Open Source User Guide

Open source Wireless-G Router - KWGR614

!!!! Opening The Router Housing or Putting In Any Customer Software on The Router Will Void The Warranty On Your Router!!!!

Hardware Specification

Chipsets:
- CPU: Realtek RTL8651B (200MHz), embedded with a 5-port Fast Ethernet switch
- Wireless: Realtek RTL8185L / RTL8225

Total memory:
- Flash: 4MB
- SDRAM: 16MB

Memory usage of the latest router firmware:
- Flash: 2MB used = 1,804KB (router firmware V1.0.1-10.17WW) + 192KB (Bootloader + BoardInfo + POT + Configuration)
- SDRAM: about 8.5MB (without including the dynamic memory allocation)

Module and Software Specification

KWGR614 is running Linux 2.4.26.

The following table lists the functional modules of the KWGR614 router and the source and versions of the different modules. More information on these functional modules can be obtained directly from the source of the packages.

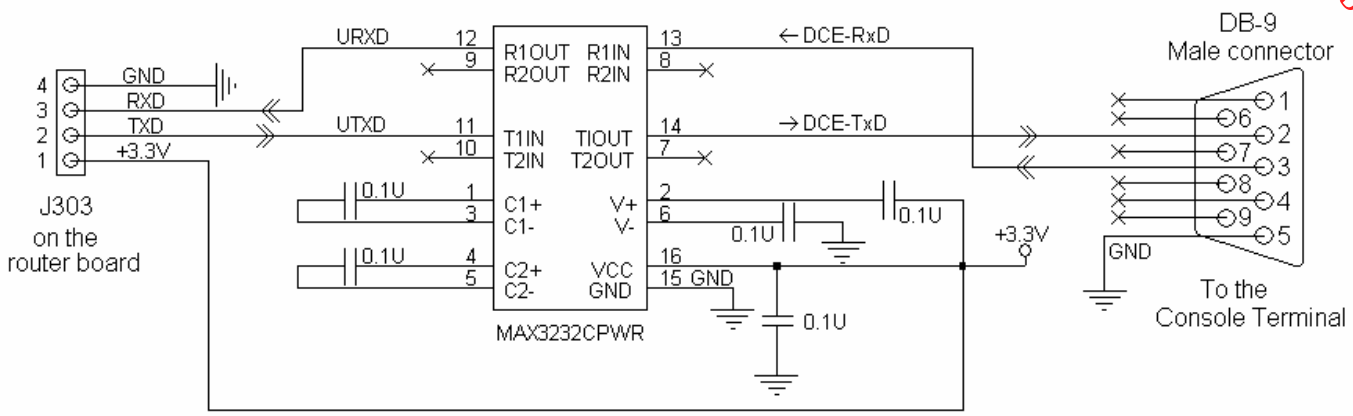
Module	Package	Version	Location (directory)
NAT/NAPT	**RomeDriver-Realtek**	**3.6.3**	**linux-2.4.x/drivers/net/re865x/rtl865x**
RIPv1/RIPv2	**Copyright 2005, DNI**	**1.0.0**	**user/ripd**
DHCP **server/client**	**udhcpd/udhcpc of Busybox V1.00-pre2**	**0.9.10**	**user/busybox/networking/udhcp**
DNS Proxy	**Dnrd**	**2.17.2**	**user/dnrd-dnshijack**
Dynamic DNS	**ez-ipupdate**	**3.0.11b7**	**user/ez-ipupdate-3.0.11b7**
Web Server	**BOA**	**0.94**	**user/boa**
UPNP	**Copyright 2005, DNI**	**1.0.0**	**user/upnp**
Telstra's Big Pond	**Bpalogin**	**V2.0**	**user/bpalogin**
Email	**Smtpclient**	**1.0.0**	**user/smtpclient**
Schedule	**Crond of Busybox V1.00-pre2**	**1.0.0**	**user/busybox/miscutils/crond.c**
PPP/PPPoE	**Pppd**	**2.3.8**	**user/pppd**
PPTP Client	**pptp-client**	**1.3.1**	**user/pptp-client**
Ntpclient	**Copyright 2005, DNI**	**1.0.0**	**user/ntpclient**
Miscellaneous	**Copyright 2005, DNI**	**1.0.0**	**user/dniutil, user/init**
Wireless driver	**Copyright Realtek**	**1.12**	**linux-2.4.x/drivers/net/wireless/rtl8185**
L2TP	**l2tpd**	**0.69**	**user/l2tpd**
Iptables	**iptables**	**1.2.7a**	**user/iptables**

Making a Console debug Interface for KWGR614

This section contains instructions on how to make a console interface to a NETGEAR KWGR614 wireless router for developer's firmware development and debugging.

