



MIPS® Linux Starter Kit for the RouterStation Pro

Document Number: MD00686

Revision 01.00

December 4, 2009

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1 Introduction

The MIPS® Linux Starter Kit provides a low-cost, high-performance platform for software development and testing of Linux-based embedded devices in a MIPS/Linux environment.

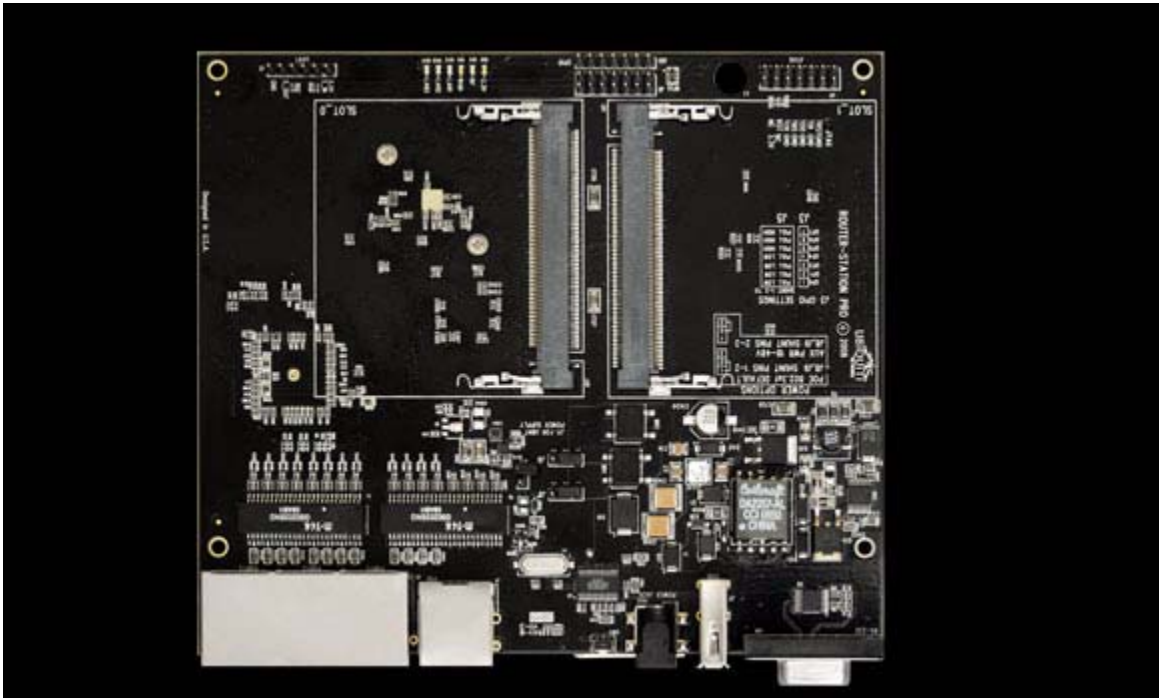
This Guide is intended to help you get up and running quickly using the Ubiquiti Networks RouterStation Pro 680 MHz board with a MIPS32® 24Kc™ CPU. This board is supported by the OpenWrt Linux distribution. OpenWrt is an open-source OS software project that is the *de facto* standard for networking and wireless router applications.

After you have read through this guide, use the OpenWrt website where you will find documentation, downloads, a Wiki, and a Forum for discussion. The RouterStation Pro board and associated software is not directly supported by MIPS Technologies.

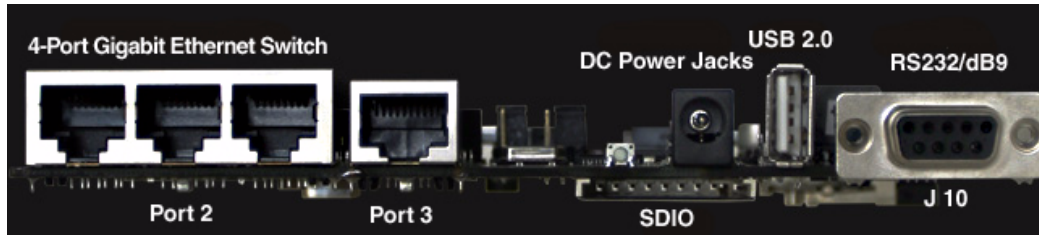
2 Package Contents

The Linux Starter Kit contains the following items:

