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TABLE OF CONTENTS

1 SDK HISTORY

Release	Features	Platform Support	Schedule
1.2 SDK	OS: Linux 2.4.30 Bootloader: Uboot Toolchain: GNU based cross-compiler Driver: UART, Giga Ethernet, Flash, Wi-Fi Driver Application: Bridging, Routing, NAT, PPPoE, Web server, DHCP client, DHCP server Wi-Fi features: WMM, WMM-PS, WEP, WPA/WPA2 personal, WPA/WPA2 Enterprise	RT2880 Shuttle Support IC+ 5 ports 10/100 Switch Support Marvall Giga Single Phy Support	Formal: 2007/03/20
1.3 SDK	Feature parity with 1.2 SDK plus: Application: NTP, DDNS, WebUI enhance, Vista RG (Native IPv6, LLTD), Firewall Driver: I2C, SPI, GPIO driver Wi-Fi features: Intergraded QA, WPS, mBSSID, WDS, STA mode, 802.1x Concurrent AP support	RT2880 MP Support	Beta: 2007/04/30 Formal: 2007/05/25
2.0 SDK	Feature parity with 1.3 SDK plus: File system support ramdisk and squashfs WebUI: save/restore configure. WPS PIN, WPS PBC, factory default, STA mode support Application: push button to load default configuration (GPIO	None	Beta: 2007/07/06 Formal: 2007/07/20

	reference design) Wi-Fi features: AP-Client Ethernet Converter Support		
2.2 SDK	Feature parity with 2.0 SDK plus: AP version 1.6.0.0 STA version 1.4.0.0 Wi-Fi Certification: 802.11 b/g/n, WPA2, WMM, WMM-PS, WPS Operation Mode reorganization to "Bridge", "Gateway", and "Ethernet Converter" support iNIC driver Support Squash with LZMA file system	Vitesse Switch Support	Formal: 2007/11/08
2.3 SDK	Feature parity with 2.2 SDK plus: iNIC v1.1.6.1 RT2561 driver v1.1.2.0 Spansion Flash Support RT2860 AP driver v1.7 RT2860 STA driver v1.5 RT2561 WebUI Multi-Language WebUI support	IC+ 100Phy Realtek 100Phy	Formal: 2008/01/16
2.4 SDK	Feature parity with 2.3 SDK plus: iNIC v1.1.7.1 RT2860 AP driver v1.8.1.0 RT2860 STA driver v1.6.0.0 Static/Dynamic Routing Content Filtering	Mii iNIC	Formal: 2008/04/07
3.0 SDK	Feature parity with 2.4 SDK plus: OS: Linux 2.6.21 (Linux2.4 for RT2880, Linux-2.6 for RT3052) 8MB Flash Support –	RT3052 Support	Formal: 2008/06/06

	S29GL064N/MX29LV640 Storage Application – FTP/Samba		
3.1 SDK	Feature parity with 3.0 SDK plus: RT2860 AP driver v1.9.0.0 RT2860 STA driver v1.7.0.0 [RT3052] 16MB/32MB NOR flash support [RT3052] Boot from 0xbf00.0000(MA14=1) [RT3052] Boot from 0xbfc0.0000(MA14=0)	RT2880 platforms RT3052 platforms	Formal: 2008/07/30
3.2 SDK	Feature parity with 3.1 SDK plus: RT2860 AP driver v2.0.0.0 RT2860 STA driver v1.8.0.0 GreenAP support Busybox 1.12.1 MTD-Based Flash API	RT2880 platforms RT3050 platforms RT3052 platforms	Formal: 2008/10/06
3.3 SDK	Feature parity with 3.2 SDK plus: RT2860 AP driver v2.2.0.0 RT2860 STA driver v2.1.0.0	RT2880 platforms RT3050 platforms RT3052 platforms	Formal: 2009/04/27
3.4 SDK	Feature parity with 3.3 SDK plus: Ralink Flow Classifier Linux-based Watchdog driver More 3G data card support Video Flow Classification Command User space watchdog daemon	RT2880 platforms RT3050 platforms RT3052 platforms RT3883 platforms RT3662 platforms	Formal: 2010/02/12
3.5 SDK	Feature parity with 3.4 SDK plus: support NAND/SPI/NOR in the same firmware	RT2880 platforms RT3050 platforms RT3052 platforms	Formal: 2010/08/06

	support Hardware NAT on RT3052/RT3883/RT3352 support Software QoS super dmz support support kernel mode pptp/l2tp to improve throughput significantly	RT3883 platforms RT3662 platforms RT3352 platforms RT5350 platforms	
3.6 SDK	Feature parity with 3.5 SDK plus: Support IPv6 Ready logo Support IPv6 MLD multicast proxy/snooping Support skb recycling mechanism Support switch packet count debug Support phy register dump Supprot user and kernel mode watchdog module Support kernel mode nvram Support iPerf Support ebtables	RT2880 platforms RT3050 platforms RT3052 platforms RT3883 platforms RT3662 platforms RT3352 platforms RT5350 platforms	Formal: 2011/07/15
4.0 SDK	Feature parity with 3.6 SDK support IPv6 Rapid Deployment support IPv6 DS-Lite support two giga phy port display AP Client site_survey	RT2880 platforms RT3050 platforms RT3052 platforms RT3883 platforms RT3662 platforms RT3352 platforms RT5350 platforms RT6855 platforms RT6856 platforms	Formal: 2012/02/22
4.1 SDK	Feature parity with 4.0 SDK plus:	RT2880 platforms RT3050 platforms RT3052 platforms RT3883 platforms	

		RT3662 platforms RT3352 platforms RT5350 platforms RT6855 platforms RT6856 platforms MT7620 platforms	
4.2 SDK	Feature parity with 4.1 SDK plus: GCC 4.6.3 compiler. uClibc 0.9.33 Samba 3.6.6 Support software QoS for linux 2.6.36 Add SFQ schedule for SW QoS Shrink memory requirement Support ethtool for linux 2.6.36 Support PPTP/L2TP accelerator Support lighthttpd web server (BSD licensed) Support port trigger Support NFC MT6605	RT2880 platforms RT3050 platforms RT3052 platforms RT3883 platforms RT3662 platforms RT3352 platforms RT5350 platforms RT6855 platforms RT6856 platforms MT7620 platforms MT7621 platforms	Formal:2013/10/31

2 VERSION HISTORY

Release	Features	Date	Author
1.2	Initial release		Steven Liu
1.3	WebUI – NTP/DDNS, iNIC I2C, SPI, GPIO Linux driver		Steven Liu
2.0	Squashfs tools installation WebUI - save/restore configure. WPS , factory default WebUI – STA, Ethernet Converter mode		Steven Liu
2.2	WebUI - Operation Mode reorganization How to downsize image		Steven Liu
2.3	How to control GPIO and LED Install mksquashfs Utility Describes Uboot configuration file Add new parameter in default setting		Steven Liu
2.4	WebUI – How to save the configurations to the flash		Winfred Lu
3.0	Updated for RT3052 Chapter Re-organization		Steven Liu
3.1	Update default parameter for LED firmware Update GPIO definition for RT3052 platform Update FAQ		Steven Liu
3.2	Reorganize user manual Update FAQ -How to enable NFS Client -How to add new language to webUI		Steven Liu / Winfred

	- How to Power down rt305x Ethernet ports - How to enable USB storage in RT305x platform -How to enable USB automount in RT305x platform	
3.3	Update FAQ -How to enable software QoS - How to enable USB Ethernet - How to build a single image for the RT2880 8M flash platform - How to start printer server -How to force link speed	Steven
3.4	- How to burn SPI Uboot firmware -How to enable new watchdog -How to verify IGMP snooping	Steven
3.5	- Update "How to enable Software QoS"	YY
3.6	- Update "NVRAM" - Update "How to enable watchdog" - EHCI/OHCI USB Power Saving - Auto-frequency and Power Saving - Concurrent AP porting Guide - SuperDMZ usage guide - How to support IPv6 Ready Logo - How to enable iPerf tool - How to enable ebtables	Red
4.0	- Update concurrent AP porting Guide - How to enable 6RD - How to enable DS-Lite	Roger/Steven/Red
4.1	- Update APSoC chip support	Red
4.2	- Update MT7621 Parts	Steven

3 OVERVIEW OF THE RALINK AP DEMO BOARD

3.1 RT2880

The RT2880 SOC combines Ralink's 802.11n draft compliant 2T3R MAC/BBP, a high performance 266-MHz MIPS4KEc CPU core, a Gigabit Ethernet MAC and a PCI host/device, to enable a multitude of high performance, cost-effective 802.11n applications. The RT2880 has two RF companion chips: The RT2820, for 2.4G-band operation; and the RT2850, for dual band 2.4G or 5G operations. In addition to traditional AP/router applications, the chipset can be implemented as a WLAN "intelligent" NIC, drastically reducing the load on the host SOC, such as DSL/Cable or Multimedia Applications processors. Users can treat the WLAN iNIC as a simple Ethernet device for easy porting and guaranteed 802.11n WLAN performance without the need to upgrade to an expensive host SOC.

Figure 1 The RT2880 Demo Board

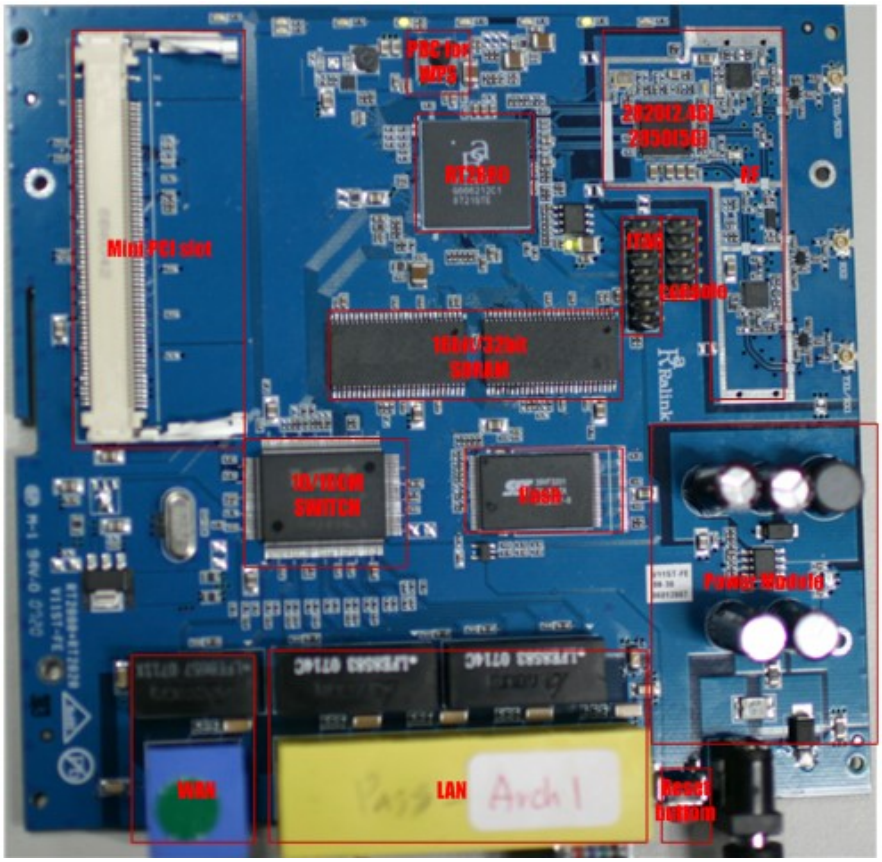


Table 1 RT2880 Memory Mapping

Address Range (hex)			Size	Block Name
0000.0000	-	001F.FFFF	2M	Reserved
0020.0000	-	0020.1FFF	8K	Reserved
0020.2000	-	0020.3FFF	8K	Reserved
0020.2000	-	0020.5FFF	8K	Reserved
0020.6000	-	002F.FFFF	1024K	Reserved
0030.0000	-	0030.00FF	256	System Control
0030.0100	-	0030.01FF	256	Timer
0030.0200	-	0030.02FF	256	Interrupt Controller
0030.0300	-	0030.03FF	256	Memory Controller
0030.0400	-	0030.04FF	256	Reserved
0030.0500	-	0030.05FF	256	UART
0030.0600	-	0030.06FF	256	Programmable I/O
0030.0700	-	0030.07FF	256	Reserved
0030.0800	-	0030.08FF	256	Reserved
0030.0900	-	0030.09FF	256	I2C
0030.0A00	-	0030.0AFF	256	Reserved

0030.0B00	-	0030.0BFF	256	SPI
0030.0C00	-	0030.0CFF	256	UART Lite
0030.0D00	-	0030.0DFF	256	Reserved
0030.0F00	-	0030.0FFF	256	Reserved
0030.1000	-	0030.FFFF	1020K	Reserved
0040.0000	-	0040.FFFF	64K	Frame Engine
0041.0000	-	0041.FFFF	64K	Embedded 16KB ROM (wrap-around in the 64KB space)
0042.0000	-	0042.FFFF	64K	PCM Controller
0043.0000	-	0043.FFFF	64K	Reserved
0044.0000	-	0047.FFFF	256K	PCI Host/Device Controller
0048.0000	-	004B.FFFF	256K	802.11n MAC/BBP
004C.0000	-	004F.FFFF	256K	Reserved
0050.0000	-	0053.FFFF	256K	Reserved
0054.0000	-	007F.FFFF	2816K	Reserved
0080.0000	-	0080.7FFF	32K	Reserved
0080.8000	-	0080.FFFF	32K	Reserved
0081.0000	-	0081.FFFF	64K	Reserved
0082.0000	-	0082.FFFF	64K	Reserved

0083.0000	-	0083.FFFF	64K	Reserved
0084.0000	-	0088.FFFF	256K	Reserved
0100.0000	-	01FF.FFFF	16M	External SRAM
0800.0000	-	0BFF.FFFF	64M	SDRAM
0C00.0000	-	0FFF.FFFF	64M	SDRAM
1000.0000	-	1003.FFFF	256K	Reserved
1004.0000	-	1007.FFFF	256K	Reserved
1008.0000	-	100B.FFFF	256K	Reserved
100C.0000	-	100F.FFFF	256K	Reserved
1010.0000	-	1BFF.FFFF	192M	Reserved
1C00.0000	-	1FFF.FFFF	64M	External Flash
2000.0000	-	2FFF.FFFF	256M	PCI Memory Space
3000.0000	-	FFFF.FFFF	3.25G	Reserved

3.2 RT3052

The RT3052 SOC combines Ralink's 802.11n draft compliant 2T2R MAC/BBP/RF, a high performance 384MHz MIPS24KEc CPU core, 5-port integrated 10/100 Ethernet switch/PHY, an USB OTG and a Gigabit Ethernet MAC. There are very few external components required for 2.4GHz 11n wireless products with the RT3052. It employs Ralink's 2nd generation 11n technologies for longer range and better throughput. The embedded high performance CPU can process advanced applications effortlessly, such as routing, security and VOIP. The USB port can be configured to access external storage for Digital Home applications. The RT3052 also has rich hardware interfaces (SPI/I2S/I2C/UART/GMAC) to enable many possible applications.