Provided below is an example schematic using MAX3232, the RS-232 Line Driver/Receiver from Texas Instruments (TI), to make a console board.

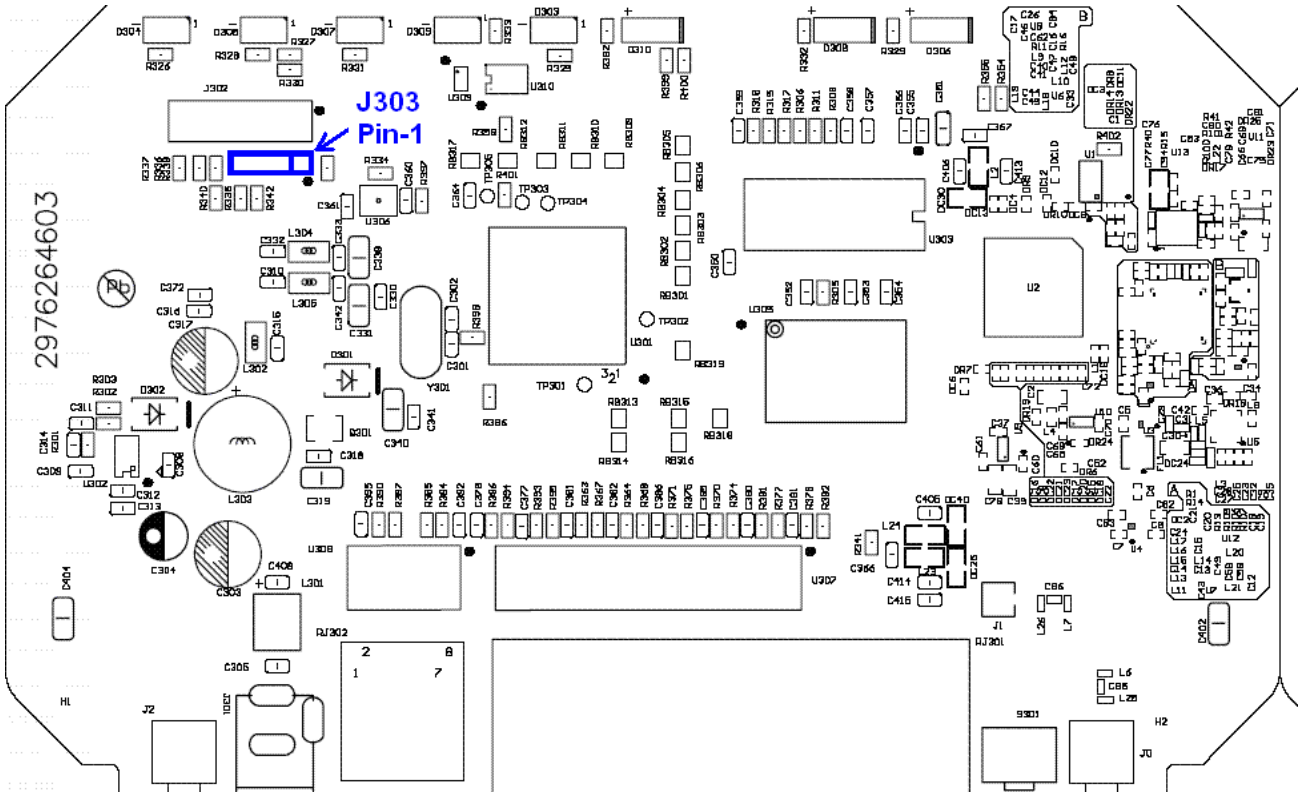
(Datasheet of the MAX3232 can be found on TI web site at http://focus.ti.com/lit/ds/symlink/max3232.pdf)



KWGR614 Console Interface

The DB9 (Male) connector is wired as a DCE (think of this as a peripheral serial port), and can be connected directly to the serial port on a host PC. This gives you access to the built-in serial console on the router (using the protocol of 38400bps, 8 data bits, none parity, 1 stop bit, without flow control).