- This document
- Ubiquiti RouterStation Pro

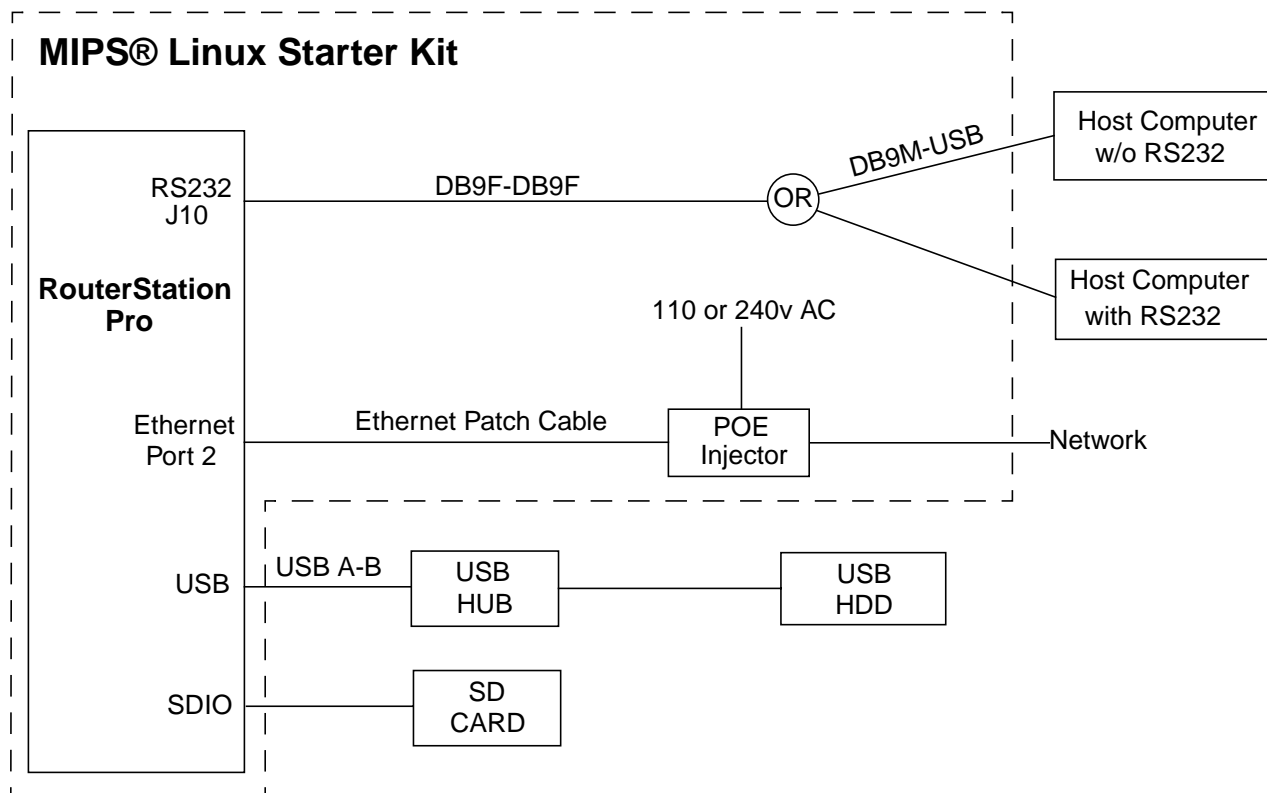


2 Package Contents



- POE (Power Over Ethernet) Injector (Streakwave POE-48i)
- USB to RS232 Connector that supports Windows Vista/XP/2000/ME/98, Linux, and MAC OSX
- Serial cable with DB9 female connectors at both ends, and with straight through (null modem) connections. Pins 1-1, 2-2, 3-3, 4-4, etc.
- 1 meter CAT5 Ethernet cable

The Linux Starter Kit includes a Ubiquiti Networks RouterStation Pro 680 MHz board with a MIPS32® 24Kc™ CPU, Gigabit Ethernet Switch (4 ports), 128MB RAM, 16MB Flash, USB 2.0 Support, SDIO Support, and more. The board firmware is OpenWRT Linux, an open-source OS software standard for networking and wireless router applications. The kit also includes a POE (Power over Ethernet) power supply adapter, a U.S. power cord, 1 meter Ethernet cable, and an RS232 pass-through cable. The user supplies a powered USB hub and uplink cable, a memory stick or USB disk drive, and peripherals.



The Ubiquiti Networks RouterStation Pro board has the following features:

- 802.3af 48V compatible
- 4-Port Gigabit Ethernet Switch
- 128MB RAM
- 16MB Flash
- USB 2.0 Support
- SDIO Support SD Memory Card, J6.
- 680 MHz MIPS® 24Kc™ CPU, fixed Big Endian, Option to overclock to 800
- Robust ESD/Surge Protection for Industrial Applications
- Support for 3 Ubiquiti SR, XR, or SR71 radios
- Built in dB9m connector
- Easy Access to full GPIO signals
- On Board 48V DC power jacks, J502
- Ships with Open-WRT Kamikaze
- For debugging, the MIPSSystem Navigator™ probe (sold separately) can be connected directly to J4.