Figure 2 The RT3052 Demo Board

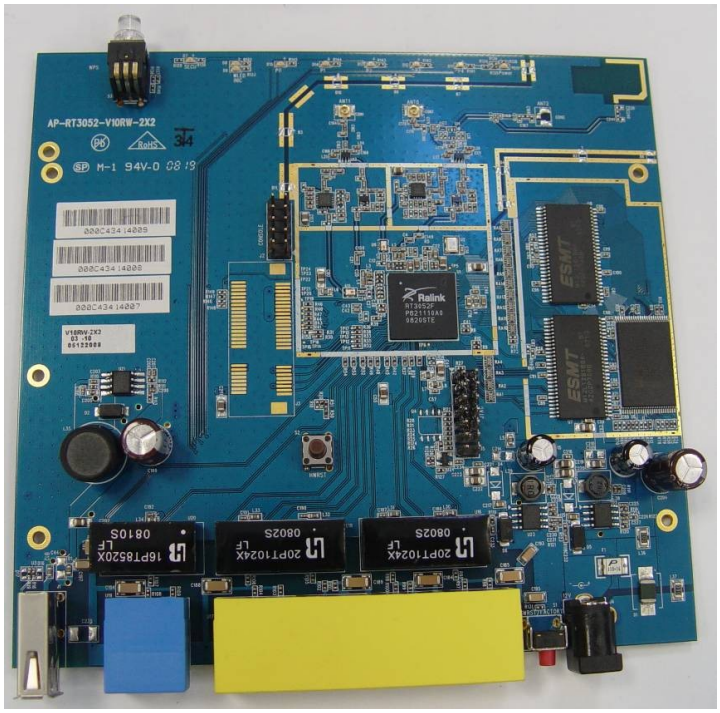


Table 2 RT3052 Memory Mapping

0000.0000	-	03FF.FFFF	64M	SDRAM

0400.0000	-	0FFF.FFFF		<<Reserved>>
1000.0000	-	1000.00FF	256	SYSCTL
1000.0100	-	1000.01FF	256	TIMER
1000.0200	-	1000.02FF	256	INTCTL
1000.0300	-	1000.03FF	256	MEM_CTRL (SDRAM & Flash/SRAM)
1000.0400	-	1000.04FF	256	PCM
1000.0500	-	1000.05FF	256	UART
1000.0600	-	1000.06FF	256	PIO
1000.0700	-	1000.07FF	256	Generic DMA
1000.0800	-	1000.08FF	256	NAND Flash Controller
1000.0900	-	1000.09FF	256	I2C
1000.0A00	-	1000.0AFF	256	I2S
1000.0B00	-	1000.0BFF	256	SPI
1000.0C00	-	1000.0CFF	256	UARTLITE
1000.0D00	-	100F.FFFF		<<Reserved>>
1010.0000	-	1010.FFFF	64K	Frame Engine
1011.0000	-	1011.7FFF	32K	Ethernet Switch
1011.8000		1011.9FFF	8K	ROM

1011_a000		1011_FFFF		<<Reserved>>
1012.0000	-	1012.7FFF	32K	<<Reserved>>
1012.8000		1012.FFFF	32K	<<Reserved>>
1013.0000	-	1013.7FFF	32K	<<Reserved>>
1013.8000	-	1013.FFFF	32K	<<Reserved>>
1014.0000	-	1017.FFFF	256K	<<Reserved>>
1018.0000	-	101B.FFFF	256K	802.11n MAC/BBP
101C.0000	-	101F.FFFF	256K	USB OTG
1020.0000	-	1AFF.FFFF		<<Reserved>>
1B00.0000	-	1BFF.FFFF	16MB	External SRAM/Flash
1C00.0000	-	1EFF.FFFF		<<Reserved>>
1F00.0000	-	1FFF.FFFF	16MB(flash) or 4KB(ram) or 8KB(rom)	When BOOT_FROM = 2'b00, <16MB external 16-bit flash is mapped. When BOOT_FROM = 2'b01, <8MB external 8-bit flash is mapped. When BOOT_FROM = 2'b10, 4KB internal boot RAM is mapped for boot from NAND application. When BOOT_FROM = 2'b11, 8KB internal boot ROM is mapped for iNIC application.

3.3 RT3883

The RT3883 SOC combines Ralink's 802.11n draft compliant 3T3R MAC/BBP/RF, a high performance 500MHz MIPS74Kec CPU core, a Gigabit Ethernet MAC, and a USB Host/Device. With the RT3883, there are very few external components required for 2.4/5GHz 11n wireless products. The RT3883 employs Ralink 2nd generation 11n technologies for longer range and better throughput. The embedded high performance CPU can process advanced applications effortlessly, such as WI-FI data processing without overloading the host processor. In addition, the RT3883 has rich hardware interfaces (SPI/ I2S/ I2C/ PCM/ UART/ USB/ PCI/ PCIe/ RGMII/ MII) to enable many possible applications.

Figure 3 The RT3883 Demo Board

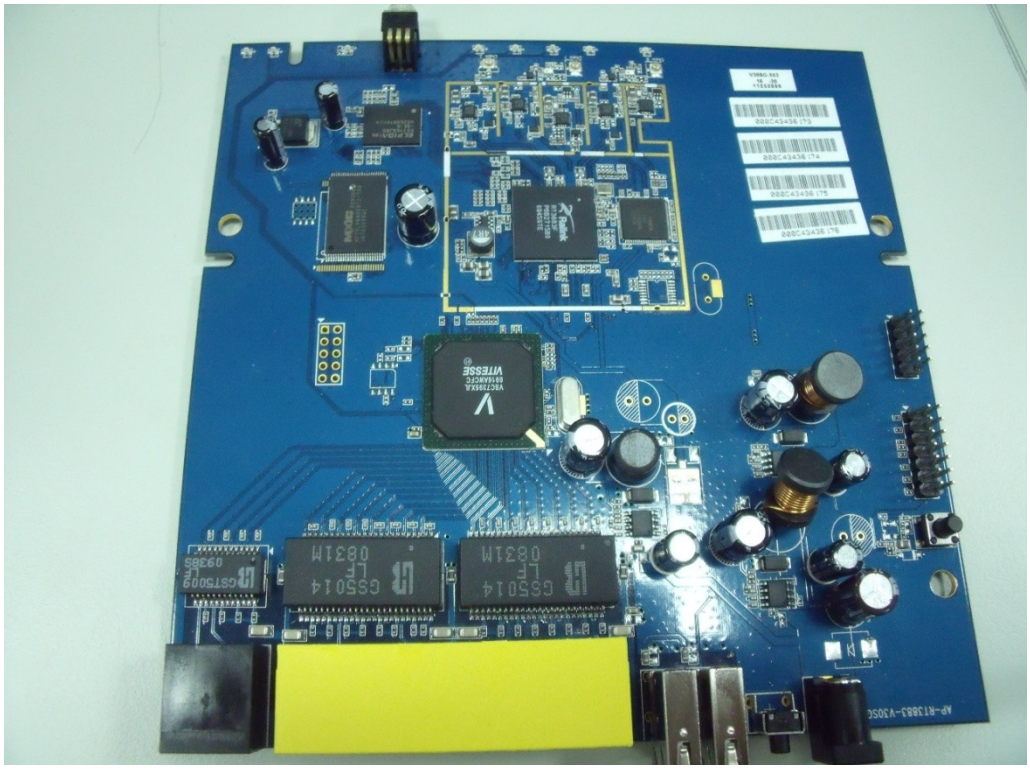


Table 3 RT3883 Memory Mapping

Start		End	Size	Description
0000.0000	-	0FFF.FFFF	256 M	DDR2 256MB/SDRAM 128MB
1000.0000	-	1000.00FF	256	SYSCTL
1000.0100	-	1000.01FF	256	TIMER
1000.0200	-	1000.02FF	256	INTCTL
1000.0300	-	1000.03FF	256	MEM_CTRL (SDR/DDR)
1000.0400	-	1000.04FF	256	<<Reserved>>
1000.0500	-	1000.05FF	256	UART
1000.0600	-	1000.06FF	256	PIO
1000.0700	-	1000.07FF	256	Flash Controller (NOR/SRAM)
1000.0800	-	1000.08FF	256	NAND Controller
1000.0900	-	1000.09FF	256	I2C
1000.0A00	-	1000.0AFF	256	I2S
1000.0B00	-	1000.0BFF	256	SPI
1000.0C00	-	1000.0CFF	256	UARTLITE
1000.0D00	-	1000.0DFF		<<Reserved>>
1000.2000	-	1000.27FF	2 K	PCM (up to 16 channel)

1000.2800	-	1000.2FFF	2 K	Generic DMA (up to 64 channel)
1000.3000	-	1000.37FF	2 K	CODEC 1
1000.3800	-	1000.3FFF	2 K	CODEC 2
1000.4000	-	100F.FFFF		<<Reserved>>
1010.0000	-	1010.FFFF	64 K	Frame Engine
1011.0000	-	1011.7FFF	32 K	<<Reserved>>
1011.8000		1011.BFFF	16 K	ROM
1011.C000	-	1011.FFFF	16 K	<<Reserved>>
1012.0000	-	1012.7FFF	16 K	USB Device
1012.8000	-	1012.FFFF	16 K	<<Reserved>>
1013.0000	-	1013.7FFF	32 K	<<Reserved>>
1013.8000	-	1013.FFFF	32 K	<<Reserved>>
1014.0000	-	1017.FFFF	256 K	PCI/ PCI Express
1018.0000	-	101B.FFFF	256 K	802.11n MAC/BBP
101C.0000	-	101F.FFFF	256 K	USB Host
1020.0000	-	1023.FFFF	256 K	<<Reserved>>
1024.0000	-	1027.FFFF	256 K	<<Reserved>>
1028.0000	-	1BFF.FFFF		<<Reserved>>

1C00.0000	-	1DFF.FFFF	16KB ROM or 32MB 16-bit Flash or 16MB 8-bit Flash	When BOOT_FROM = 3'b000, up-to 32MB external 16-bit flash is mapped. When BOOT_FROM = 3'b001, up-to 16MB external 8-bit flash is mapped. When BOOT_FROM = 3'b010/3'b011/3'b100, 16KB internal boot ROM is mapped.
1E00.0000	-	1FFF.FFFF		External SRAM/Flash
2000.0000	-	2FFF.FFFF	256 M	PCI/PCIe Memory Space

3.4 RT3352

The RT3352 SOC combines Ralink's 802.11n draft compliant 2T2R MAC/BBP/PA/RF, a high performance 400MHz MIPS24KEc CPU core, a Gigabit Ethernet MAC, 5-pors integrated 10/100 Ethernet Swtich/PHY and an USB Host/Device. With the RT3352, there are very few external components required for 2.4GHz 11n wireless products. The RT3352 employs Ralink 2nd generation 11n technologies for longer range and better throughput. The embedded high performance CPU can process advanced applications effortlessly, such as WIFI data processing without overloading the host processor. In addition, the RT3352 has rich hardware interfaces (SPI/ I2S/ I2C/ PCM/ UART/ USB/ GMAC) to enable many possible applications.

Figure 4 The RT3352 Demo Board

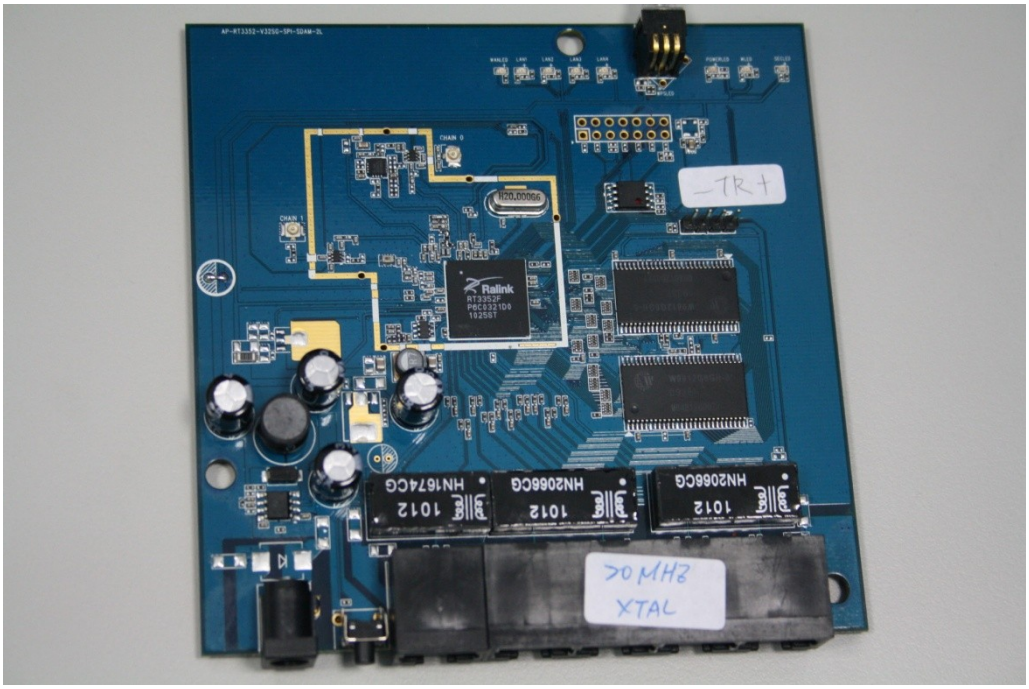


Table 4 RT3352 Memory Mapping

Start		End	Size	Description
0000.0000	-	0FFF.FFFF	256 M	DDR2 256MB/SDRAM 128MB
1000.0000	-	1000.00FF	256	SYSCTL

1000.0100	-	1000.01FF	256	TIMER
1000.0200	-	1000.02FF	256	INTCTL
1000.0300	-	1000.03FF	256	MEM_CTRL (SDR/DDR)
1000.0400	-	1000.04FF	256	<<Reserved>>
1000.0500	-	1000.05FF	256	UART
1000.0600	-	1000.06FF	256	PIO
1000.0700	-	1000.07FF	256	<<Reserved>>
1000.0800	-	1000.08FF	256	<<Reserved>>
1000.0900	-	1000.09FF	256	I2C
1000.0A00	-	1000.0AFF	256	I2S
1000.0B00	-	1000.0BFF	256	SPI
1000.0C00	-	1000.0CFF	256	UARTLITE
1000.0D00	-	1000.0DFF	256	MIPS CNT
1000.2000	-	1000.27FF	2 K	PCM (up to 16 channel)
1000.2800	-	1000.2FFF	2 K	Generic DMA (up to 64 channel)
1000.3000	-	1000.37FF	2 K	<<Reserved>>
1000.3800	-	1000.3FFF	2 K	<<Reserved>>
1000.4000	-	100F.FFFF		<<Reserved>>

1010.0000	-	1010.FFFF	64 K	Frame Engine
1011.0000	-	1011.7FFF	32 K	Ethernet Swtich
1011.8000		1011.BFFF	16 K	ROM
1011.C000	-	1011.FFFF	16 K	<<Reserved>>
1012.0000	-	1012.7FFF	16 K	USB Device
1012.8000	-	1012.FFFF	16 K	<<Reserved>>
1013.0000	-	1013.7FFF	32 K	<<Reserved>>
1013.8000	-	1013.FFFF	32 K	<<Reserved>>
1014.0000	-	1017.FFFF	256 K	<<Reserved>>
1018.0000	-	101B.FFFF	256 K	802.11n MAC/BBP
101C.0000	-	101F.FFFF	256 K	USB Host
1020.0000	-	1023.FFFF	256 K	<<Reserved>>
1024.0000	-	1027.FFFF	256 K	<<Reserved>>
1028.0000	-	1BFF.FFFF		<<Reserved>>
1C00.0000	-	1C00.3FFF	16KB ROM	When system is power on, 16KB internal boot ROM is mapped.

3.5 RT5350

The RT5350 SOC combines Ralink's 802.11n draft compliant 1T1R MAC/BBP/PA/RF, a high performance 360MHz MIPS24KEc CPU core, 5-ports integrated 10/100 Ethernet Swtich/PHY and an USB Host/Device. With the RT5350, there are very few external components required for 2.4GHz 11n wireless products. The RT5350 employs Ralink 2nd generation 11n technologies for longer range and better throughput. The embedded high performance CPU can process advanced applications effortlessly, such as WIFI data processing without overloading the host processor. In addition, the RT5350 has rich hardware interfaces (SPI/ I2S/ I2C/ PCM/ UART/ USB) to enable many possible applications.

