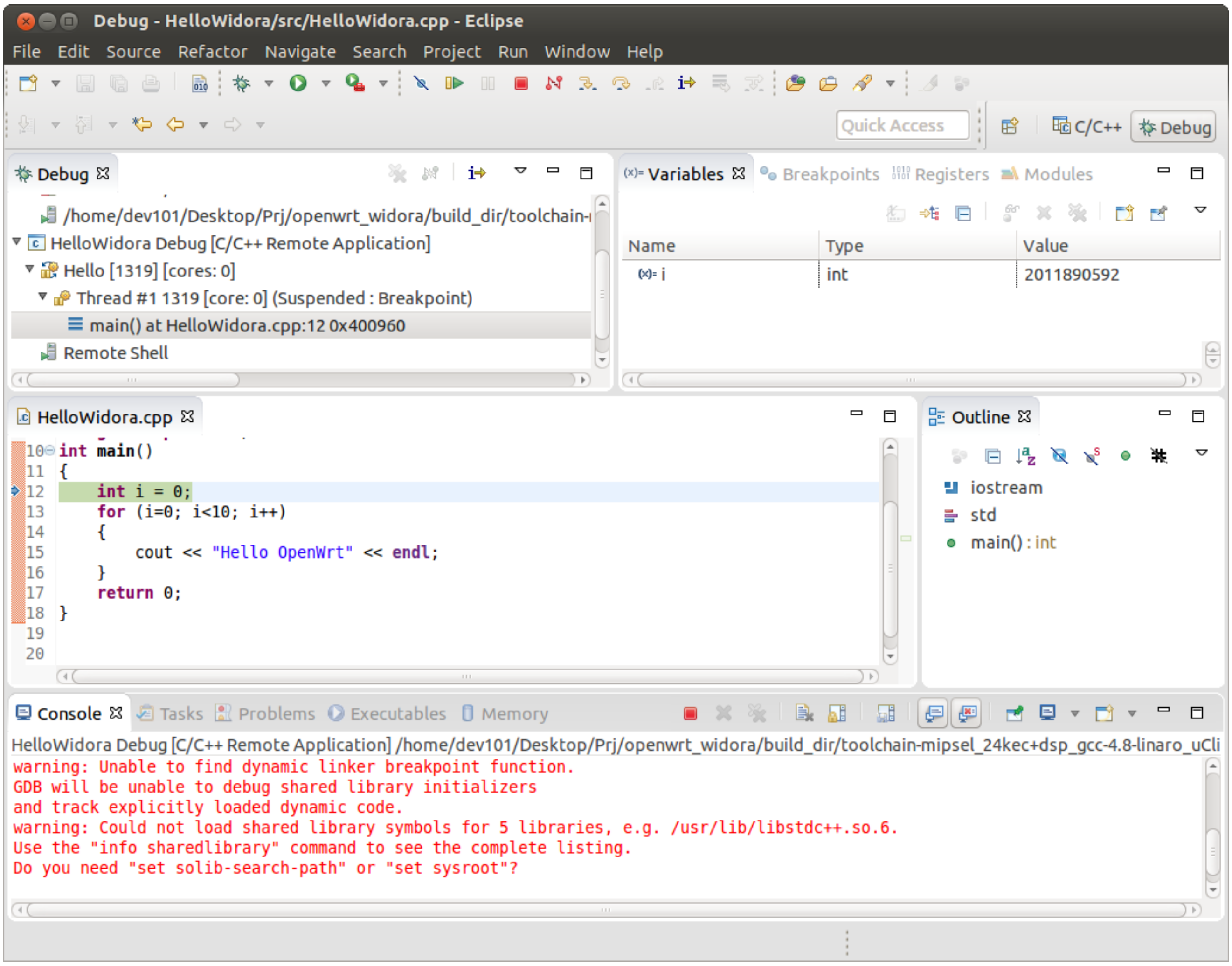
Do you want to open this perspective now?

□ Remember my decision

No Yes

HelloWidora Debug [C/C++ Remote Application] /home/dev101/Desktop/Prj/openwrt_widora/build_dir/toolchai

```
GDB will be unable to debug shared library initializers
and track explicitly loaded dynamic code.
warning: Can not parse XML OS data; XML support was disabled at compile time
warning: Could not load shared library symbols for 5 libraries, e.g. /usr/lib/libstdc++.so.6
Use the "info sharedlibrary" command to see the complete listing.
Do you need "set solib-search-path" or "set sysroot"?
```



```
/home/dev101/Desktop/Prj/openwrt_widora/build_dir/toolchain-
HelloWidora Debug [C/C++ Remote Application]
  Hello [1319] [cores: 0]
    Thread #1 1319 [core: 0] (Suspended : Breakpoint)
      main() at HelloWidora.cpp:12 0x400960
  Remote Shell
```