The POE (Power Over Ethernet) Injector (Streakwave POE-48i), also included in the kit, is an advanced power supply / power inserter with the following features:

- Carrier class power over Ethernet system
- Auto ranging power supply/ inserter
- Built-in Ethernet surge protection to prevent equipment damage
- Overload and short circuit protection
- Minimum cross talk and insertion loss
- Advanced switching technology – runs cool
- Powers clients which accept power on unused Ethernet pins 4, 5, 7, and 8
- FCC and CE approved
- Current indicator (CI) option available

3 Getting Started

To complete the board setup, you will need a powered USB hub and uplink cable, a memory stick or USB disk drive, and a computer running a terminal emulation program to use as a console. Note: International users should use a nationally-approved power supply cord with the external power supply in place of the one provided in the Kit.

1. Plug the POE injector into the WAN Ethernet port marked “POE”. But don’t connect the PSU yet!
2. Connect the RS232 cable between the adapter and your computer, either directly if your computer has an RS232 port or by using the RS232-USB adapter.
3. Start up your favorite terminal program and set to 115200 baud rate, 8-bit data, 1 stop bit, no flow control.
4. Plug in your power supply.
5. In your terminal window, you should now see the board’s boot messages scrolling up the screen. A full boot requires approximately two minutes. When the board has successfully booted, hit the “Enter” key a few times, and a prompt should appear (no login required).
6. Now power up your USB hub and connect the uplink cable to the USB port on the RouterStation Pro. You should see the following message:

```
root@OpenWrt:/# usb 1-1: new high speed USB device using ar71xx-ehci and address 2
usb 1-1: configuration #1 chosen from 1 choice
hub 1-1:1.0: USB hub found
hub 1-1:1.0: 4 ports detected
```

If you plug in your USB hard drive, you should see the following message:

```
root@OpenWrt:/# usb 1-1.4: new high speed USB device using ar71xx-ehci and address
4
usb 1-1.4: configuration #1 chosen from 1 choice
scsi0 : SCSI emulation for USB Mass Storage devices
scsi 0:0:0:0: Direct-Access      ST92011A                3.05 PQ: 0 ANSI: 0
sd 0:0:0:0: [sda] 39070080 512-byte hardware sectors (20004 MB)
sd 0:0:0:0: [sda] Write Protect is off
sd 0:0:0:0: [sda] Assuming drive cache: write through
sd 0:0:0:0: [sda] 39070080 512-byte hardware sectors (20004 MB)
sd 0:0:0:0: [sda] Write Protect is off
sd 0:0:0:0: [sda] Assuming drive cache: write through
sda: sda1 sda2
sd 0:0:0:0: [sda] Attached SCSI disk
yaffs: dev is 8388609 name is "sda1"
yaffs: passed flags ""
yaffs: Attempting MTD mount on 8.1, "sda1"
yaffs: dev is 8388609 name is "sda1"
yaffs: passed flags ""
yaffs: Attempting MTD mount on 8.1, "sda1"
EXT2-fs: sda1: couldn't mount because of unsupported optional features (4).
kjournald starting. Commit interval 5 seconds
EXT3 FS on sda1, internal journal
EXT3-fs: recovery complete.
EXT3-fs: mounted filesystem with ordered data mode.
yaffs: dev is 8388610 name is "sda2"
yaffs: passed flags ""
```

```
yaffs: Attempting MTD mount on 8.2, "sda2"
yaffs: dev is 8388610 name is "sda2"
yaffs: passed flags ""
yaffs: Attempting MTD mount on 8.2, "sda2"
```

The exact message will depend on whether your hard drive was formatted under Linux or Windows.

A `df` command should receive the following response:

```
root@OpenWrt:/# df
Filesystem          1k-blocks      Used Available Use% Mounted on
rootfs              3584          3584         0 100% /
/dev/root           3584          3584         0 100% /rom
tmpfs               31164           36    31128  0% /tmp
tmpfs                512             0        512  0% /dev
mini_fo:/tmp/root   3584          3584         0 100% /tmp/root
/dev/mtdblock3     7552           328     7224  4% /jffs
mini_fo:/jffs      3584          3584         0 100% /
/dev/sda1          18975324     176196  17835232  1% /mnt/usbdrive
```

The board by default is configured as a bridge. This make it suitable to connect port 2 on the board directly to your host computer's Ethernet port with the Ethernet cable provided in the kit.