Figure 5 The RT5350 Demo Board

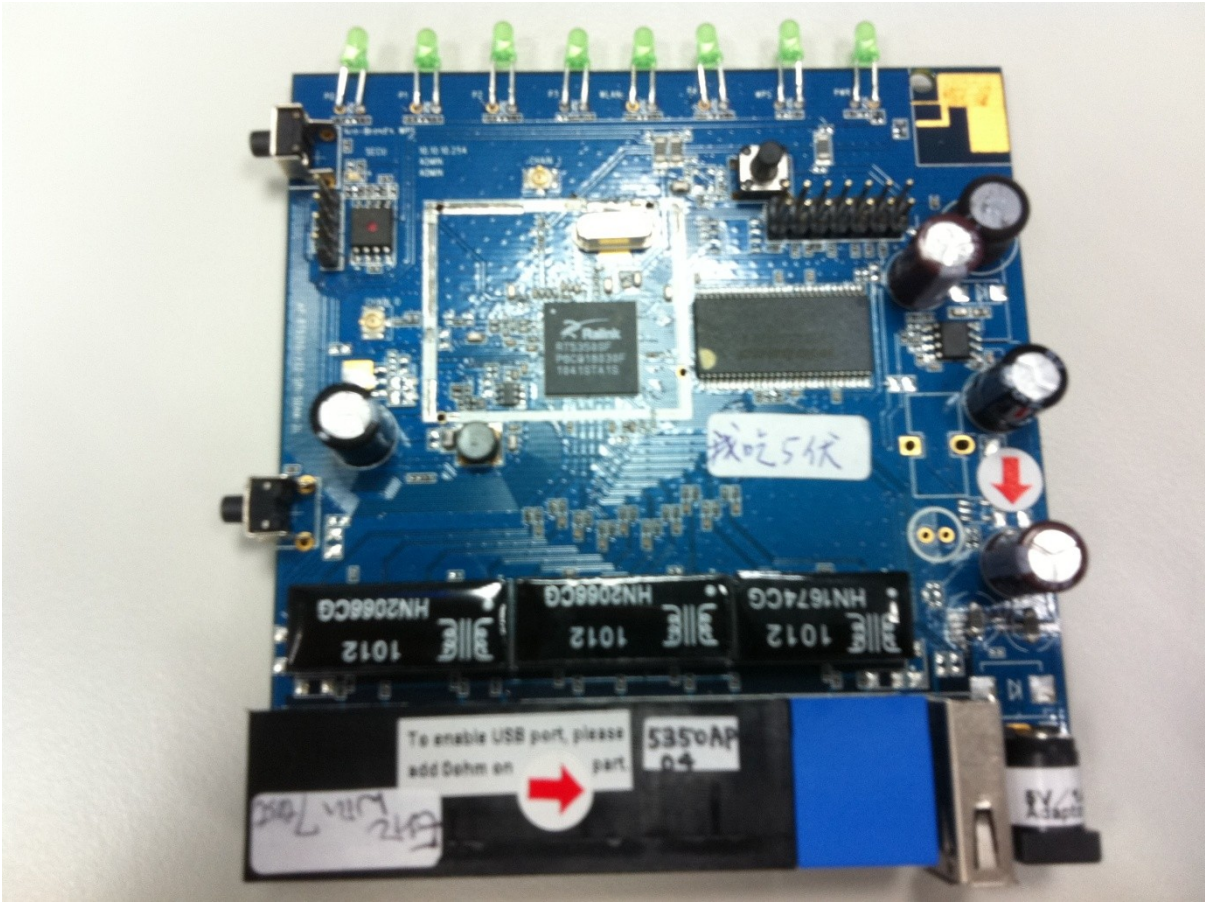


Table 5 RT5350 Memory Mapping

Start		End	Size	Description
0000.0000	-	03FF.FFFF	64 M	SDRAM 64MB
0400.0000	-	0FFF.FFFF	192M	Reserved
1000.0000	-	1000.00FF	256	SYSCTL
1000.0100	-	1000.01FF	256	TIMER
1000.0200	-	1000.02FF	256	INTCTL
1000.0300	-	1000.03FF	256	MEM_CTRL (SDR)
1000.0400	-	1000.04FF	256	<<Reserved>>
1000.0500	-	1000.05FF	256	UART
1000.0600	-	1000.06FF	256	PIO
1000.0700	-	1000.07FF	256	Reserved>>
1000.0800	-	1000.08FF	256	Reserved>>

1000.0900	-	1000.09FF	256	I2C
1000.0A00	-	1000.0AFF	256	I2S
1000.0B00	-	1000.0BFF	256	SPI
1000.0C00	-	1000.0CFF	256	UARTLITE
1000.0D00	-	1000.0DFF	256	MIPS CNT
1000.2000	-	1000.27FF	2 K	PCM (up to 16 channel)
1000.2800	-	1000.2FFF	2 K	Generic DMA (up to 64 channel)
1000.3000	-	1000.37FF	2 K	Reserved>>
1000.3800	-	1000.3FFF	2 K	Reserved>>
1000.4000	-	100F.FFFF		<<Reserved>>
1010.0000	-	1010.FFFF	64 K	Frame Engine
1011.0000	-	1011.7FFF	32 K	Ethernet Swtich

1011.8000		1011.BFFF	16 K	ROM
1011.C000	-	1011.FFFF	16 K	<<Reserved>>
1012.0000	-	1012.7FFF	16 K	USB Device
1012.8000	-	1012.FFFF	16 K	<<Reserved>>
1013.0000	-	1013.7FFF	32 K	<<Reserved>>
1013.8000	-	1013.FFFF	32 K	<<Reserved>>
1014.0000	-	1017.FFFF	256 K	Reserved>>
1018.0000	-	101B.FFFF	256 K	802.11n MAC/BBP
101C.0000	-	101F.FFFF	256 K	USB Host
1020.0000	-	1023.FFFF	256 K	<<Reserved>>
1024.0000	-	1027.FFFF	256 K	<<Reserved>>
1028.0000	-	1BFF.FFFF		<<Reserved>>

1C00.0000	-	1C00.3FFF	16KB ROM	When system is power on, 16KB internal boot ROM is mapped.

3.6 RT6855

Best in Class Network Processors for 802.11n AP/Router

High performance yet cost-effective network processor, that enable scalable Wi-Fi AP/Router designs when combined with Ralink 1x1, 2x2, 3x3 802.11n and 802.11ac wireless chips.

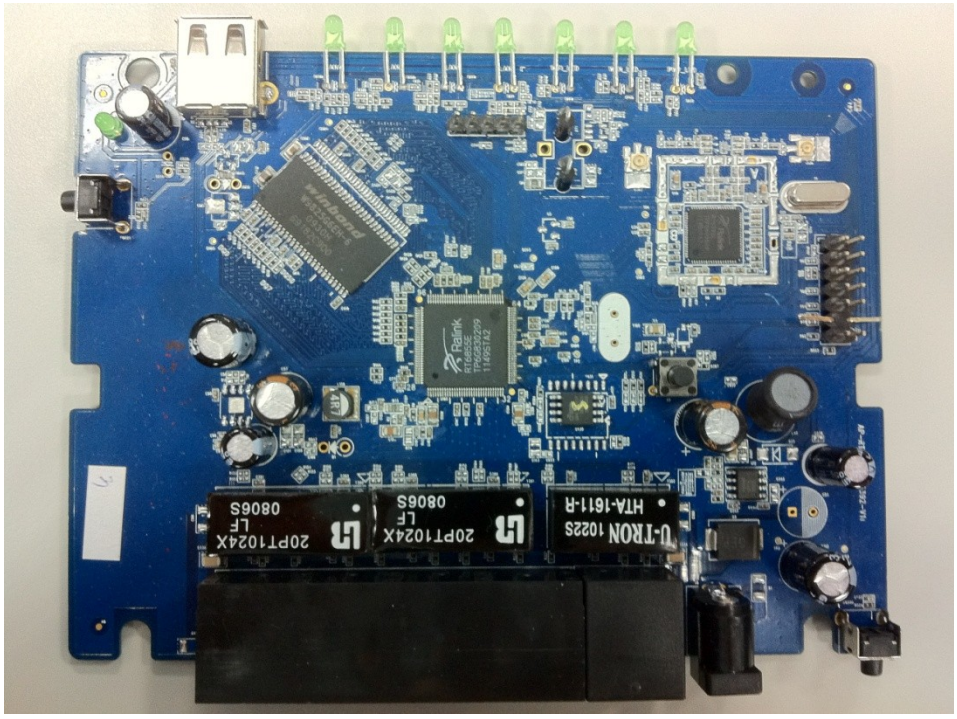
¬ Integrated with a 32-bit MIPS 34Kc CPU, a 5-port 10/100 switch, PCI express port, USB port interface

¬ iNIC (Intelligent NIC) design that provides an easy and ideal solution to add high performance 802.11n/ 802.11ac to any embedded platforms.

Overview:

The RT6855 single chip network processor series contains , an 32-bit MIPS ® 34Kc™ CPU core, a 5-port 10/100 Ethernet switch and a rich array of interfaces to enable interoperability with many possible applications, such as dual PCI express port to connect to 802.11n wireless chip, USB 2.0 port for network storage, 3/4G connectivity, and SPI Flash memory interface to support large bandwidth applications through the AP/router.

Figure 6 The RT6855 Demo Board



3.7 RT6856

Best in Class Network Processors for High Performance 802.11n AP/Router

High performance yet cost-effective network processor, that enable scalable Wi-Fi AP/Router designs when combined with Ralink 1x1, 2x2, 3x3 802.11n and 802.11ac wireless chips.

¬ Integrated with a 32-bit MIPS 34Kc CPU, a 5-port 10/100 switch, dual PCI express ports, USB ports interface

¬ iNIC (Intelligent NIC) design that provides an easy and ideal solution to add high performance 802.11n/ 802.11ac to any embedded platforms.

Overview:

The RT6855 single chip network processor series contains , an 32-bit MIPS ® 34Kc™ CPU core, a 5-port 10/100 Ethernet switch and a rich array of interfaces to enable interoperability with many possible applications, such as dual PCI express port to connect to 802.11n wireless chip, USB 2.0 port for network storage, 3/4G connectivity and printing, PCM interface for analog and VoIP telephony, and an I2S interface for audio streaming, and dual SPI Flash memory interface to support large bandwidth applications through the AP/router.

Figure 7 The RT6856 Demo Board

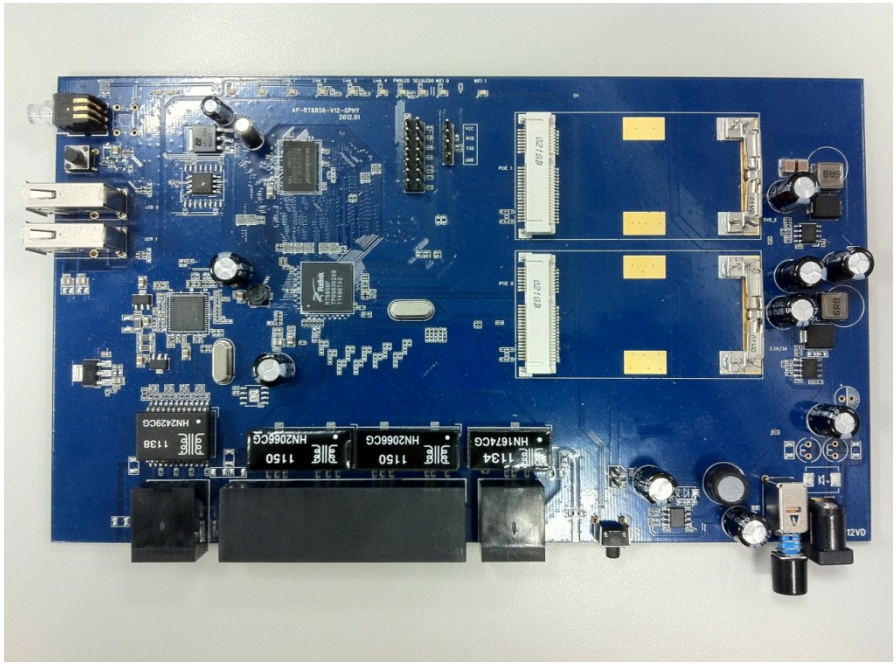


Table 6 RT6856 Memory Mapping

Module	Physical Memory Map
PCIe RC IO	0x1F60_0000 ~ 0x1F60_FFFF
PCIe RC Memory	0x1F70_0000 ~ 0x1F8F_FFFF 0x2000_0000 ~ 0x2FFF_FFFF
System control unit	0x1FB0_0000 ~ 0x1FB0_FFFF
SMC	0x1FB1_0000 ~ 0x1FB1_FFFF

DMC	0x1FB2_0000 ~ 0x1FB2_FFFF
GDMA	0x1FB3_0000 ~ 0x1FB3_FFFF
Interrupt controller	0x1FB4_0000 ~ 0x1FB4_FFFF
Frame Engine	0x1FB5_0000 ~ 0x1FB5_7FFF
Switch	0x1FB5_8000 ~ 0x1FB5_FFFF
ATM SAR	0x1FB6_0000 ~ 0x1FB6_FFFF
Crypto Engine	0x1FB7_0000 ~ 0x1FB7_FFFF
PCIe RC configuration address	0x1FB8_0020
PCIe RC configuration data	0x1FB8_0024
SPI master controller	0x1FBC_0000 ~ 0x1FBC_FFFF
PCM	0x1FBD_0000 ~ 0x1FBD_FFFF
NFC	0x1FBE_0000 ~ 0x1FBE_FFFF

UART	0x1FBF_0000 ~ 0x1FBF_00FF
Timers	0x1FBF_0100 ~ 0x1FBF_01FF
GPIO	0x1FBF_0200 ~ 0x1FBF_02FF
UART2	0x1FBF_0300 ~ 0x1FBF_03FF

3.8 MT7620

The MT7620 router-on-a-chip includes an 802.11n MAC and baseband, a 2.4 GHz radio and FEM, a 580 MHz MIPS® 24K™ CPU core, a 5-port 10/100 switch and two RGMII. The MT7620 includes everything needed to build an AP router from a single chip. The embedded high performance CPU can process advanced applications effortlessly, such as routing, security and VoIP. The MT7620 also includes a selection of interfaces to support a variety of applications, such as a USB port for accessing external storage.

The following table covers the main features offered by the MT7620N and MT7620A. Overall, the MT7620N supports the requirements of an entry-level AP/router, while the more advanced MT7620A supports a number of interfaces together with a large maximum RAM capacity.

Features	MT7620N	MT7620A
CPU	MIPS24KEc (580 MHz)	MIPS24KEc (580 MHz)
Total DMIPs	580 x 1.6 DMIPs	580 x 1.6 DMIPs
I-Cache, D-Cache	64 KB, 32 KB	64 KB, 32 KB

Features	MT7620N	MT7620A
L2 Cache	n/a	n/a
HNAT/HQoS	HNAT	HNAT 2 Gbps forwarding
Memory		
DRAM Controller	16 b	16 b
SDRAM	512 Mb, 120 MHz	512 Mb, 120 MHz
DDR1	512 Mb, 193 MHz	1 Gb, 193 MHz
DDR2	n/a	2 Gb, 193 MHz
NAND	n/a	Small page 512Byte (max 512M bit) Large page 2Kbyte (max 8G bit)
SPI Flash	3B addr mode (max 128Mbit) 4B addr mode (max 512Mbit)	3B addr mode (max 128Mbit) 4B addr mode (max 512Mbit)
SD	n/a	SD-HC class 10 (32GB)
RF	2T2R 802.11n 2.4 GHz	2T2R 802.11n 2.4 GHz
PCIe	n/a	1
USB 2.0	1	1
Switch	5p FE SW	5p FE SW + RGMII(1) 4p FE SW + RGMII(2)
I2S	n/a	1

Features	MT7620N	MT7620A
PCM	n/a	1
I2C	1	1
UART	1 (Lite)	2 (Lite/Full)
JTAG	1	1
Package	DRQFN148- 12 mm x 12 mm	TFBGA265- 11 mm x 11 mm