Connect the console board to the pin header (J303) on the router board.



The pin-out of J303 on the KWGR614 board is as follows:
Pin 1: VDDH (3.3V)
Pin 2: TxD
Pin 3: RxD
Pin 4: GND (Ground)

There are 3rd party vendors who provide compatible console boards, such us the AD233AK/AD233BK RS232 adapter kits at:

http://www.compsys1.com/workbench/On_top_of_the_Bench/Max233_Adapter/max233_adapter.html

Make sure the adapter board is connected correctly to the corresponding pins of J303 on the router board.

Source Code and Executable

The following section of the document highlights the steps and procedures that are required to download the source code, install the toolchain, compile and link the existing source code and develop the user applications for the KWGR614 Router. Suse Linux 10.1 was used for development throughout this guide.

Note: The KWGR614 firmware had been built successfully on the following Linux OS platforms
- Redhat 9.0/8.x
- Fedora 5
- SuSE Linux 10.1

1. Download the complete archive from Netgear OSC web site (http://kbserver.netgear.com/kb_web_files/open_src.asp) and unpack KWGR614_V1.0.1_10.17**WW**_gpl_package.zip

   Note: V1.0.1_10.17 is the firmware version number. WW denotes Worldwide version. Other versions are available e.g NA for North America. Apply the correct file name where appropriate, if you download a different version.

2. unzip KWGR614_V1.0.1_10.17WW_gpl_package.zip

   Unzip will result in three files:
   KWGR614_README.txt (The Opensource User Guide)
   KWGR614_V1.0.1_10.17WW_src.tar.bz2
   toolchain_mips_20050831.tar.bz2

3. Unpack the Source code.

   tar –xvf KWGR614_V1.0.1_10.17WW_src.tar.bz2

   This will create a sub directory KWGR614_xxx/.
   xxx -> V1.0.1_10.17WW (xxx denotes the version number)

   The Directory has a number of useful documents that we recommend to read before proceeding.

   Useful Documents
   - /vendors/Documentation/KWGR614_README.txt
   - /SOURCE
   - /README
   - /Documentation/Adding-User-Apps-HOWTO
   - /Documentation/Addid-Platforms-HOWTO

4. Install the Tool chain in the root Directory
   # cd /
   # mkdir uclibc
   # cd uclibc
   # tar jxvf toolchain_mips_20050831.tar.bz2
   # mv toolchain_mips.pv.0831 toolchain_mips

Note: Root user permissions may be required to create the uclibc directory and install the toolchain into the root directory of the filesystem.

5. Compile

   Change working directory to KWGR614_xxx/

   a. Type "make menuconfig", and customize your kernel config options.

   - Target Platform Selection --->
     [*] Customize Kernel Settings (NEW)
   - Exit

- Exit
- Save configuration? yes
- Exit
- Save configuration? yes

Note: If you are building runtime image for the first time, be sure to save the configuration when leaving "make menuconfig", even if no change is made to default settings.

b. Type "make dep"

c. (Optional) If you need to customize busybox, goto KWGR614_xxx/user/busybox/, and type "make menuconfig" to select user level application you need. Then go back to KWGR614_xxx/, and type "make dep" again. This would update all dependencies.

d. Type "make"
This would build the kernel, user apps, and create image file run.bix under KWGR614_xxx/images/ directory.

After compiling and linking the existing source code already provided, you can now upload the KWGR614_xxx/images/run.bix file directly to the router after connecting the router to your PC and using the “Router firmware Upgrade” page on the Router Web GUI.