After you have done that, you can now ssh to the board:

```
LOGIN: = root
PASSWORD: = ubnt
```

3.1 Router Configuration

3.1.1 Ethernet Interface

- J1 Single WAN port 10/100/1000
- J2 Triple LAN Port 10/100/1000
- RGMII Ethernet Logical Ports to Ethernet Phy Switch -
 - 1 RGMII port for WAN Port
 - 1 RGMII port for LAN Ports
- Ethernet Phy switch, Atheros AR8316

3.1.2 Real Time Clock "RTC" Interface

- RTC Interface shares the SPI bus with the on board FLASH
- Active high signal on SPI CS enables RTC; active low signal on SPI CS enables FLASH
- Manufacturer Part# PCF2123TS Datasheet

3.1.3 Supported I/O

UART J3 6-pin Header

Terminal Settings 115200 baud, 8 bits, no parity, 1 stop bit.

| Pin Out | Name |
|---------|--------|
| Pin 1 | 3.3VDC |
| Pin 2 | S_in |
| Pin 3 | NC |
| Pin 4 | NC |
| Pin 5 | S_out |
| Pin 6 | GND |

Use either this header for UART or onboard RS-232 J10.

JTAG Port "J4"

14-Pin header

| Pin Out | Name | Pin Out | Name |
|---------|------|---------|---------|
| Pin 1 | TRST | Pin 2 | GND |
| Pin 3 | TDI | Pin 4 | GND |
| Pin 5 | TDO | Pin 6 | GND |
| Pin 7 | TMS | Pin 8 | GND |
| Pin 9 | TCK | Pin 10 | GND |
| Pin 11 | RST | Pin 12 | NC |
| Pin 13 | NC | Pin 14 | 3.3 VDC |

See [Section 4.3 "Probes & Probe Software"](#).

USER GPIO Header "J33"

Single Row 7-pin Header. Next to it is a J5 dual-row header to enable user-selectable pull-up or pull-down for each GPIO.

J33 Pinout and Strapping option "place shunt to enable strapping option".

| Pin Out | Name | J5 Strapping |
|---------|--------|--------------|
| Pin 1 | GPIO_0 | Pull Low |
| Pin 2 | GPIO_1 | Pull Low |
| Pin 3 | GPIO_3 | Pull Low |
| Pin 4 | GPIO_4 | Pull Low |
| Pin 5 | GPIO_5 | Pull High |

| Pin Out | Name | J5 Strapping |
|---------|--------|--------------|
| Pin 6 | GPIO_6 | Pull High |
| Pin 7 | GPIO_7 | Pull High |

3.1.4 RESET BUTTON "SW4"

Uses GPIO_8 with weak pull-up, Active Low. Used for resetting to factory defaults or multiple functions. Software dependent.

3.1.5 LED INDICATORS

Link/Act signals are connected to the Ethernet Phy Switch.

| LED | Name | Function | GPIO |
|------|-------|-----------|--------|
| D29 | POWER | 3.3VDC | NA |
| D24 | RF | RADIO Act | GPIO_2 |
| DS4 | WAN | Link/Ac | NA |
| DS14 | LAN1 | Link/Ac | NA |
| DS12 | LAN2 | Link/Ac | NA |
| DS13 | LAN3 | Link/Ac | NA |

3.1.6 Configuration Files

Out of the box, the board is *not* configured as a router, so the board configuration files must be modified to allow routing from the WAN to the LAN ports with a firewall.

The network configuration file in `/etc/config` configures the board as a bridge:

```
# Copyright (C) 2006 OpenWrt.org

config 'interface' 'loopback'
    option 'ifname' 'lo'
    option 'proto' 'static'
    option 'ipaddr' '127.0.0.1'
    option 'netmask' '255.0.0.0'

config 'interface' 'lan'
    option 'ifname' 'eth0 eth1'
    option 'type' 'bridge'
    option 'proto' 'static'
    option 'ipaddr' '192.168.1.20'
    option 'netmask' '255.255.255.0'
    option 'dns' ''
    option 'gateway' ''
```

3 Getting Started

To configure the board as a router, the file must be modified, using the UCI interface or *vi*, as follows:

```
# Copyright (C) 2006 OpenWrt.org

config 'interface' 'loopback'
    option 'ifname' 'lo'
    option 'proto' 'static'
    option 'ipaddr' '127.0.0.1'
    option 'netmask' '255.0.0.0'
config 'interface' 'lan'
    option 'ifname' 'eth1'
    option 'proto' 'static'
    option 'ipaddr' '192.168.1.20'
    option 'netmask' '255.255.255.0'
    option 'dns' ''
    option 'gateway' ''

config 'interface' 'wan'
    option 'ifname' 'eth0'
    option 'proto' 'dhcp'
```