Figure 8 MT7620N Demo Board

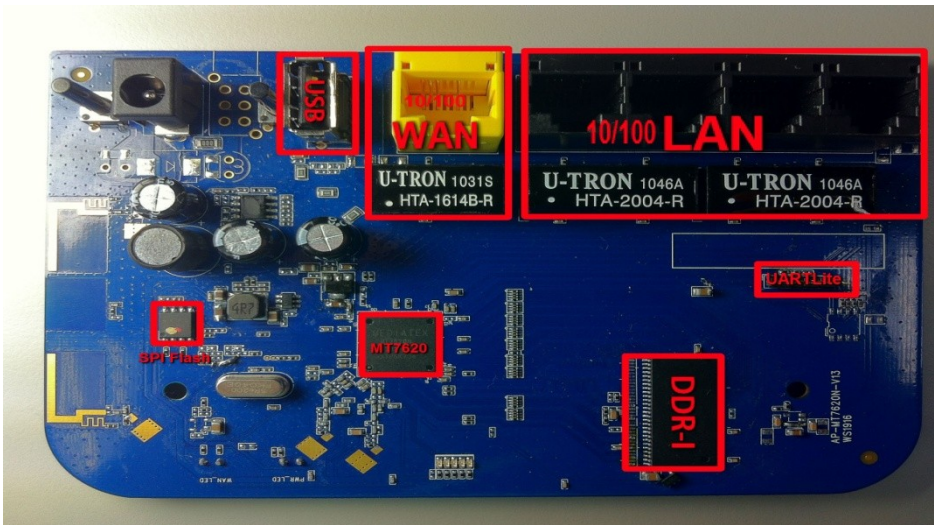


Figure 9 MT7620A Demo Board

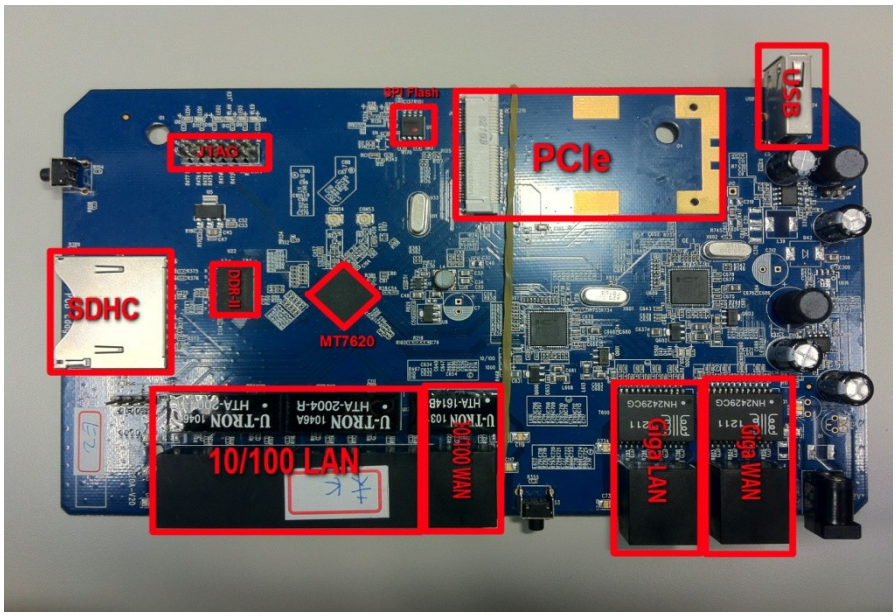


Table 7 MT7620 Memory Mapping

Start		End	Size	Description
0000.0000	-	0FFF.FFFF	256 MBytes	DDR2 256 MB/ DDR1 256 MB/SDRAM 128 MB
1000.0000	-	1000.00FF	256 Bytes	SYSCTL
1000.0100	-	1000.01FF	256 Bytes	TIMER
1000.0200	-	1000.02FF	256 Bytes	INTCTL
1000.0300	-	1000.03FF	256 Bytes	MEM_CTRL (SDR/DDR)
1000.0400	-	1000.04FF	256 Bytes	Rbus Matrix CTRL
1000.0500	-	1000.05FF	256 Bytes	UART
1000.0600	-	1000.06FF	256 Bytes	PIO

Start		End	Size	Description
1000.0700	-	1000.07FF	256 Bytes	<<Reserved>>
1000.0800	-	1000.08FF	256 Bytes	NAND Controller
1000.0900	-	1000.09FF	256 Bytes	I2C
1000.0A00	-	1000.0AFF	256 Bytes	I2S
1000.0B00	-	1000.0BFF	256 Bytes	SPI
1000.0C00	-	1000.0CFF	256 Bytes	UARTLITE
1000.0D00	-	1000.0DFF	256 Bytes	MIPS CNT
1000.2000	-	1000.27FF	2 KBytes	PCM (up to 16 channels)
1000.2800	-	1000.2FFF	2 KBytes	Generic DMA (up to 64 channels)
1000.3000	-	1000.37FF	2 KBytes	<<Reserved>>
1000.3800	-	1000.3FFF	2 KBytes	<<Reserved>>
1000.4000	-	100F.FFFF		<<Reserved>>
1010.0000	-	1010.FFFF	64 KBytes	Frame Engine
1011.0000	-	1011.7FFF	32 KBytes	Ethernet Swtich
1011.8000		1011.FFFF	32 KBytes	ROM
1012.0000	-	1012.7FFF	32 KBytes	USB Device Control
1012.8000	-	1012.FFFF	32 KBytes	<<Reserved>>

Start		End	Size	Description
1013.0000	-	1013.3FFF	16 KBytes	SDHC
1013.4000	-	1013.FFFF	48 KBytes	<<Reserved>>
1014.0000	-	1017.FFFF	256 KBytes	PCI Express
1018.0000	-	101B.FFFF	256 KBytes	WLAN BBP/MAC
101C.0000	-	101F.FFFF	256 KBytes	USB Host
1020.0000	-	1023.FFFF	256 KBytes	<<Reserved>>
1024.0000	-	1027.FFFF	256 KBytes	<<Reserved>>
1028.0000	-	1BFF.FFFF		<<Reserved>>
1C00.0000	-	1C00.7FFF	32 KB ROM	When the system is powered on, a 24 KB internal boot ROM is mapped.

3.9 MT7621

The MT7621 SoC includes a high performance 880 MHz MIPS1004Kc CPU core and high speed USB3.0/PCIe/SDXC interfaces, which is designed to enable a multitude of high performance, cost-effective IEEE 802.11n/ac applications with a MediaTek (Ralink) WiFi client card.

There are several masters (MIPS 1004KEc, USB, PCI Express, SDXC, FE) in the MT7621 SoC on a high performance, low latency Rbus, (Ralink Bus). In addition, the MT7621 SoC supports lower speed peripherals such as UART Lite, GPIO, NFI and SPI via a low speed peripheral bus (Pbus). The DDR2/DDR3 controller is the only bus slave on the Rbus. It includes an Advanced Memory Scheduler to arbitrate the requests from bus masters, enhancing the performance of memory access intensive tasks.

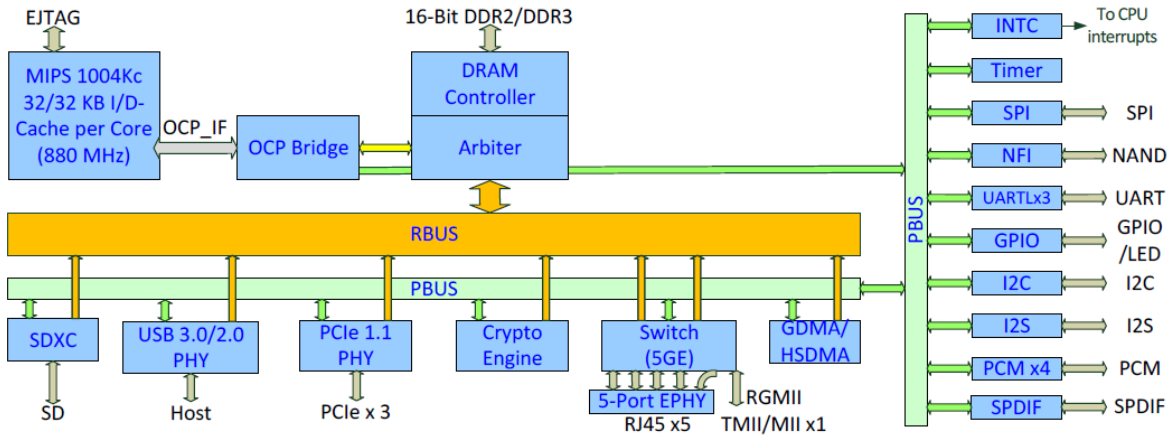


Figure 10 MT7621A Demo Board

Table 8 MT7621 Memory Mapping

Start	End	Size	Description
0	1BFFFFFF	448M	DRAM Direct Map
1C000000	1DFFFFFF	32M	<<Reserved>>
1E000000	1E0000FF	256	SYSCTL
1E000100	1E0001FF	256	TIMER
1E000200	1E0002FF	256	INTCTL
1E000300	1E0003FF	256	Flash Controller (NOR/SRAM/SDRAM)
1E000400	1E0004FF	256	Rbus Matrix CTRL
1E000500	1E0005FF	256	MIPS CNT
1E000600	1E0006FF	256	GPIO
1E000700	1E0007FF	256	S/PDIF
1E000800	1E0008FF	256	DMA_CFG_ARB
1E000900	1E0009FF	256	I2C
1E000A00	1E000AFF	256	I2S
1E000B00	1E000BFF	256	SPI CSR
1E000C00	1E000CFF	256	UARTLITE 1
1E000D00	1E000DFF	256	UARTLITE 2
1E000E00	1E000EFF	256	UARTLITE 3
1E000F00	1E000FFF	256	ANACTL
1E001000	1E0017FF	2K	<<Reserved>>
1E001800	1E001FFF	2K	<<Reserved>>
1E002000	1E0027FF	2K	PCM (up to 16 channel)
1E002800	1E002FFF	2K	Generic DMA (up to 64 channel)
1E003000	1E0037FF	2K	NAND Controller *(actually 1K in Module)
1E003800	1E003FFF	2K	NAND_ECC Controller *(actually 3K in module)
1E004000	1E004FFF	4K	Crypto Engine
1E005000	1E005FFF	4K	MEM_CTRL (DDRII/DDRIII)
1E006000	1E006FFF	4K	EXT_MC_ARB
1E007000	1E007FFF	4K	HS DMA
1E008000	1E00FFFF	32K	<<Reserved>>
1E010000	1E0FFFFF	960K	<<Reserved>>
1E100000	1E10DFFF	56K	Frame Engine (FE SRAM: 0x1E108000~0x1E10DFFF)
1E10E000	1E10FFFF	8K	PCIe SRAM
1E110000	1E117FFF	32K	Ethernet GMAC
1E118000	1E11FFFF	32K	ROM
1E120000	1E12FFFF	64K	<<Reserved>>
1E130000	1E137FFF	32K	SDXC
1E138000	1E13FFFF	32K	<<Reserved>>
1E140000	1E17FFFF	256K	PCI Express
1E180000	1E1BFFFF	256K	<<Reserved>>
1E1C0000	1E1FFFFF	256K	USB Host (U2+U3)
1E200000	1E23FFFF	256K	<<Reserved>>
1E240000	1E24FFFF	64K	<<Reserved>>

1E250000	1E7FFFFF	5824K	<<Reserved>>
1E800000	1EBFFFFF	4M	PCIE Direct Access for iNIC
1EC00000	1FBBFFFF	16128K	<<Reserved>>
1FBC0000	1FBDFFFF	128	CM_GIC
1FBE0000	1FBEFFFF	64K	<<Reserved>>
1FBF0000	1FBF7FFF	32K	CM_CPC
1FBF8000	1FBFFFFF	32K	CM_GCR
1FC00000	1FFFFFFF	4M	ROM/SPI FLASH Direct Access
20000000	23FFFFFF	64M	DRAM Re-Map
24000000	5FFFFFFF	960M	<<Reserved>>
60000000	6FFFFFFF	256M	PCIE Direct Access
70000000	7FFFFFFF	256M	<<Reserved>>

4 AP SDK SOURCE CODE OVERVIEW

The subsequent command is used in the development environment. It makes a directory equivalent to "/home/${user}/RT288x_SDK".

#tar jxvf RT288x_SDK_{version}_{date}.tar.bz2

- The RT288x_SDK package contains the subsequent directories.
  - toolchain : mips toolchain
  - source : Linux kernel source
  - tools :useful script
- The source directory contains the subsequent directories.
  - config : auto-configuration files
  - images : Linux image
  - lib : uClibc 0.9.28
  - linux-2.4.x : Linux kernel source for RT2880
  - linux-2.6.21.x : Linux kernel source for RT3052/RT3883/RT3352/RT3883
  - linux-2.6.36MT.x : Linux kernel source for RT6855/RT6856
  - linux-2.6.36.x : Linux kernel source for MT7620/MT7621
  - rootfs : root file system (uncompressed)
  - tools : useful script to generate rootfs
  - user : user applications
  - vendor : init scripts of target platform (inittab, rcS...etc)

5 TOOL-CHAIN

The Ralink AP SDK uses buildroot to make the Linux kernel image. Buildroot is a set of Makefiles and patches. It is easy to make a cross-compilation toolchain and root file system for the target Linux system. Use the uClibc C library.

5.1 Install toolchain

#cp RT288x_SDK/toolchain/buildroot-gcc342.tar.bz2 /opt

 # tar jxvf buildroot-gcc342.tar.bz2

The extract procedure makes a directory equivalent to "/opt/buildroot-gdb"

For MT7621,

- Decompress buildroot-gcc463.tar.bz2 to /opt (64bits)
- Decompress mips-2012.03.tar.bz2 to /opt (64bits)

5.2 Install LZMA Utility

lzma is necessary to make the compressed kernel image. The Ralink RT2880 SDK uses lzma to compress the kernel image.

```
#cd RT288x_SDK/toolchain/lzma-4.32.0beta3
#./configure
#make
#make install (install lzma to /usr/local/bin)
```

Use gzip or lzma to compress the kernel image.

Make changes to RT288x_SDK/source/vendors/Ralink/{Platform}/Makefile

```
COMP = gzip
```

Use gzip to compress the Linux kernel image.

```
COMP = lzma
```

Use lzma to compress the Linux kernel image.

5.3 Install mksquashfs utility

mksquashfs-lzma is necessary to make the compressed rootfs. The Ralink AP SDK uses mksquashfs with lzma to compress the root filesystem.

Linux-2.4.x Kernel Version

#cd RT288x_SDK/toolchain/mksquash_lzma-3.0

#make

#make install (install mksquashfs-lzma to /opt/buildroot-gcc342/bin/mksquashfs_lzma-3.0)

Linux-2.6.21.x Kernel Version

#cd RT288x_SDK/toolchain/mksquash_lzma-3.2

#make

#make install (copy mksquashfs to /opt/buildroot-gcc342/bin/mksquashfs_lzma-3.2 & lzma_alone to /opt/buildroot-gcc342/bin/)

Linux-2.6.36.x Kernel Version

#tar jxvf squashfs4.2.tar.bz2

#cd squashfs4.2/squashfs-tools$

#make

#cp mksquashfs /opt/buildroot-gcc342/bin/mksquashfs_lzma-4.2

LZMA_ALONE IS NECESSARY TO MAKE YOUR OWN RAMDISK IMAGE, IF YOU TURN ON "COMPRESS RAMDISK BY LZMA" ON LINUX 2.4/2.6.21 KERNEL.

Linux-2.4.x /Linux-2.6.21.x Kernel Version

#make menuconfig

Kernel/Library/Defaults Selection --->

Machine selection --->

[*] Compress ramdisk by lzma instead of gzip

Linux-2.6.36.x Kernel Version

#make menuconfig

Kernel/Library/Defaults Selection --->

General setup --->

[*] Support initial ramdisks compressed using LZMA

6 BOOT LOADER

6.1 Uboot Configuration

tar jxvf Uboot_{version}_{BETA/FINAL}_{date}.tar.bz2

#cd Uboot

#make menuconfig

1. Set the DRAM Size

DRAM Component:

	Row	Column
64Mb	12	8
128Mb	12	9
256Mb	13	9

DRAM Bus: 16bits / 32bits

Example:

- W9825G6EH: 4Mx4Banksx16bits SDRAM:
  - Row Address: A0-A12, Column address: A0-A8
  - DRAM Component=256Mb
  - DRAM Bus =16bits
- W981216DH/W9812G6DH: 2Mx4Banksx16bits SDRAM:
  - Row Address: A0-A11, Column address: A0-A8
  - DRAM Component=128Mb
  - DRAM Bus =16bits
- IS42S32800B: 2Mx4Banksx32bits SDRAM:
  - Row Address: A0-A11, Column address: A0-A8

- DRAM Component=128Mb
- DRAM Bus =32bits

2. LAN/WAN Partition

The switch automatically operates in dump switch mode when the board turns on. Clients on the LAN get the dynamic IP address from the remote DHCP server connected to the WAN port.

Set the LAN/WAN partition to prevent the Client's DHCP request being sent to the WAN side.

6.2 Build the uboot Image

make

.....

1. RT2880/RT3052/RT3883/RT3352/RT5350:

- NOR Flash: **uboot.bin** is located in Uboot/.

  # cp uboot.bin /tftpboot
- SPI Flash: **uboot.img** is located in Uboot/

  # cp uboot.img /tftpboot
- NAND Flash: **uboot.img** is located in Uboot/

  # cp uboot.img /tftpboot

2. RT6855/RT6856/MT7620/MT7621:

- SPI Flash: **uboot.bin** is located in Uboot/.

  # cp uboot.bin /tftpboot
- NAND Flash: **uboot.img** is located in Uboot/

  # cp uboot.img /tftpboot

6.3 Burn the uboot image

Press '9' on the Uboot menuconfig, to open the invisible menu.

Set the operation:

1: Load system code to SDRAM via TFTP
2: Load system code then write to Flash via TFTP
3: Boot system code via Flash (default)
4: Enter boot command line interface
5: Load ucos code to SDRAM via TFTP

You chose 9

9: System Load Boot Loader then write to Flash via TFTP.