Custom Applications on OpenSource Router

To develop any custom applications on this router, please follow the following steps

Version String

Set your custom version string in the file user/dni/nvram_realtek.c by defining OS_VERSION. Be certain to remove any duplicate definition.

user/dni/nvram_realtek.c

```
#define OS_VERSION “V1.01.01 Custom”
```

The country suffix can be removed from the version string by redefining EXTENSION.

user/dni/nvram_realtek.c

```
#if 1
#ifdef EXTENSION
#undef EXTENSION
#endif
#define EXTENSION “”
#endif
```

New NVRAM Parameters

Define the structure of the parameter.

user/boa/src/rtl865x/board.h

```
#define MAX_QUESTION_LENGTH 64
typedef struct exampleParam_s
{
        char question[MAX_QUESTION_LENGTH];
        int answer;
} exampleParam_t;
```

Add the new parameter to the main parameter structure to include it in the configuration set.

user/boa/src/rtl865x/board.h

```
typedef struct romeCfgParam_s
{
       . . .
       exampleParam_t exampleParam;
} romeCfgParam_t;
```

Create get/set functions for the parameter.

user/dniutil/nvram_realtek.c

```
char *
nvram_get_example_question (char *name)
{
        DPRINTF("nvram_get(\"%s\")\n", name);
        sprintf(str, "%s", pRomeCfgParam->exampleParam.question);
        return (str);
}

int
nvram_set_example_question(char *name, char *value)
{
        DPRINTF("nvram_set(\"%s\", \"%s\")\n", name, value);
        strncpy(pRomeCfgParam->exampleParam.question, value, \
                sizeof(pRomeCfgParam->exampleParam.question));
        return 1;
}

char *
nvram_get_example_answer (char *name)
{
        DPRINTF("nvram_get(\"%s\")\n", name);
        sprintf(str, "%d", pRomeCfgParam->exampleParam.answer);
        return (str);
}

int
nvram_set_example_question(char *name, char *value)
{
        DPRINTF("nvram_set(\"%s\", \"%s\")\n", name, value);
        pRomeCfgParam->exampleParam.answer = atoi(value);
        return 1;
}
```

Add the get/set handlers to the NVRAM handler table.

user/dniutil/nvram_realtek.c

```
struct ej_nvram_handler nvram_handlers[] =
{
       . . .
       {"example_question", nvram_get_example_question, nvram_set_example_question},
       {"example_answer", nvram_get_example_answer, nvram_set_example_answer},
       { NULL, NULL, NULL },
};
```

Declare an instance of the parameter for runtime memory use.

user/boa/src/dni/board.c

```
exampleParam_t                  ramExampleParam;  //nvram example
```

Define default values for the parameter.

user/boa/src/dni/board.c

```
// nvram example
exampleParam_t exampleParamDefault[1] =
{
        {
                "What is the meaning of life, the universe, and everything?",
                42
        }
};
```

Define the initialization function.

user/boa/src/dni/board.c

```
uint32 example_init(void)
{
        /* read cfg from cfgmgr */
        if (cfgmgr_read(CFGMGR_TABID_EXAMPLE, \
            (void*)&(pRomeCfgParam->exampleParam), \
            sizeof(struct exampleParam_t))!=0)
        {
                printf("example_init: call cfgmgr_read fail\n");
                /* take proper actions */
                return NOT_OK;
        }

        //printf("example_init\n");
        return OK;
} /* end example_init */
```

Add the function to system initialization.

user/boa/src/dni/board.c

```
uint32 sysInit(void)
{
	. . .
	/* init nvram example */
	example_init();
	. . .
} /* end sysInit */
```

Add an ID to the configuration management table and to the control table.

user/boa/src/rtl865x/rtl_board.h

```
enum _board_cfgmgr_tabId_e {
	. . .
	CFGMGR_TABID_EXAMPLE,
	CFGMGR_TABID_MAX
};
```

user/boa/src/dni/board.c

```
static _board_cfgmgr_ctrl_t _board_cfgmgr_ctrlTbl[CFGMGR_TABID_MAX+1] =
{
	. . .
	{CFGMGR_TABID_EXAMPLE, exampleParamDefault, (sizeof(exampleParamDefault))},
	{CFGMGR_TABID_MAX, NULL, 0}
};
```