3.2 Boot Listing

```
+
ADM6996FC PHY found on MAC0
ADM6996FC PHY found on MAC1
Ethernet eth0: MAC address 00:15:6d:c1:28:00
IP: 192.168.1.20/255.255.255.0, Gateway: 0.0.0.0
Default server: 192.168.1.42
RedBoot(tm) bootstrap and debug environment [ROMRAM]
Ubiquiti Networks certified release, version 0.9.8.03 - built 17:36:44, Dec  8 2008
Copyright (C) 2000, 2001, 2002, 2003, 2004 Red Hat, Inc.
Board: Ubiquiti AR71xx-based board
RAM: 0x80000000-0x84000000, [0x8003abc0-0x83fe1000] available
FLASH: 0xbf000000 - 0xc0000000, 256 blocks of 0x00010000 bytes each.
== Executing boot script in 1.000 seconds - enter ^C to abort
RedBoot> fis load -d -e kernel
Trying LZMA decompression...
Image loaded from 0x80060000-0x8029b086
Image is not ELF, skipping ELF parsing...
RedBoot> exec
Now booting linux kernel:
  Base address 0x80050000 Entry 0x80060000
  Cmdline : console=ttyS0,115200 init=/init
Linux version 2.6.26.8 (jm@hpu) (gcc version 4.1.2) #7 Wed Dec 17 17:00:48 EET 2008
console [early0] enabled
CPU revision is: 00019374 (MIPS 24K)
Determined physical RAM map:
  memory: 04000000 @ 00000000 (usable)
Initrd not found or empty - disabling initrd
Zone PFN ranges:
  Normal      0 ->    16384
Movable zone start PFN for each node
early_node_map[1] active PFN ranges
  0:          0 ->    16384
Built 1 zonelists in Zone order, mobility grouping on.  Total pages: 16256
```

```

Kernel command line: rootfstype=squashfs,yaffs,jffs2 noinitrd console=ttyS0,115200
init=/etc/preinit
Primary instruction cache 64kB, VIPT, 4-way, linesize 32 bytes.
Primary data cache 32kB, 4-way, VIPT, cache aliases, linesize 32 bytes
Writing ErrCtl register=00008102
Readback ErrCtl register=00008102
PID hash table entries: 256 (order: 8, 1024 bytes)
Dentry cache hash table entries: 8192 (order: 3, 32768 bytes)
Inode-cache hash table entries: 4096 (order: 2, 16384 bytes)
Memory: 62128k/65536k available (1830k kernel code, 3340k reserved, 328k data, 128k
init, 0k highmem)
SLUB: Genslabs=6, HWalign=32, Order=0-3, MinObjects=0, CPUs=1, Nodes=1
Mount-cache hash table entries: 512
net_namespace: 644 bytes
NET: Registered protocol family 16
MIPS: machine is Ubiquiti RouterStation
registering PCI controller with io_map_base unset
NET: Registered protocol family 2
IP route cache hash table entries: 1024 (order: 0, 4096 bytes)
TCP established hash table entries: 2048 (order: 2, 16384 bytes)
TCP bind hash table entries: 2048 (order: 1, 8192 bytes)
TCP: Hash tables configured (established 2048 bind 2048)
TCP reno registered
NET: Registered protocol family 1
squashfs: version 3.0 (2006/03/15) Phillip Lougher
Registering mini_fo version $Id$
JFFS2 version 2.2. (NAND) (SUMMARY) © 2001-2006 Red Hat, Inc.
yaffs Dec 17 2008 13:23:02 Installing.
msgmni has been set to 121
io scheduler noop registered
io scheduler deadline registered (default)
Serial: 8250/16550 driver $Revision: 1.90 $ 1 ports, IRQ sharing disabled
serial8250.0: ttyS0 at MMIO 0x18020000 (irq = 11) is a 16550A
console handover: boot [early0] -> real [ttyS0]
ag71xx_mdio: probed
eth0: Atheros AG71xx at 0xb9000000, irq 4
eth1: Atheros AG71xx at 0xba000000, irq 5
Atheros AR71xx SPI Controller driver version 0.2.2
m25p80 spi0.0: mx25l128 (16384 Kbytes)
Searching for RedBoot partition table in spi0.0 at offset 0xfe0000
Searching for RedBoot partition table in spi0.0 at offset 0xff0000
7 RedBoot partitions found on MTD device spi0.0
Creating 7 MTD partitions on "spi0.0":
0x00000000-0x00030000 : "RedBoot"
0x00030000-0x000f0000 : "kernel"
0x000f0000-0x00bd0000 : "rootfs"
mtd: partition "rootfs" set to be root filesystem
mtd: partition "rootfs_data" created automatically, ofs=470000, len=760000
0x00470000-0x00bd0000 : "rootfs_data"
0x00bd0000-0x00fd0000 : "data"
0x00fd0000-0x00ff0000 : "cfg"
0x00ff0000-0x00fff000 : "FIS directory"
0x00fff000-0x01000000 : "RedBoot config"
Atheros AR71xx hardware watchdog driver version 0.1.0
Registered led device: ubnt:green:led0
Registered led device: ubnt:green:led1
Registered led device: ubnt:green:rf
Registered led device: ubnt:green:led3