Warning! Erase Boot Loader in Flash then burn new one. Are you sure? (Y/N) Please Input new ones /or Ctrl-C to discard

Input device IP (10.10.10.123) ==:
Input server IP (10.10.10.3) ==:
Input Uboot filename (uboot.bin) ==:

7 USER LIBRARY

7.1 Library Configuration

RT288x_SDK uses ulibc 0.9.28 for user applications. The subsequent instructions show how to change the default library setting.

```
# make menuconfig
Kernel/Library/Defaults Selection  --->
[ *] Customize uClibc Settings
```

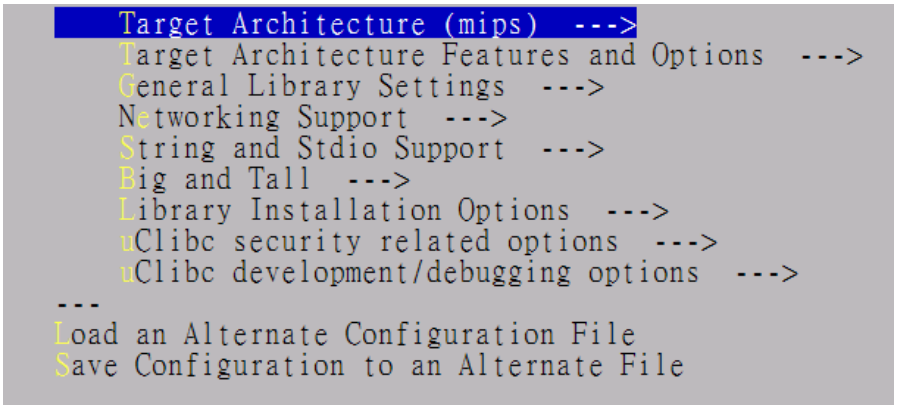


Figure 8 uClib configurations Menu

7.2 Library Porting

The subsequent instructions show how to add a new library to the RT288x_SDK.

Example: Port libtest to RT288x_SDK

1. *#/ cp -r libtest to RT288x_SDK/source/lib*
2. modify RT288x_SDK/source/lib/libtest/Makefile
   [you can reference to libnvram/Makefile]
3. modify RT288x_SDK/source/lib/Makefile

ifeq ($(CONFIG_LIB_LIBTEST_FORCE),y)

DIRS += libtest

endif

ifeq ($(CONFIG_LIB_LIBTEST_FORCE),y)

@$(MAKE) -C libtest shared

endif

4. modify RT288x_SDK/source/config/config.in

bool 'Build libtest' CONFIG_LIB_LIBTEST_FORCE

#/ make menuconfig

You can see the "Build libtest" on the menu.

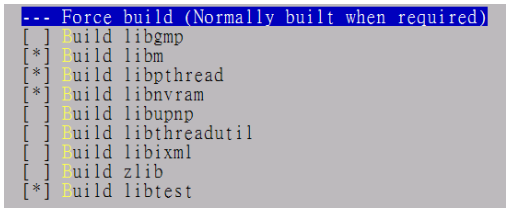


Figure 9 User Library Configure Menu

5. Compile your new library

#make dep

#make lib_only

7.3 Build user library

 # cd RT288x_SDK/source

 # make lib_only

 # make romfs

.....

The shared libraries are shown in RT288x_SDK /source/romfs/lib

8 USER APPLICATION

Many useful network applications (e.g. wan protocol, http server, debugging tools, etc.) are supplied with the RT288x_SDK to make porting easier.

8.1 Ralink Proprietary Applications

8.1.1 ATED

Description: for rt2860 v1.4 ATE test program

Usage: ate

Note:

- Execute ate on the demo board
- Connect directly from the LAN port to the PC
- Execute QA on the PC (wait 30 seconds)

8.1.2 REG

Description: register the read/write test program

Usage: reg [r/w/s] [offset] [value]

Note:

- To use system register: reg s 0
- To use wireless register: reg s 1 To use other base address offset: reg s [offset]
- The rt_rdm module must be put in first

Example:

/# reg s b0000000

/# reg r 18 / read b0000018 */*

/# reg w 18 12345678 / write 0x12345678 to b0000018 */*

8.1.3 FLASH

Description: flash read/write test program

Usage:

a. read: flash -r [offset(hex)] -c [num of bytes]
b. write: flash -w [offset(hex)] -o [value(hex)] -c [num of bytes]
c. erase: flash -f [first sector_num] -l [last sector_num

Example:

a. read: flash -r 370000 -c 4
b. write: flash -w 370000 -o 1234 -c 4
c. erase: flash -f 60 -l 61

8.1.4 ETH_MAC

Description: flash read/write program to update Ethernet MAC address (RT6856&MT7621)

Usage:

a. read: eth_mac r <lan|wan>
b. write: eth_mac w <lan|wan> <MACADDR[0]> <MACADDR[1]>

Example:

a. read: eth_mac r lan
b. write: eth_mac w lan 00 0c 43 76 21 01

8.1.5 GPIO

Description: GPIO test program

Usage: GPIO [r/w/i/l]

The name of the GPIO testing user application is "*gpio*".

- gpio w: writing test (output)

- gpio r: reading test (input)
- gpio i (<gpio>): interrupt test for GPIO number
- gpio l <gpio> <on> <off> <blinks> <rests> <times>: set led on <gpio>(0~24) on/off interval, no. of blinking/resting cycles, blinking time

Pin sharing scheme

It is important to know what normal function pins are shared with the GPIO pins. Only one normal function and GPIO can operate at the same time.

- GPIOMODE: GPIO purpose select)
  Configure the pins to use as GPIO.
- PIODIR: programmed I/O direction
  Configure the direction of all GPIO pins to use as GPIO.
  an output is set as '1', and an input pin is set as '0'.
- PIODATA: programmed I/O data
  Write data for output GPIO pins, and read data for input GPIO pins. PIOSET, PIORESET, PIOTOG are also used for adjusting GPIO data bits.
- PIOINT, PIOEDGE, PIORENA, and PIOFMASK should be set when using GPIO pins for input that causes an interruption.

8.1.6 MII_MGR

Description: mii register read/write test program

Usage:

a. get: mii_mgr -g -p [phy number] -r [register number]
b. set: mii_mgr -s -p [phy number] -r [register number] -v [0xvalue]

Example:

a. get: mii_mgr -g -p 3 -r 4
b. set: mii_mgr -s -p 4 -r 1 -v 0xff11

Kernel Module:

$SDK/source/$LINUX/drivers/net/raeth/mii_mgr.c
$SDK/source/$LINUX/drivers/net/raeth/ra_ioctl.h

- IOCTL Commands
  - RAETH_MII_READ
    - Get phy register via the mdc/mdio interface.

- RAETH_MII_WRITE
  - Set phy register via the mdc/mdio interface.

- IOCTL interface

```
typedef struct ralink_mii_ioctl_data {
  __u32   phy_id;
  __u32   reg_num;;
  __u32   val_in;
  __u32   val_out;
};
```

- phy_id: Address of PHY device
- reg_num: Register addresses within PHY device
- val_ine:
  - GET: the phy register data that is read from phy
  - SET: the current register data after MDIO setting
- Val_out: the phy register data that wants to be set
-

User applications run mii_mgr commands through the ioctl interface to the raeth driver.

8.1.7 MTD

Description: MTD writing program for firmware update

Usage: mtd_write -r write [file] [device]

Example: mtd_write -r write image.bin mtd4

8.1.8 NVRAM

Description:

a. get value in NVRAM for RT2860 or INIC platform
b. set value in NVRAM for RT2860 or INIC platform
c. display all configurations in NVRAM, or generate .dat files

nvram_daemon is a daemon and register for NVRAM settings, or setting NVRAM values referring to a given file. It receives interruptions from GPIO pin 0. If SIGUSR1 is received (user one-clicked GPIO pin 0 button), nvram_daemon tells the GoAhead web server to start the WPS PBC procedure by sending it SIGUSR1. If SIGUSR2 is received (user pressed GPIO pin 0 button for several seconds), nvram_daemon will restore the system configuration to the default values.

Usage:

a. get: nvram_get [<2860/inic>] <field>
b. set: nvram_set [<2860/inic>] <field>
c. init: ralink_init <command> [<platform>] [<file>]

Commands:

- rt2860_nvram_show (display rt2860 values in nvram)
- inic_nvram_show (display inic values in nvram)
- show (display values in nvram for <platform>)
- gen (generate config file from nvram for <platform>)
- renew (replace nvram values for <platform> with <file>)

Platform:

- 2860 - rt2860 station
- inic - intelligent nic

File: File name for renew command

daemon: nvram_daemon

Example:

a. nvram_get 2860 SSID /* get the SSID */
b. nvram_set 2860 SSID ralink /* set the SSID to ralink */
c. ralink_init gen 2860 /* generate the RT2860 .dat file from NVRAM */
d. ralink_init show inic /* display the INIC configurations in NVRAM */
e. ralink_init renew 2860 ra.dat /* set NVRAM values for RT2860 platform according to ra.dat file */
f. nvram_daemon /* start the nvram_daemon */

To avoid accessing NVRAM inconsistently, sdk also supports Kernel mode NVRAM.

$ make menuconfig

[*] Customize Kernel Settings

Machine selection --->

```
    System type (Ralink RT305x/RT3350 board)  --->
    Soc Hardware Type (RT305x/RT3350-ASIC)  --->
[ ] Ralink RT3350 chipset
    DRAM Size (16M)  --->
    Flash Type (NOR)  --->
[ ] Dual Image
[*] Kernel NVRAM
    Root File System Type (RootFS_in_RAM)  --->
(8192) Default RAM disk size
[*] Compress ramdisk by lzma instead of gzip
[ ] Ralink WatchDog
[ ] Ralink DFS Timer
```

8.1.9 SPICMD

Description: SPI Toolkit for SPI EEPROM Read/Write Program...

Usage: spicmd read/write parameters

Note:

- spicmd read the address
- spicmd writes the size address value
- size is 1, 2, 4 bytes

8.1.10 I2CCMD

Description: I2C Toolkit for EEPROM Read/Write via I2C Interface...

Usage: i2ccmd read/write parameters

Note:

- i2ccmd read the address
- i2ccmd write the size address value
- size is 1, 2, 4 bytes

8.1.11 I2SCMD

Description: I2S Toolkit for raw playback/record via I2S Interface...
Usage: i2scmd [cmd] [srate] [vol] < playback files
Note:

- cmd = 0|1 - i2s raw playback|record
- srate = 8000|16000|32000|44100|48000 Hz playback sampling rate
- vol = -10~2 db playback volumn

Example:

- i2scmd 0 48000 2 </etc_ro/test_sound.snd

8.1.12 SPDIFCMD

Description: SPDIF Toolkit for raw playback via SPDIF Interface...
Usage:

[fmt=0] [srate] [wordlen] [pathname]

[fmt=1] [srate] [rawtype] [pathname]

fmt = 0|1 - spdif pcm| raw data

srate = 22050| 24000| 32000|44100|48000|88200|96000|176400|192000 Hz sampling frequency

rawtype = for raw data (fmt = 1) -- (0: Null data;) 1: AC3 data; (3: Pause)

wordlen = 16| 24 bits per sample

downsample = 1: no down sample; 2: 2x down sample; 4: 4x down sample

[fmt=2] [pathname]

Example: (for PCM data, 16 bit)

spdifcmd 0 48000 16 </etc_ro/test_sound.snd

8.1.13 Script

Description: WebUI configuration script.

Usage: Refer to the script help message.

8.2 goahead

Source code: RT288x_SDK/source/user/goahead/

Description: Old WebUI reference design of the AP/Router Solution.

8.3 lighttpd

Source code: RT288x_SDK/source/user/ lighttpd-1.4.20/

Description: New WebUI reference design of the AP/Router Solution.

8.4 nvram library

Source code: RT288x_SDK/source/lib/libnvram

Description: Library for nvram_get, nvram_set and ralink_init.

8.5 wsc_upnp

Source code: RT288x_SDK/source/user/WSC_UPNP

Description: Ralink WPS (Wi-Fi Protected Setup) UPNP Daemon

Required library: libupnp, pthread

8.6 iptables

Source code:

RT288x_SDK/source/user/iptables # for Linux-2.4

RT288x_SDK/source/user/ iptables-1.4.0rc1 #for Linux-2.6.21
RT288x_SDK/source/user/ iptables-1.4.10 #for Linux-2.6.36

Description: Administration tool for IPv4 packet filtering and NAT.

8.7 ntpclient

Source code: RT288x_SDK/source/user/ntpclient
Description: ntpclient is an NTP (RFC-1305) client for Unix-like computers. Its functionality is a small subset of xntpd, but it appears to perform better (or at least has the ability to function better) within that limited scope. It is much smaller than xntpd and is more applicable to embedded computers.

8.8 mtd-utils

Source code: RT288x_SDK/source/user/ mtd-utils
Description: for jffs2 file system support erase/format…etc. example: mkfs.jffs2, erase, eraseall

8.9 ppp-2.4.2

Source code: RT288x_SDK/source/user/ ppp-2.4.2
Description: a package which uses the Point-to-Point Protocol (PPP) to supply Internet connections over serial lines.

8.10 bridge-utils

Source code: RT288x_SDK/source/user/ bridge-utils
Description: brctl is used to set up, maintain, and inspect the Ethernet bridge configuration in the Linux kernel. An Ethernet bridge is a device commonly used to connect different networks of the Ethernet together, so that the Ethernets will appear as one Ethernet to the participants. Each of the Ethernets being connected corresponds to one physical interface in the bridge. These individual Ethernets are bundled into one bigger ('logical') Ethernet. This bigger Ethernet corresponds to the bridge network interface.

8.11 wireless_tools

Source code: RT288x_SDK/source/user/ wireless_tools

Description: This package contains the Wireless tools. The wireless tools are used to control the Wireless Extensions. The Wireless Extensions is an interface that lets you set the Wireless LAN specific parameters and get the specific stats.

8.12 inadyn

Source code: RT288x_SDK/source/user/ inadyn

Description: INADYN is a dynamic DNS client. It maintains the IP address of a host name. It periodically checks if the IP address stored by the DNS server is the real current address of the machine that is running INADYN

8.13 zebra-0.95a_ripd

Source code: RT288x_SDK/source/user/ zebra-0.95a_ripd

Description: GNU Zebra is free software that manages various IPv4 and IPv6 routing protocols. Currently GNU Zebra supports BGP4, BGP4+, OSPFv2, OSPFv3, RIPv1, RIPv2, and RIPng.

8.14 wpa_supplicant-0.5.7

Source code: RT288x_SDK/source/user/ wpa_supplicant-0.5.7

Description: WPA Supplicant (Supported WPA/IEEE 802.11i)

8.15 totd-1.5

Source code: RT288x_SDK/source/user/ totd-1.5

Description: Totd is a small DNS proxy nameserver that supports IPv6 only hosts/networks that communicate with the IPv4 world using some translation mechanism.

8.16 samba-3.0.2/samba-3.0.37/samba-3.6.6

Source code: RT288x_SDK/source/user/ samba-3.0.2

Description: Samba is an Open Source/Free Software suite that has, since 1992, provided file and

print services to all manner of SMB/CIFS clients, including the numerous versions of Microsoft Windows operating systems. Samba is freely available under the GNU General Public License.

8.17 radvd-1.0

Source code: RT288x_SDK/source/user/ radvd-1.0

Description: The router advertisement daemon (radvd) is run by Linux or BSD systems acting as IPv6 routers. It sends Router Advertisement messages, specified by RFC 2461, to a local Ethernet LAN periodically and when requested by a node sending a Router Solicitation message. These messages are required for IPv6 stateless auto configuration.

8.18 pptp-client

Source code: RT288x_SDK/source/user/ pptp-client

Description: pptp is an implementation of the PPTP protocol for Linux and other Unix systems.

8.19 rp-l2tp-0.4

Source code: RT288x_SDK/source/user/ rp-l2tp-0.4

Description: This is a user-space implementation of L2TP (RFC 2661) for Linux

8.20 ctorrent-dnh3.2

Source code: RT288x_SDK/source/user/ ctorrent-dnh3.2

Description: CTorrent is a BitTorrent Client program written in C/C++ for FreeBSD and Linux. CTorrent is fast and small.