Name	Type	Value
i	int	2011890592

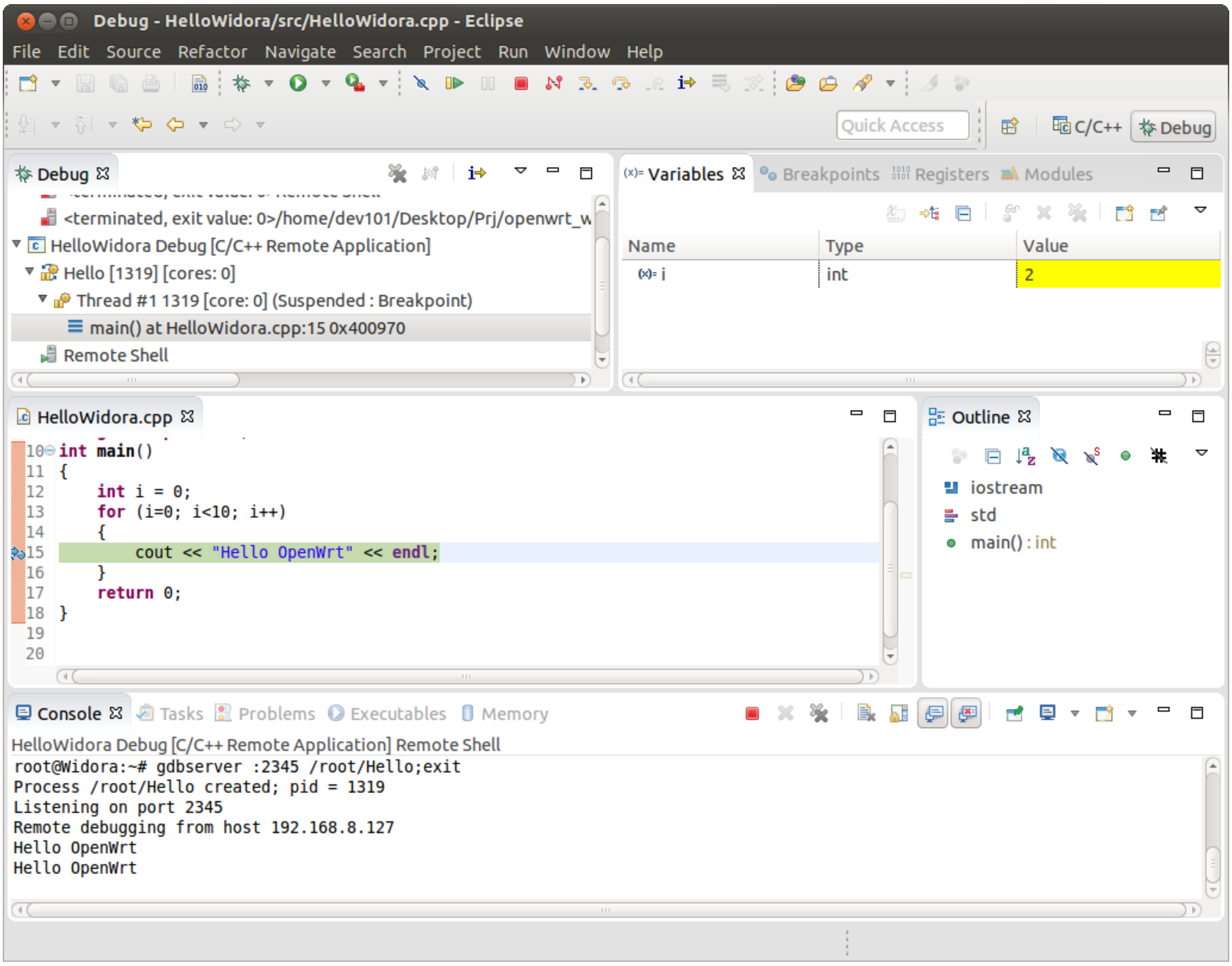
```
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