```

3 Getting Started

```
Registered led device: ubnt:green:led4
Registered led device: ubnt:green:led5
Registered led device: ubnt:green:led6
Registered led device: ubnt:green:led7
TCP vegas registered
NET: Registered protocol family 17
Bridge firewalling registered
802.1Q VLAN Support v1.8 Ben Greear <greearb@candelatech.com>
All bugs added by David S. Miller <davem@redhat.com>
VFS: Mounted root (squashfs filesystem) readonly.
Freeing unused kernel memory: 128k freed
Please be patient, while OpenWrt loads ...
Algorithmics/MIPS FPU Emulator v1.5
- preinit -
Press CTRL-C for failsafe
jffs2 not ready yet; using ramdisk
mini_fo: using base directory: /
mini_fo: using storage directory: /tmp/root
- init -
Please press Enter to activate this console. br-lan: Dropping NETIF_F_UFO since no
NETIF_F_HW_CSUM feature.
device eth0 entered promiscuous mode
eth1: link up (100Mbps/Full duplex)
device eth1 entered promiscuous mode
br-lan: port 2(eth1) entering learning state
br-lan: topology change detected, propagating
br-lan: port 2(eth1) entering forwarding state
br-lan: port 2(eth1) entering disabled state
br-lan: port 2(eth1) entering learning state
br-lan: topology change detected, propagating
br-lan: port 2(eth1) entering forwarding state
NET: Registered protocol family 10
lo: Disabled Privacy Extensions
ADDRCONF(NETDEV_UP): eth0: link is not ready
SCSI subsystem initialized
usbcore: registered new interface driver usbfs
usbcore: registered new interface driver hub
usbcore: registered new device driver usb
ath9k: 0.1
NTFS driver 2.1.29 [Flags: R/O MODULE].
PPP generic driver version 2.4.2
tun: Universal TUN/TAP device driver, 1.6
tun: (C) 1999-2004 Max Krasnyansky <maxk@qualcomm.com>
PPP MPPE Compression module registered
ip6tnl0: Disabled Privacy Extensions
IPv6 over IPv4 tunneling driver
sit0: Disabled Privacy Extensions
Ethernet Channel Bonding Driver: v3.2.5 (March 21, 2008)
bonding: Warning: either miimon or arp_interval and arp_ip_target module parameters
must be specified, otherwise bonding will not detect link failures! see bonding.txt
for details.
ip_tables: (C) 2000-2006 Netfilter Core Team
Driver 'sd' needs updating - please use bus_type methods
ar71xx-ehci ar71xx-ehci: Atheros AR71xx built-in EHCI controller
ar71xx-ehci ar71xx-ehci: new USB bus registered, assigned bus number 1
ar71xx-ehci ar71xx-ehci: irq 3, io mem 0x1b000000
ar71xx-ehci ar71xx-ehci: USB 2.0 started, EHCI 1.00, driver 10 Dec 2004
usb usb1: configuration #1 chosen from 1 choice
```

```

hub 1-0:1.0: USB hub found
hub 1-0:1.0: 2 ports detected
nf_conntrack version 0.5.0 (1024 buckets, 4096 max)
IP2P v0.8.1_rc1 loading
IMQ driver loaded successfully.
    Hooking IMQ before NAT on PREROUTING.
    Hooking IMQ after NAT on POSTROUTING.
ipt_time loading
nf_nat_amanda: Unknown symbol nf_nat_amanda_hook
nf_conntrack_rtsp v0.6.21 loading
nf_nat_rtsp v0.6.21 loading
Ebttables v2.0 registered
ip6_tables: (C) 2000-2006 Netfilter Core Team
ip6_queue: failed to register queue handler
wlan: trunk
ath_hal: module license 'Proprietary' taints kernel.
ath_hal: 2008-10-02 (AR5210, AR5211, AR5212, AR5416, RF5111, RF5112, RF2413,
RF5413, RF2133, RF2425, REGOPS_FUNC, DFS, XR)
ath_rate_minstrel: Minstrel automatic rate control algorithm 1.2 (trunk)
ath_rate_minstrel: look around rate set to 10%
ath_rate_minstrel: EWMA rolloff level set to 75%
ath_rate_minstrel: max segment size in the mrr set to 6000 us
wlan: mac acl policy registered
ath_pci: trunk
ar71xx-ohci ar71xx-ohci: Atheros AR71xx built-in OHCI controller
ar71xx-ohci ar71xx-ohci: new USB bus registered, assigned bus number 2
ar71xx-ohci ar71xx-ohci: irq 14, io mem 0x1c000000
usb usb2: configuration #1 chosen from 1 choice
hub 2-0:1.0: USB hub found
hub 2-0:1.0: 2 ports detected
usbcore: registered new interface driver snd-usb-audio
usbcore: registered new interface driver usbserial
usbserial: USB Serial support registered for generic
usbcore: registered new interface driver usbserial_generic
usbserial: USB Serial Driver core
Initializing USB Mass Storage driver...
usbcore: registered new interface driver usb-storage
USB Mass Storage support registered.
gpio-buttons driver version 0.1.1
input: gpio-buttons as /devices/platform/gpio-buttons/input/input0
usbserial: USB Serial support registered for ark3116
usbcore: registered new interface driver ark3116
usbserial: USB Serial support registered for pl2303
usbcore: registered new interface driver pl2303
pl2303: Prolific PL2303 USB to serial adaptor driver