8.21 dhcp6

Source code: RT288x_SDK/source/user/ dhcp6

Description: DHCPv6 is a stateful address auto-configuration protocol for IPv6, a counterpart to IPv6 stateless address auto-configuration protocol. It can be used independently or coexist with its counterpart protocol. This protocol uses client/server mode of operation but also provides support through a Relay Agent. It is currently being defined by IETF DHC WG. The specification is still in the draft form.

8.22 dnsmasq-2.40

Source code: RT288x_SDK/source/user/ dnsmasq-2.40

Description: Dnsmasq is a lightweight, easy to configure DNS forwarder and DHCP server. It is designed to provide DNS and, optionally, DHCP, to a small network. It can serve the names of local machines which are not in the global DNS. The DHCP server integrates with the DNS server and allows machines with DHCP-allocated addresses to appear in the DNS with names configured either in each host or in a central configuration file. Dnsmasq supports static and dynamic DHCP leases and BOOTP/TFTP for network booting of diskless machines.

8.23 igmpproxy

Source code: RT288x_SDK/source/user/ igmpproxy

Description: IGMPproxy is a simple mulitcast router for Linux that only uses the IGMP protocol.

8.24 matrixssl-1.8.3

Source code: RT288x_SDK/source/user/ matrixssl-1.8.3

Description: MatrixSSL is an embedded SSL implementation designed for small footprint applications and devices. It is an open-source software package available under the GNU license. It consists of a single library file with a simple API set that an application writer can use to secure their application.

8.25 rp-pppoe-3.8

Source code: RT288x_SDK/source/user/ rp-pppoe-3.8

Description: pppoe is a user-space redirector which permits the use of PPPoE (Point-to-Point Over Ethernet) with Linux. PPPoE is used by many DSL service providers.

8.26 usb_modeswitch-0.9.5

Source code: RT288x_SDK/source/user/ usb_modeswitch-0.9.5

Description: USB_ModeSwitch is (surprise!) a small mode switching tool for controlling "flip flop" (multiple device) USB gear. Several new USB devices (especially high-speed WAN stuff, they're

expensive anyway) have their MS Windows drivers onboard; when plugged in for the first time they act like a flash storage and start installing the driver from there. After that (and on every consecutive plugging) this driver switches the mode internally, the storage device vanishes (in most cases), and a new device (like an USB modem) shows up. Some call that feature "ZeroCD".

8.27 Port new user application

Example: Add hello application to /bin

(a)Create hello directory in RT288x_SDK/source/user

#mkdir RT288x_SDK/source/use/hello

(b) Add Makefile to RT288x_SDK/source/user/hello

```
EXEC = hello
OBJS = hello.o
CFLAGS +=

all: $(EXEC)

$(EXEC): $(OBJS)
	$(CC) $(LDFLAGS) -o $@ $(OBJS)

romfs:
	$(ROMFSINST) /bin/$(EXEC)

clean:
	-rm -f $(EXEC) *.elf *.gdb *.o
```

(c) Add hello.c to RT288x_SDK/source/user/hello

```
main()
{
    printf("hello world\n");
}
```

(d) Edit RT288x_SDK/source/config/config.in

mainmenu_option next_comment

comment 'XXX Add-on Applications'

bool 'hello_world' CONFIG_USER_HELLO_WORLD

endmenu

(e) Edit RT288x_SDK/source/user/Makefile

dir_$(CONFIG_USER_HELLO_WORLD) += hello

(f) Turn on hello application

#make menuconfig

[*] hello_world (NEW)

(g) Build new image

#make dep

#make

(h) Check file is correct

#cd RT288x_SDK/source/romfs/bin

#file hello

#hello: ELF 32-bit LSB executable, MIPS, MIPS-II version 1 (SYSV), dynamically linked (uses shared libs), stripped

(i) Testing

BusyBox v1.4.2 (2007-05-04 11:15:35 CST) Built-in shell (ash)

Enter 'help' for a list of built-in commands.

/ #

/ # hello

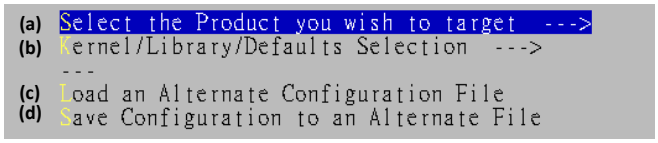
```
hello world
/ #
```

9 LINUX KERNEL

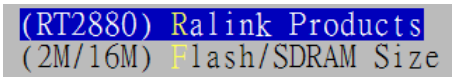
9.1 Linux configuration

 # cd RT288x_SDK/source

 # make menuconfig



1. Use 'Select the Product you wish to target' to set the target platform.



2. Use the 'Flash/SDRAM Size'

- 2M/16M: 2M Flash and 16M DRAM for pure AP solution (pass Vista basic logo and Wi-Fi certification b/g/n logo)
- 4M/16M: 4M Flash and 16M DRAM for complete AP solution, including AP, STA mode)
- 8M/32M: 8M Flash and 32M DRAM for complete AP/NAS solution, including USB applications)

Note:

1. Choose the target platform type (RT2880 or RT3052 or RT3883.)
2. Modify the User/Kernel Configuration or Load/Save User/Kernel Default setting.
3. Load the target platform setting from a file.
4. Save the target platform setting to a file.

Use 'Kernel/Library/Defaults Selection' to open the configuration menu. Use 'Default all settings'.

```
--- Kernel is linux-2.4.x
     Cross Compiler Path: "/opt/buildroot-gdb/bin"
---
[ ] Default all settings (lose changes)
[ ] Customize Kernel Settings (NEW)
[ ] Customize Vendor/User Settings
[ ] Customize Busybox Settings
[ ] Customize uClibc Settings
[ ] Update Default Vendor Settings
```

3. Go out of the configuration menu and save the new kernel configuration.

```
+-----------------------------------------------------------+
|   Do you wish to save your new kernel configuration?      |
+-----------------------------------------------------------+
|                    <Yes >      <  No  >                   |
+-----------------------------------------------------------+
```

The script gets all user/kernel default settings back. The subsequent message is shown after getting the default settings back.

> **** End of Linux kernel configuration.*
>
> **** Check the top-level Makefile for additional configuration.*
>
> **** Next, you must run 'make dep'.*

Note: The default configuration file is stored in a different file, referring to the 'Flash/DRAM size' settings. Go to RT288x_SDK/source/vendors/Ralink/{RT2880/RT3052/RT3883}/config to see all the default setting files.

a. Busybox default configuration files

- ✓ 2M_16M_config.busybox-2.4.x/2M_16M_config.busybox-2.6.21.x
- ✓ 4M_16M_config.busybox-2.4.x/4M_16M_config.busybox-2.6.21.x
- ✓ 8M_16M_config.busybox-2.4.x/8M_16M_config.busybox-2.6.21.x

b. User application default configure file

- ✓ 2M_16M_config.vendor-2.4.x/2M_16M_config.vendor-2.6.21.x
- ✓ 4M_16M_config.vendor-2.4.x/4M_16M_config.vendor-2.6.21.x
- ✓ 8M_16M_config.vendor-2.4.x/8M_16M_config.vendor-2.6.21.x

c. uClibc default configure file

- ✓ 4M_16M_config.uclibc-2.4.x/4M_16M_config.uclibc-2.6.21.x
- ✓ 2M_16M_config.uclibc-2.4.x/2M_16M_config.uclibc-2.6.21.x
- ✓ 8M_16M_config.uclibc-2.4.x8M_16M_config.uclibc-2.6.21.x

d. Linux kernel 2.4/2.6.21/2.6.36 default configure file

- ✓ 2M_16M_config.linux-2.4.x/2M_16M_config.linux-2.6.21.x/2M_16M_config.linux-2.6.36.x
- ✓ 4M_16M_config.linux-2.4.x/4M_16M_config.linux-2.6.21.x/4M_16M_config.linux-2.6.36.x
- ✓ 8M_16M_config.linux-2.4.x/8M_16M_config.linux-2.6.21.x/8M_16M_config.linux-2.6.36.x

9.2 Change Flash/DRAM Size

Change the DRAM size setting using "make menuconfig" if you increase or decrease the size of DRAM.

#make menuconfig
Kernel/Library/Defaults Selection ---->
[*] Customize Kernel Settings (NEW)
Machine selection ---->

- Linux 2.4

(RT2880-ASIC) RT2880 Chip Type
(32M) DRAM Size
(4M) Flash Size

- Linux 2.6

System type (Ralink RT3052 board) ---->
Soc Hardware Type (RT3052-ASIC) ---->

DRAM Size (32M) --->

Root File System Type (RootFS_in_RAM) --->

9.3 Change Switch Controller in RT2880 Platform

The RT288x_SDK supports the IC+ 175C/D switch controller on the RT2880 platform at this time. You can use 'make menuconfig' to adjust the switch controller settings.

#make menuconfig

Kernel/Library/Defaults Selection --->

[*] Customize Kernel Settings

Network device support --->

Ralink Driver --->

```
(IC+)   GMAC is connected to
[*]     Partition LAN/WAN on IC+
(W/LLLL)   LAN/WAN Partition
```

W/LLLL in the LAN/WAN Partition item means P0 is a WAN port, and LLLL/W means P4 is WAN Port. The switch is configured by the script, not the Ethernet driver. Please see config-vlan.sh in RT288x_SDK/source/user/rt2880_app/ scripts.

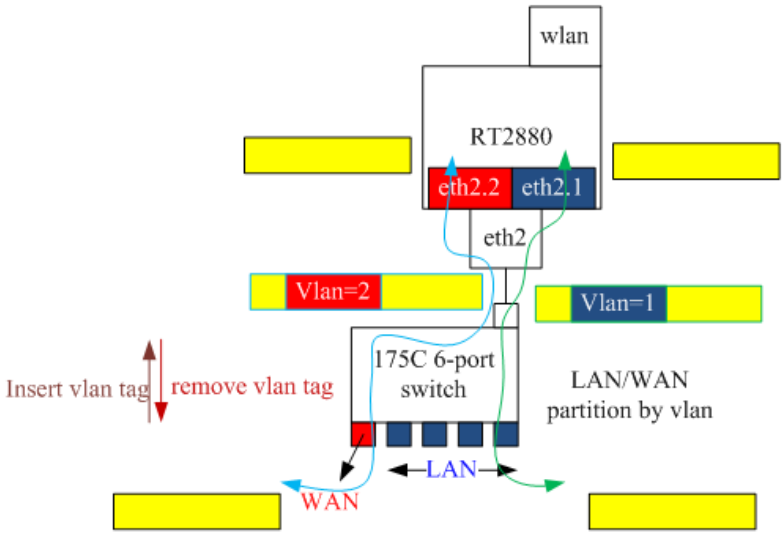
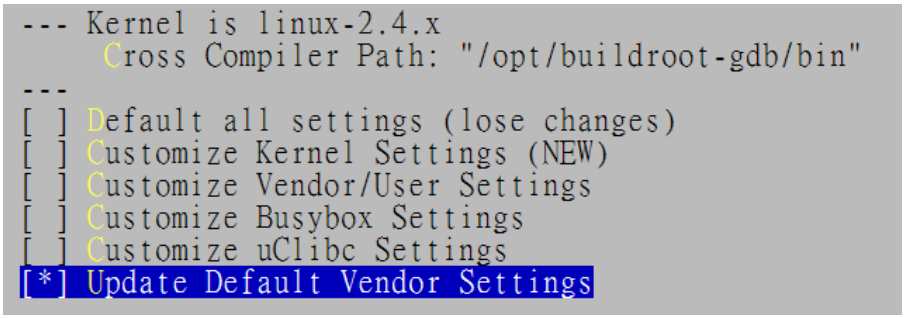


Figure 10 IC+ 10/100 Switch Operation Diagram

9.4 Update User/Kernel default settings

Modify the default setting if necessary. Select the 'Kernel/Library/Defaults Selection' item to enter the kernel/application configuration menu. After entering the menu, select the 'Update Default Vendor Settings' item to update the User/Kernel default settings. (Note: the new default setting will be saved in RT288x_SDK/source/vendors/Ralink/{RT2880/RT3052/RT3883}/config)



Select "Exit" to leave the configuration menu. Select "Yes" to save the new kernel configuration.

The script updates the User/Kernel default settings.

9.5 Compile Linux image

```
#make dep
#make
```

The following files in RT288x_SDK/images, and ${user}_uImage will be copied to /tftpboot by default.

a. ramdisk.gz - root file system
b. ${user}_uImage - Linux image (Linux kernel+rootfs)
c. zImage.{gz/lzma} - compressed Linux kernel

Note: What kinds of "make" can be used?

a. make Linux image if you modify kernel source files
b. make modules romfs Linux image if you modify the kernel module source files
c. make user_only romfs Linux image if you modify application source files
d. You can execute "make" to generate a new image (make = make lib_only user_only modules romfs Linux image)

9.6 Port new Linux kernel module

Example: Port the hello networking module to the RT2880 platform

1. Add the source code to the rt2880 directory

```
# mkdir RT288x_SDK/source/linux-2.4.x/drivers/net/hello
#vi RT288x_SDK/source/linux-2.4.x/drivers/net/hello/Makefile

O_TARGET := hello.o
obj-y    := main.o
obj-m    := $(O_TARGET)
include $(TOPDIR)/Rules.make


#vi RT288x_SDK/source/linux-2.4.x/drivers/net/hello/main.c

#include <linux/init.h>
#include <linux/module.h>
static int hello_init(void)
{
   printk("hello world\n");
   return 0;
}
static void hello_exit(void)
{
   printk("goodbye\n");
}
```

module_init(hello_init);

module_exit(hello_exit);

MODULE_LICENSE("GPL");

~

2. Modify RT288x_SDK/source/linux-2.4.x/drivers/net/Makefile

subdir-$(CONFIG_RT2880_HELLO) += hello

3. Modify Config.in

tristate ' Ralink hello module' CONFIG_RT2880_HELLO

4. Turn on the hello module

#make menuconfig

<M> Ralink hello module

5. Compile the source code

#make dep

#make

6. Test

/ # insmod hello

hello world

/ #

9.7 Execute commands at boot up time

Edit RT288x_SDK/source/vendors/Ralink/RT2880/rcS

#!/bin/sh

mount –a

goahead& <-- add new command here

9.8 Add new files in RootFs

If you execute the "make clean" script, it will delete RT288x_SDK/source/romfs directory.
You cannot copy the file to RT288x_SDK/source/romfs manually because it will disappear after executing "make clean".

Example: add xxx.bin to rootfs

a. copy xxx.bin to RT288x_SDK/source/vendors/Ralink/{RT2880/RT3052/RT3883/RT3352/RT5350}

b. edit RT288x_SDK/source/vendors/Ralink/{RT2880/RT3052/RT3883/RT3352/RT5350}/Makefile

romfs:

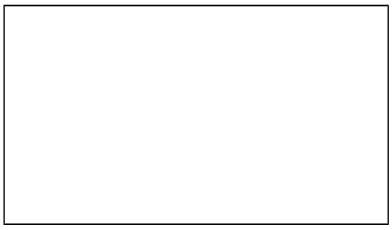
$(ROMFSINST) /etc_ro/xxx.bin

The script will copy xxx.bin to RT288x_SDK/source/romfs/etc_ro after executing "make romfs"

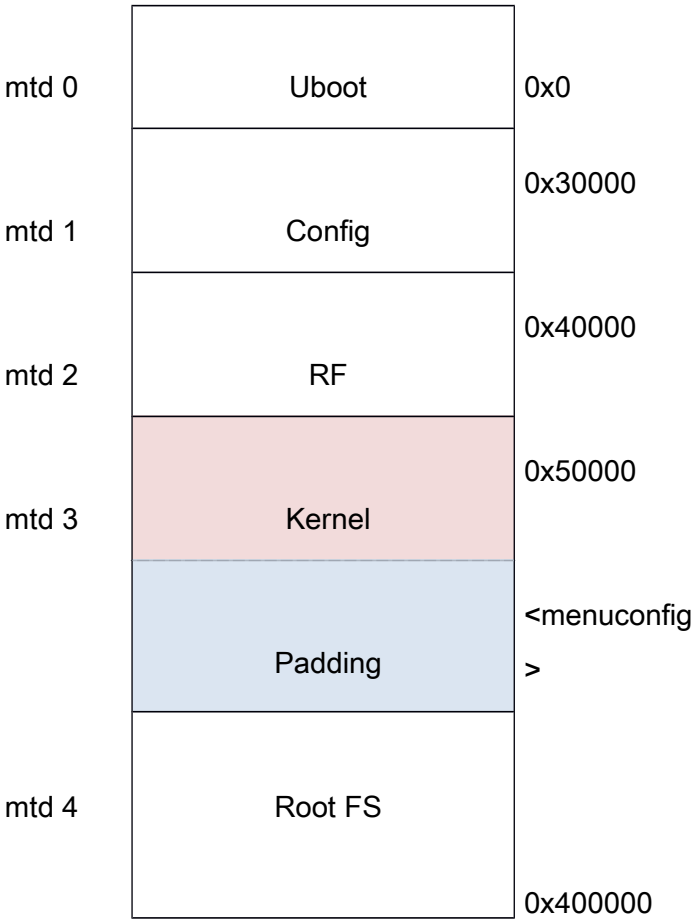
9.9 Image DownSize

The MTD partitions are subsequently shown.
RootFS in RAM Mode

mtd 0	uboot	0x0
mtd 1	config	0x30000
mtd 2	RF	0x40000
mtd 3	Kernel/RootFS	0x50000



RootFS in Flash Mode



In RootFS in Flash mode, the image builder will add a padding bit to the end of kernel image if the kernel image size is smaller than the size of mtd3. The size of mtd3 must be adjusted to save flash memory.