Create a save function for the parameter.

user/boa/src/dni/board.c

```
int example_cfg_save(void)
{
	cfgmgr_write(CFGMGR_TABID_EXAMPLE, \
			(void*)&(pRomeCfgParam->exampleParam),\
			sizeof(exampleParam_t));
	cfgmgr_task();
	return 1;
}
```

Add the parameter to the NVRAM commit function.

user/boa/src/dni/board.c

```
int nvram_commit(void)
{
	. . .
	cfgmgr_write(CFGMGR_TABID_EXAMPLE, \
			(void*)&(pRomeCfgParam->exampleParam), \
			sizeof(exampleParam_t));
	cfgmgr_task();
	return 1;
}
```

Clean and rebuild userspace after any changes to board.h.

At the shell prompt.

```
work> cd user; make clean; cd ..; make
```

Web Page Integration

The boa web server is used. Custom web pages are integrated at:

```
user/boa/src/www_WW/
```

Create the main page in the above directory. Use <% nvram_get("variable name"); %> to insert the value of a NVRAM variable.

user/boa/src/www_WW/example.html

```
<html>
<head>
<meta http-equiv="content-type" content="text/html;charset=ISO-8859-1">
<META http-equiv='Pragma' CONTENT='no-cache'>
<META HTTP-EQUIV="Cache-Control" CONTENT="no-cache">
<title>Router Customization Example</title>
<link rel="stylesheet" href="/form1.css" type="text/css">
<script language="javascript" type="text/javascript">
<!-- hide script from old browsers
function loadhelp(fname)
{
        if(top.helpframe != null) {
                top.helpframe.location.href="help/help"+fname+".html"
        }
}
//-->
</script>
</head>
<body bgcolor="#ffffff" leftmargin="0" topmargin="0" marginwidth="0" marginheight="0"
onload="loadhelp('_example');">
Q: <% nvram_get("example_question"); %><br>
A: <% nvram_get("example_answer"); %>
</body>
</html>
```

Create the help file in the help directory. Name the file the same as the main page with a "help_" prefix.

user/boa/src/www_WW/help/help_example.html

```
<html>
<head>
<META name="description" content="KWGR614">
<META http-equiv="Content-Type" content="text/html; charset=iso-8859-1">
<META http-equiv="Pragma" content="no-cache">
<META HTTP-equiv="Cache-Control" content="no-cache">
<title>Help</title>
<link rel="stylesheet" href="help.css">
</head>
<body bgcolor="#0099cc" >
        <h1>Example Help</h1>
        <p>This is an example web page showing how to get a parameter from nvram.
</body>
</html>
```

Add a link to the admin page menu by editing the contents file and including a reference to the new web page.

```
user/boa/src/www_WW/contents1.html
```

```
. . .

<table>
        <tr>
                <td valign="top">
                        <img src="img/redbullet.gif" alt="" width="7" height="7">
                </td>
                <td>
                        <a href="example.html" target="formframe">Example</a>
                </td>
        </tr>

. . .
```

Device Recovery procedure

Lastly, if the uploaded firmware crashes the router, follow the steps highlighted below for device recovery.

(1) Power off the unit
(2) Press and hold the RESET button at the rear panel
(3) Power on to reboot the unit
(4) Monitor the Test LED, and keep holding the RESET button until the Test LED changes from blinking to steady ON (which means the boot loader has entered the TFTP recovery mode)
(5) Connect the PC (configured with static IP address 192.168.1.x) to the LAN port of the unit.
(6) Transmit the working firmware image file to the unit (the firmware can be downloaded from Netgear support website):
    * For Windows PC, enter the DOS command:
        tftp -i 192.168.1.1 PUT KWGR614_XXX.bix
    * For a Linux PC, use the command:
        tftp -m binary 192.168.1.1 -c put KWGR614_XXX.bix
    where the “192.168.1.1” is the unit’s LAN IP address and “KWGR614_XXX.bix” is the firmware image file to transmit.
(7) Monitor the Test LED. When it starts blinking, the recovery procedure is complete
(8) Power cycle to reboot KWGR614
(*Repeat the above steps if the procedure is interrupted or failed)