```

4 Additional Software Support

```
fuse init (API version 7.9)
BusyBox v1.11.3 (2008-12-17 13:03:27 EET) built-in shell (ash)
Enter 'help' for a list of built-in commands.
```

```

|-----|-----|-----|-----|-----|-----|-----|-----|
|   -   |   -   |   -   |   -   |   -   |   -   |   -   |   -   |
|-----|-----|-----|-----|-----|-----|-----|-----|
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-----|-----|-----|-----|-----|-----|-----|-----|
|   | W I R E L E S S   F R E E D O M
KAMIKAZE (bleeding edge, r13658) -----
* 10 oz Vodka      Shake well with ice and strain
* 10 oz Triple sec mixture into 10 shot glasses.
* 10 oz lime juice Salute!
-----
root@OpenWrt:/#
```

4 Additional Software Support

MIPS provides a complete portfolio of tools to address all stages of software development, including state-of-the-art compiler technology, embedded RTOS and Linux support, EJTAG probes, and development boards.

4.1 MIPS® Navigator™ ICS

The MIPS Navigator™ ICS (Integrated Component Suite) is fully integrated with the CodeSourcery SG++ GNU-based Toolchain for MIPS, providing a complete development environment and a rich set of software utilities that is easy to install and use.

The Eclipse environment has rapidly become the embedded industry standard for integrated development environments (IDEs) with software tools and plug-ins from many vendors integrating sophisticated editing, compiling, debugging, and program management tools. MIPS Technologies has leveraged this power and extensibility as a control environment and user interface for developing and debugging MIPS-Based™ embedded systems.

The MIPS Navigator ICS fully supports the MIPS System Navigator™ probes for low-level debugging and hardware bring-up. It organizes and presents the information to the user in a more logical way, for faster debugging of both hardware and software.

There are two versions of the CodeSourcery SG++ toolchain integrated into MIPS Navigator ICS. One version can be used to develop and target bare-iron systems that have no operating system or have a traditional RTOS. The other version is for GNU/Linux targets. This allows a wide range of embedded systems to be developed using this environment.

MIPS Navigator ICS completely automates the installation process for the development environment, including the Eclipse-based IDE, the tool chains, probe software and the MIPSsim™ Instruction Set Simulators. Once installed, it provides sample projects to get the developer started rapidly on new MIPS-Based embedded development projects.

Key Features

- Includes industry standard Eclipse-based CDT and plug-ins
- Includes the CodeSourcery SG++ GNU-based Toolchain for MIPS for both bare-iron targets and GNU/Linux targets

- Provides a complete control center for debugging with MIPS System Navigator probes
- All on-chip and off-chip probe trace features are integrated with the IDE
- Supports multi-core debug with multiple MIPS cores on the EJTAG chain
- Includes MIPSsim CPU Instruction Set Simulators
- Supports all MIPS32 and MIPS64 cores, including the 74K™ and 1004K™ cores
- Optional plug-in available for Hot Spot Analysis (HSA) that graphically displays code execution results using the zero-overhead PC sampling capability of certain MIPS cores and the MIPS System Navigator probes
- Optional debug plug-ins available for the ThreadX-aware RTOS debugger and the Viosoft Arriba Linux debugger
- Optional debug plug-in available for the Viosoft Linux Event Analyzer (LEA)
- Node locked PC or floating licenses available
- Runs on Windows or PC Linux
- Software integrated into a single, easy to use installation

4.2 Eclipse Plug-ins for Debug & Analysis

For advanced debugging and analysis, MIPS Technologies provides Eclipse plug-ins that can be used in the MIPS Navigator ICS environment or any Eclipse-based IDE. These include the Hot Spot Analyzer (HSA) for use with the System Navigator probes, the Arriba Linux Debugger, and the Linux Event Analyzer (LEA) for MIPS-based Linux targets.

4.3 Probes & Probe Software

MIPS Technologies provides the System Navigator® family of EJTAG probes. The System Navigator probes are designed to support the special features and integrated peripherals of the MIPS family of synthesizable cores. The MIPS EJTAG and PDtrace™ features are completely supported.