Step1: Check the original kernel image size (ex: 446603)

#make image

.....

#==========<SquashFS Info>=================

 # Original Kernel Image Size

576110 /home/steven/RT288x_SDK/source/images/zImage.lzma

 # Padded Kernel Image Size

786368 /home/steven/RT288x_SDK/source/images/zImage.lzma

 # Original RootFs Size

4329746 /home/steven/RT288x_SDK/source/romfs

 # Compressed RootFs Size

1069056 /home/steven/RT288x_SDK/source/images/ramdisk

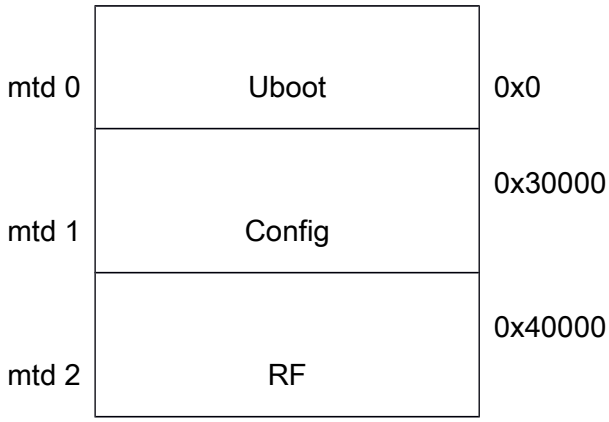
 # Padded Kernel Image + Compressed Rootfs Size

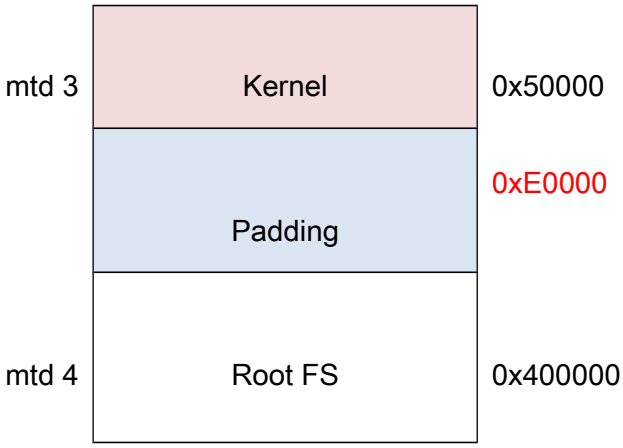
1855424 /home/steven/RT288x_SDK/source/images/zImage.lzma

#=== .....

Step2: Change mtdblock size

576110=0x8CA6E -> 0x90000 (multiple of 0x10000 because the flash sector size=64KB)





host:$ make menuconfig

Hit 'Kernel/Library/Defaults Selection' to enter configuration menu.

```
(linux-2.4.x) Kernel Version
[ ] Default all settings (lose changes)
[*] Customize Kernel Settings
[ ] Customize Vendor/User Settings
[ ] Customize Busybox Settings
[ ] Update Default Vendor Settings
```

Leave configuration menu and save new kernel configuration.

```
Code maturity level options  --->
Loadable module support  --->
Machine selection  --->
CPU selection  --->
General setup  --->
```

```
(RT2880-ASIC) RT2880 Chip Type
(32M) DRAM Size
(4M) Flash Size
(RootFS_in_Flash) RT2880 Root File System
(90000) MTD Kernel Partition Size (Unit:Bytes)
```

10 FLASH LAYOUT AND FIRMWARE UPGRADE

10.1 Flash Layout

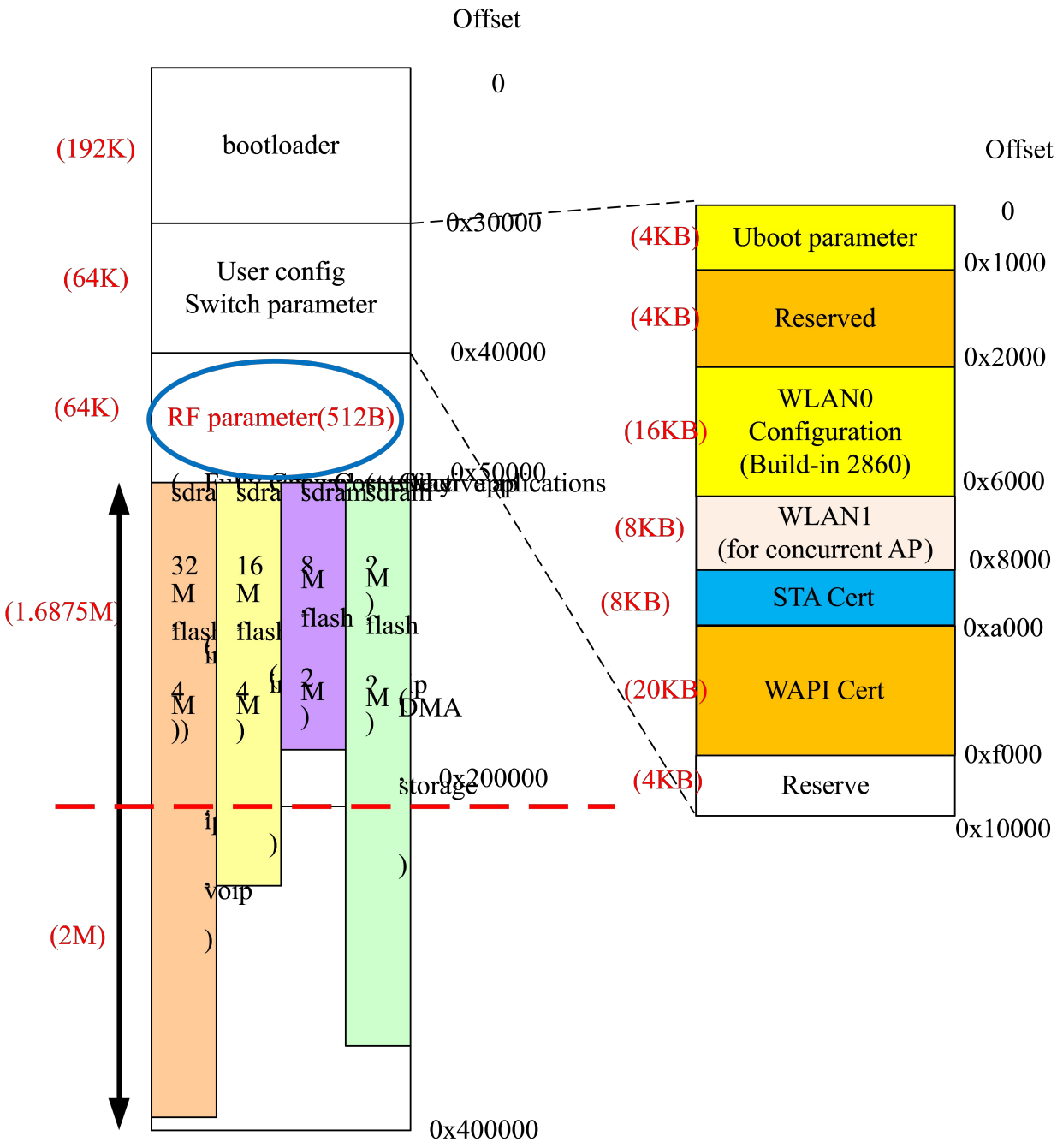


Figure 11 Ralink SDK Flash Layout (4MB)

In the 'user configure switch parameter' partition, the WLAN0 configuration is for built-in first wifi interface parameters, the WLAN1 configuration is for second wifi interface parameters, and the STA cert configuration is stored certificate for station, and the WAPI cert configuration is stored certificate for WAPI. Beside Uboot and WLAN0 blocks, you may use the free space to save your own parameters.

Another, RT6855 and RT6856 are standalone solutions without WiFi. So, their LAN/WAN MAC address is stored in 0xE000-0xE00b in RF Parameter block of flash.

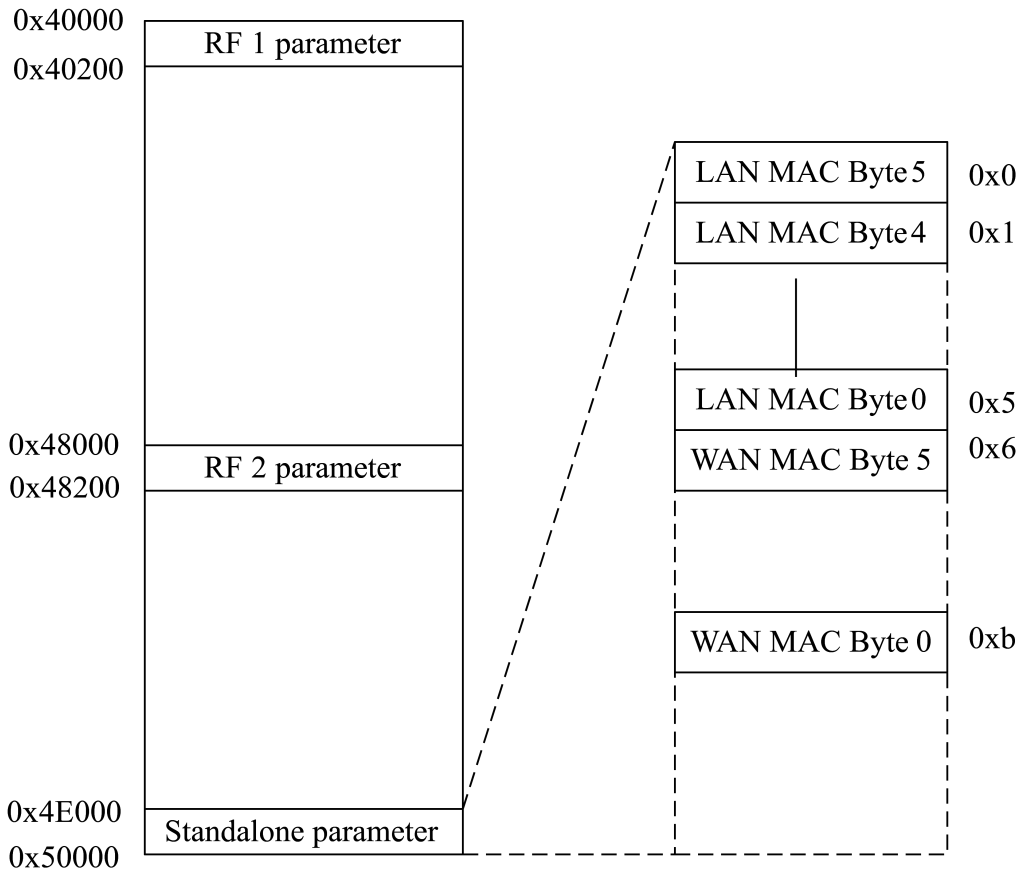


Figure 12 RF parameter block of Ralink SDK Flash Layout

10.2 Firmware Upgrade

10.2.1 By Uboot

```
=========================================
Ralink UBoot Version: 2.0
-----------------------------------------
ASIC 2880_MP (MAC to 100PHY Mode)
DRAM COMPONENT: 128Mbits
DRAM BUS: 32BIT
Total memory: 32Mbytes
Date:May  9 2008  Time:11:14:00
=========================================
 D-CACHE set to 4 way
 I-CACHE set to 4 way

 ##### The CPU freq = 266 MHZ ####

 SDRAM bus set to 32 bit
 SDRAM size =32 Mbytes

Please choose the operation:
   1: Load system code to SDRAM via TFTP.
   2: Load system code then write to Flash via TFTP.
   3: Boot system code via Flash (default).
   4: Entr boot command line interface.
   5: Load ucos code to SDRAM via TFTP.
```

1. Select option 2 on the UBoot menu to burn the Linux image from 0x50000 to 0x400000.
2. Select option 9 on the Uboot menu to update your uboot from 0x0 to 0x30000.

10.2.2 By WebUI

You can use WebUI to upgrade the Linux image.

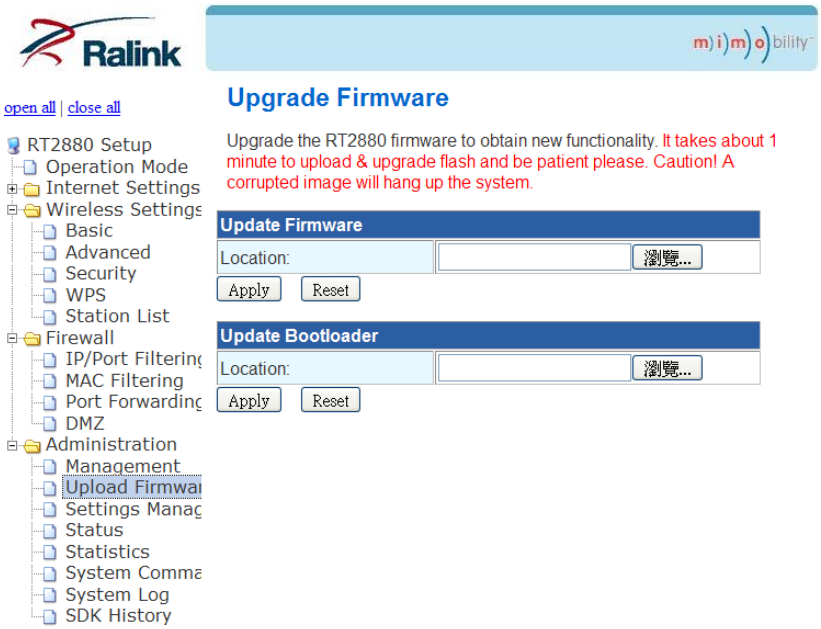
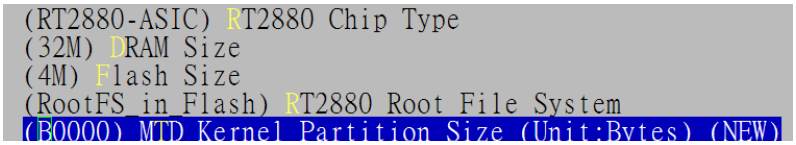


Figure 13 WebUI Firmware Upgrade

CGI uses the mtd_write command to burn a Linux image.

- **File system in RAM** - Burn Linux image to mtdblock3 (Kernel)

- **File system in Flash** - Burn first x bytes to mtdblock3, and others to mtdblock4 (ps. X byes = MTTD kernel partition size in "make menuconfig"



11 FAQ

11.1 RT2880 Default password/UART/networking setting

Table 4 Networking Setting

LAN	IP Address	10.10.10.254
	Subnet	255.255.255.0
WAN	IP Address	DHCP

Table 5 UART Setting

Item	Value
Baud Rate	57600
Data bits	8
Parity	None
Stop Bit	1
Flow Control	None

Table 6 Web Setting

	Default Value
	admin

	admin

11.2 System requirements for the host platform

RT2880 SDK uses Fedora 6 Host to build the image. Change your Linux distribution if you cannot successfully build the image.

Table 7 Requirements of Host Platform

	Value
	Fedora 6
	2.6.18-1.2798.fc6
	512MB
	40G

11.3 How to add new default parameter in flash

There are four default settings In RT288x_SDK/source/vendors/Ralink/RT2880, based on different platforms.