```
HelloWidora Debug [C/C++ Remote Application] /home/dev101/Desktop/Prj/openwrt_widora/build_dir/toolchain-mipsel_24kec+dsp_gcc-4.8-linaro_uCli
warning: Unable to find dynamic linker breakpoint function.
GDB will be unable to debug shared library initializers
and track explicitly loaded dynamic code.
warning: Could not load shared library symbols for 5 libraries, e.g. /usr/lib/libstdc++.so.6.
Use the "info sharedlibrary" command to see the complete listing.
Do you need "set solib-search-path" or "set sysroot"?
```

The above red color warning can be ignored since you haven't enabled `“Advanced configuration options (for developers)->Build Options->Debugging”` in OpenWrt build settings and rebuild all with debugging information for your Widora firmware.

6 Finish

Congratulations, now you have a complete OpenWrt Development Suite! You can develop your C/C++ program in Eclipse IDE, Cross-Compile it, set break points and do remote debugging.



<terminated, exit value: 0>/home/dev101/Desktop/Prj/openwrt_w
HelloWidora Debug [C/C++ Remote Application]
Hello [1319] [cores: 0]
Thread #1 1319 [core: 0] (Suspended : Breakpoint)
main() at HelloWidora.cpp:15 0x400970
Remote Shell

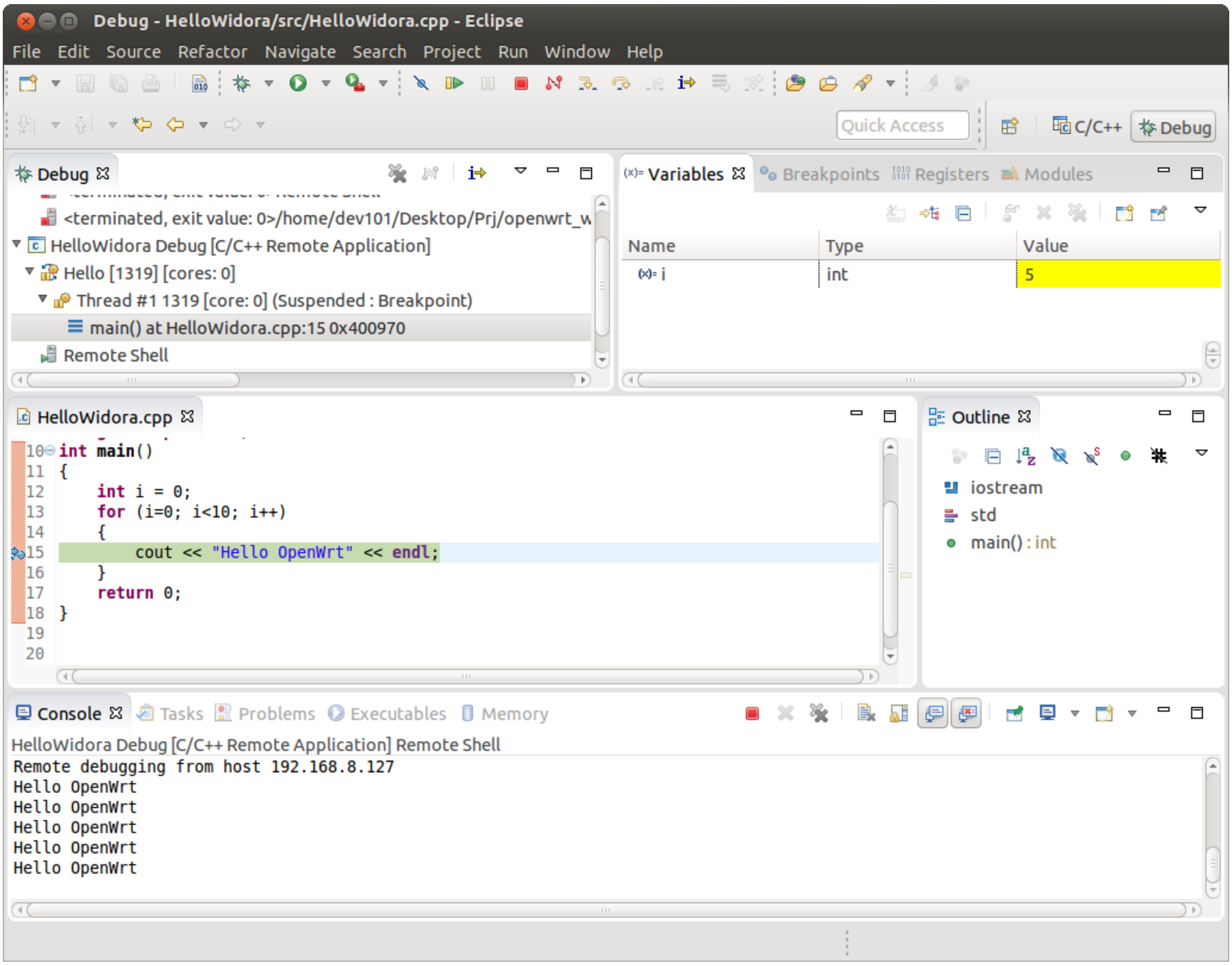
Name	Type	Value
i	int	2

```
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

iostream
std
main() : int

HelloWidora Debug [C/C++ Remote Application] Remote Shell

```
root@Widora:~# gdbserver :2345 /root/Hello;exit
Process /root/Hello created; pid = 1319
Listening on port 2345
Remote debugging from host 192.168.8.127
Hello OpenWrt
Hello OpenWrt
```



<terminated, exit value: 0>/home/dev101/Desktop/Prj/openwrt_w
HelloWidora Debug [C/C++ Remote Application]
Hello [1319] [cores: 0]
Thread #1 1319 [core: 0] (Suspended : Breakpoint)
main() at HelloWidora.cpp:15 0x400970
Remote Shell

Name	Type	Value
i	int	5

```
int main()
{
    int i = 0;
    for (i=0; i<10; i++)
    {
        cout << "Hello OpenWrt" << endl;
    }
    return 0;
}
```

HelloWidora Debug [C/C++ Remote Application] Remote Shell

```
Remote debugging from host 192.168.8.127
Hello OpenWrt
Hello OpenWrt
Hello OpenWrt
Hello OpenWrt
Hello OpenWrt
```