4.4 CodeSourcery GNU Toolchain for MIPS

CodeSourcery, in partnership with MIPS Technologies, provides releases of the Sourcery G++ GNU Toolchain for the MIPS architecture. Sourcery G++ supports bare-iron (ELF) and GNU/Linux target systems. There are three editions available - Lite, Personal and Professional. These are available for download from CodeSourcery.

4.5 MIPS Linux

MIPS Technologies actively supports, develops, and improves the Linux kernel for the MIPS® architecture, in particular MIPS Technologies cores, the MIPS32® and MIPS64® ISAs and associated ASEs, and the Malta™ platform.

Complete Linux distributions for developers are also available through our partners MontaVista, TimeSys, and Wind River.

5 Applications

Here are some things that you can do with the Router Station Pro board.

1. Build your own version of the firmware and install the new firmware on the board.

WARNING: At the time of this writing, the factory ROM images do not appear to be posted on the manufacturer website. This means that writing your own firmware to the flash on the board is irreversible. You will not be able to go back to the original ROM image, until Ubiquiti makes the required firmware image available on their website.

The RouterStation Pro ships with the Kamikaze release of OpenWrt, an open-source wireless software project. You can download the Kamikaze branch of OpenWrt and build your own version of the OpenWRT firmware. Instructions for doing this are located at: <http://downloads.openwrt.org/kamikaze/8.09.1/docs/openwrt.html>.

To help you get started, here is a brief summary of the steps involved.

- Download using the subversion command:

```
$ svn checkout svn://svn.openwrt.org/openwrt/trunk kamikaze
```

- The OpenWrt firmware is configured much the same way as the build of a Linux kernel. You use the "make menuconfig" command to chose the configuration options. The Linux kernel used in the OpenWrt firmware can be separately configured with the "make kernel_menuconfig" command, which runs the traditional Linux kernel configuration program. So, after downloading, begin by configuring the Linux kernel. You will need to add a few things like USB support and turn on kernel debugging.

```
$ make kernel_menuconfig
```

- Add the following items to the kernel configuration:

Device Drivers -> USB Support ->

Add "Support for Host-Side USB"

Add "USB device filesystem"

Add "EHCI HCD (USB 2.0) Support"

Add "USB EHCI support for AR71xx"

Add "OHCI HCD Support"

Add "USB OHCI support for Atheros AR71xx"

Add "USB Announce New Devices"

Add "USB Mass Storage Support"

Device Drivers -> SCSI Device Support ->

Add "SCSI Device Support"

Add "SCSI Disk Support"

File Systems ->

Add "Ext3 Journaling Filesystem Support"

Kernel Hacking ->

Turn on kernel debugging

Save the kernel configuration and exit.

- Now, configure the OpenWrt firmware.

```
$ make menuconfig
```

Target System -> Atheros AR71XX/AR7240/AR913x

Target Profile -> Ubiquiti RouterStation Pro

Utilities ->

Add gdbserver

Add fconfig (Redboot Configuration Editor)

Utilities -> Disk ->

Add fdisk

- Save configuration changes and build with make:

```
$ make
```

This downloads all toolchain and Linux sources needed, and then builds them. Then the firmware is built, and an image that can be flashed to the ROM is created.

- Once the build has completed, the file that can be flashed to the board is located in the following file, beneath the location where you installed the OpenWrt files:

```
.../bin/openwrt-ar71xx-ubnt-rspro-squashfs.bin
```

You need a tftp server to download this file to the RouterStation Pro board. Copy the file to the tftp directory used by your server.

- You need to verify that your board is connected via the network to your host running the tftp server. Also make sure you have a working console connection to the board during this procedure.
- Restart the board in "Recovery Mode" by holding switch SW4 until the red LED blinks, while turning on the power.

6 Additional Information

- On the host, run the tftp program and connect to the board. Set the mode to binary and use the put command:

```
tftp> binary
tftp> put openwrt-ar71xx-ubnt-rspro-squashfs.bin
```

- When this file is downloaded, the board will flash the new kernel and root file system to the board and automatically reboot.
2. Use the Navigator ICS debugger and a MIPS probe to connect to the running Linux kernel on the board. Set breakpoints, step through, and debug the kernel.

6 Additional Information

There are a number of websites that provide additional information on the RouterStation Pro board:

- Manufacturer site: <http://www.ubnt.com/>
- Ubiquiti Networks Forum: <http://www.ubnt.com/forum/>
- Ubiquiti RouterStation Platform Forum (includes RouterStation pro): <http://www.ubnt.com/forum/forum-display.php?f=23>
- OpenWrt home page: <http://openwrt.org/>

7 Revision History

| Date | Revision | Description |
|------------------|-----------------|--------------------|
| December 4, 2009 | 01.00 | Initial release. |

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