- RT2860_default_vlan: IC+ (gateway mode)/Vitesse Platform
- RT2860_default_novlan: IC+ (bridge mode)/Marvell 1000 Phy platform
- RT2860_default_oneport: IC+ 100 Phy platform
- RT2561_default: RT2561 PCI NIC (RT2860+RT2561 concurrent)

11.3.1 Example 1

Add a new default parameter - WHOAMI for IC+ platform

1. Edit RT288x_SDK/source/vendors/Ralink/RT2880/ RT2860_default_vlan, and add the following line.

WHOAMI=steven

2. Push "wps/load_default" button or execute the following commands

#ralink_init clear 2860

#reboot

3. Use nvram_get to retrieve WHOAMI parameter in script file (RT288x_SDK/source/user/rt2880_app/scripts), or nvram_bufset, nvram_bufget, nvram_commit in your CGI(RT288x_SDK/source/user/goahead/src) to use your feature.

11.3.2 Example 2

Save the RADIO ON/OFF button in WebUI to flash:

1. Add a line to RT288x_SDK/source/vendors/Ralink/RT2880/ RT2860_default_vlan for the default value:

RadioOn=1

2. Modify RT288x_SDK/source/user/goahead/src/wireless.c, function wirelessBasic() to save the radio on/off value to flash:

```
radio = websGetVar(wp, T("radiohiddenButton"), T("2"));
if (!strncmp(radio, "0", 2)) {
    nvram_bufset(RT2860_NVRAM, "RadioOn", radio);
    doSystem("ifconfig ra0 down");
    websRedirect(wp, "wireless/basic.asp");
    return;
}
```

```
else if (!strncmp(radio, "1", 2)) {
    nvram_bufset(RT2860_NVRAM, "RadioOn", radio);
    doSystem("ifconfig ra0 up");
    websRedirect(wp, "wireless/basic.asp");
    return;
}
```

3. Modify the RT288x_SDK/source/user/rt2880_app/scripts/internet.sh script not to bring ra0 up if RadioOn value stored in flash is not 1. Change "ifconfig ra0 0.0.0.0" to…

```
radio=`nvram_get 2860 RadioOn`
if [ "$radio" = "1" ]
    ifconfig ra0 0.0.0.0 up
else
    ifconfig ra0 0.0.0.0 down
fi
```

11.4 Enable Ethernet Converter Feature

The Wi-Fi Interface on the RT2880 platform should be configured for STA mode. All PCs under the RT2880 GMAC port connect to the AP via the RT2880 platform.

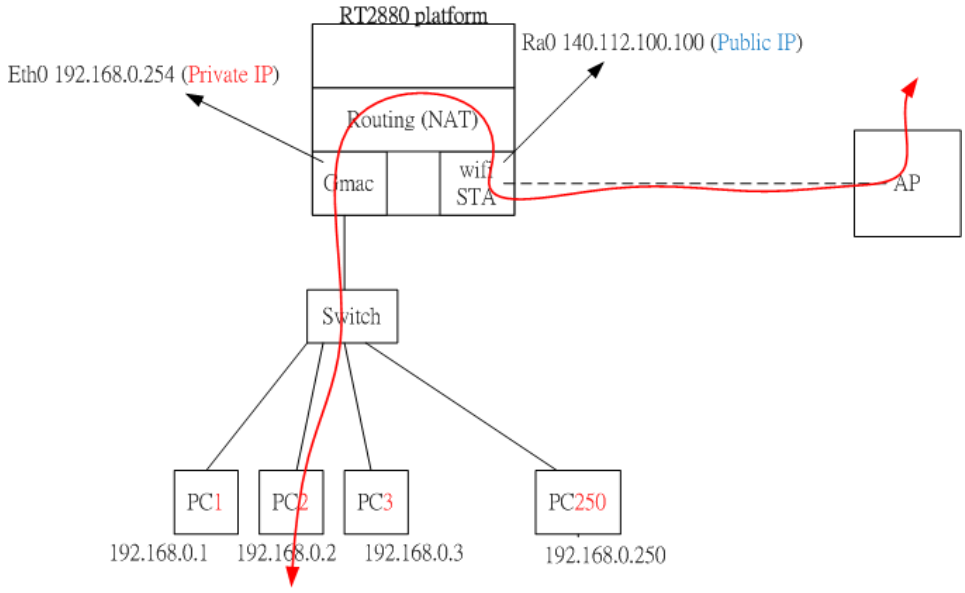


Figure 14 Ethernet Converter Operation Diagram

If the RT2880 platform can be operated as an AP or Ethernet converter by WebUI Configuration, make sure STA support and AP support as a Linux module is on in the rt2860v2 driver.

```
<M>   Ralink RT2860 802.11n AP support - 2860v2, (RBUS and PCI)
(RBUS) Bus Type
[ ]    LED SUPPORT
[*]    WSC (WiFi Simple Config)
[ ]    Nintendo
[ ]    LLTD (Link Layer Topology Discovery Protocol)
[*]    ATE
[*]    WDS
[*]    MBSSID
[ ]    AP-CLient Support
[ ]    IGMP snooping support
[ ]    NETIF Block
<M>   Ralink RT2860 802.11n STA support - 2860v2, (RBUS and PCI)
(RBUS) Bus Type
[ ]    LED SUPPORT
[ ]    WPA Supplicant
[ ]    WSC (WiFi Simple Config)
```

Turn on the rt2860v2 STA support if the RT2880 platform is an Ethernet converter only.

Select the operation mode on the "Operation Mode Configuration" web page.

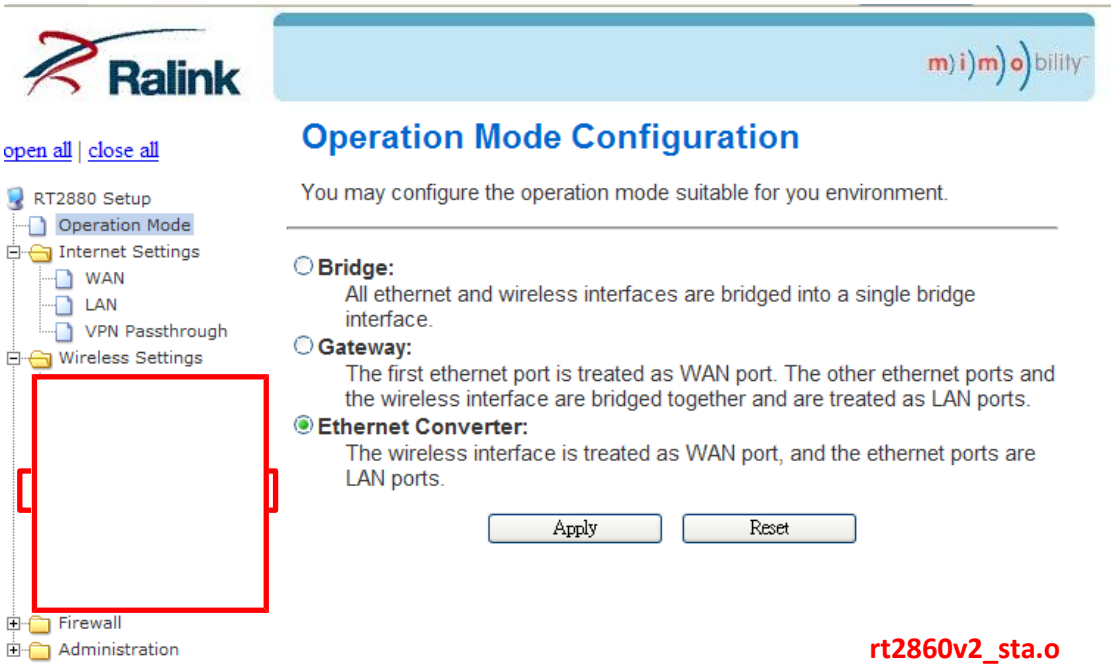


Figure 15 WebUI - STA Mode Setting

11.5 Change RF chip from RT2820 to RT2850 on the RT2880 platform

The QA program can burn an RT2850 EEPROM binary file. Click the "Load File" button and choose your own EEPROM binary file. The QA program will immediately burn the binary file to flash.

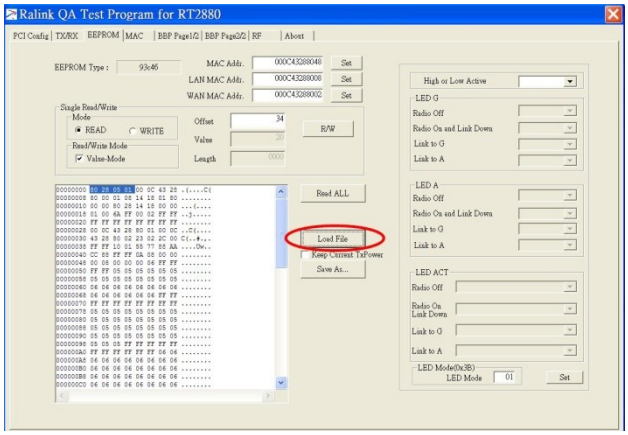


Figure 16 QA – Burn your own EEPROM binary file

11.6 How to change the Ethernet MAC address

The Ralink Ethernet driver uses GMAC0_ADDR to save its LAN/WAN mac address. If GMAC0_ADDR is empty, it will generate a random mac address instead.

#define GMAC0_ADDR (RT_EEPROM_BASE + 0x28)

#define GMAC1_ADDR (RT_EEPROM_BASE + 0x2E)

Note: If you need the LAN/WAN Ports to have different MAC addresses, adjust the Ethernet driver to get GMAC0_ADDR for LAN, and GMAC1_ADDR for WAN.
Use the QA program to modify your flash content.

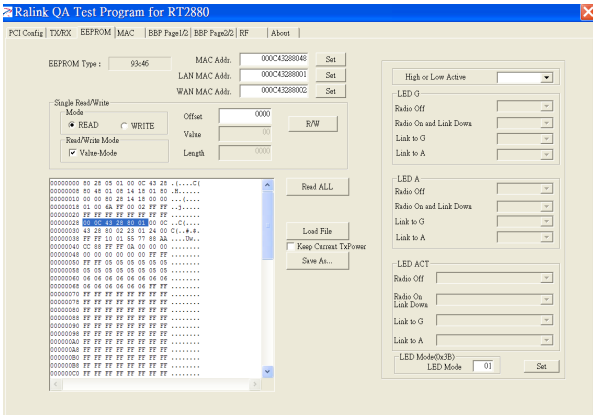


Figure 17 QA – Modify GMAC Mac address

11.7 How to configure GPIO ports

$SDK/source/linux-2.4.x/drivers/char/ralink_gpio.c

$SDK/source/linux-2.4.x/drivers/char/ralink_gpio.h

- RALINK_GPIO_SET_DIR - Configure the direction of the GPIO pins using bitmaps. Bit 1 is for output, and bit 0 is for input. For example, value 0x5 is for configuring GPIO pin 0 and 2 as output pins, and the other pins as input pins.
- RALINK_GPIO_SET_DIR_IN - Configure one or several GPIO pins as input pins using bitmaps. For example, value 0x5 is for configuring GPIO pin 0 and 2 as input pins, and other pins are ignored.
- RALINK_GPIO_SET_DIR_OUT - Configure one or several GPIO pins as output pins using bitmaps. For example, value 0x5 is for configuring GPIO pin 0 and 2 as output pins, and other pins are ignored.
- RALINK_GPIO_READ - Read the value from the GPIO data.
- RALINK_GPIO_WRITE - Write a value to the GPIO data.
- RALINK_GPIO_SET - Set a value with corresponding bits on to the GPIO data. For example, value 0x5 means GPIO data bit 0 and 2 will be set to 1, and the other bits will be ignored.
- RALINK_GPIO_CLEAR - Clear a value with corresponding bits off the GPIO data. For example, value 0x5 means GPIO data bit 0 and 2 will clear to 0, and other bits will be ignored.
- RALINK_GPIO_READ_BIT - Read the corresponding bit from the GPIO data. For example, bit 2 means read the third bit from GPIO data.
- RALINK_GPIO_WRITE_BIT - Write a corresponding bit to the GPIO data. For example, bit 2 and value 1 mean to write value 1 to the third bit of GPIO data.
- RALINK_GPIO_READ_BYTE - Read the corresponding byte from the GPIO data. For example, byte 2 means to read the third byte from GPIO data.

- RALINK_GPIO_WRITE_BYTE - Write a corresponding byte to the GPIO data. For example, byte 2 and value 0x33 mean to write value 0x33 to the third byte of the GPIO data.
- RALINK_GPIO_READ_INT - Same as RALINK_GPIO_READ.
- RALINK_GPIO_WRITE_INT - Same as RALINK_GPIO_WRITE.
- RALINK_GPIO_SET_INT - Same as RALINK_GPIO_SET.
- RALINK_GPIO_CLEAR_INT - Same as RALINK_GPIO_CLEAR.
- RALINK_GPIO_ENABLE_INTP - Enable GPIO input interrupt.
- RALINK_GPIO_DISABLE_INT - Disable GPIO input interrupt.

RALINK_GPIO_REG_IRQ - Register to receive an interruption from a GPIO pin. When the GPIO pin is interrupted, a signal SIGUSR1 or SIGUSR2 will be sent to the registered user process id. SIGUSR1 is sent when the GPIO pin has been clicked once, and SIGUSR2 is send when the GPIO pin has been pressed for several seconds.

11.8 Use GPIO to turn on LED

The following tables show the current GPIO definition for RT2880/RT3052/RT3883/RT3352/RT5350.

Table 6 GPIO Usage of RT2880

RT2880 Pin #	Pin name	GPIO define	Board version		Description
			2.4G	Dual	
			V30RW-FE	V11RW-GB	
K20	GPIO0	WPS/ Reset to default	●	●	Low Active signal input for Wi-Fi protection setup function and restore the setting to default value when push bottom for 3 second
P17	GPIO8/**DTR_N**		●	●	Reserved
R17	GPIO10/**DCD_N**	Giga PHY Reset		●	Low Active output for GigaPHY reset
T18	GPIO11/**DSR_N**		●	●	Reserved
P20	GPIO12/**CTS_N**	System Status/ Power LED	●	●	Low Active output for system ready LED display
N19	GPIO13/**RIN**	Security LED	●	●	Low Active output for security LED indicates when wireless security is enabled, display security status on panel
R20	GPIO14/**RXD**		●	●	Reserved for system reboot, Low Active output

Table 7 GPIO Usage of RT3052

RT3052 Pin #	Pin name	GPIO define	Board version	Description
			AP-RT3052-V20RW-2X2	
U10	GPIO0	WPS PBC	●	Low Active signal input for WPS function when push bottom over 3 second
T10	GPIO1/**I2C_SD**			
R10	GPIO2/**I2C_SCLK**			
U9	GPIO3/**SPI_EN**	RX_SW	●	GPIO3/GPIO5 ANT diversity 10: ANT2 01: ANT0
T9	GPIO4/**SPI_CLK**			
U8	GPIO5/**SPI_DOUT**	RX_SWN	●	
R9	GPIO6/**SPI_DIN**	iNIC mode select	●	Resistor strapping input 1: load code mode 0: dump switch mode
G2	GPIO7/**RTS_N**			
F2	GPIO8/-**TXD**-			
G1	GPIO9/-**CTS_N**-	System/ Power LED	●	Low Active output System status/Power display
J3	GPIO10/-**RXD**-	SW RST/ Factory	●	1. SW RST: Low Active signal input 2.Factory default: push bottom over 3 second
J4	GPIO11/-**DTR_N**-			
H3	GPIO12/-**DCD_N**-			
F1	GPIO13/-**DSR_N**-	Security LED	●	Low Active output security mode display
K4	GPIO14/-**RIN**-	WPS LED	●	Low Active output Indicate WPS PBC status

Table 8 GPIO Usage of RT3883/RT3662

RT3883/RT3662 Ball #	Ball name	Function	Description
K9	GPIO0	WPS LED	Use for WPS LED on Reference board.
K8	GPIO1	GPHYRST_N	Use for Giga Switch reset on Reference board.
L9	GPIO2	Band selection	RF 2.4GHz/5GHz Band selection.
L8	GPIO3	WPS_PB	WPS Push Button.
G14	GPIO4	SWRST_N_PB	Factory Default Push Button.
H14	GPIO5	Boot Strapping	Boot Strapping
H12	GPIO6	Boot Strapping	Boot Strapping
H13	GPIO7	Boot Strapping	Boot Strapping
G12	GPIO8	NC	Reserved for internal use.

The Ralink SDK GPIO driver gives an interface to set the frequency of the LEDs connected to the GPIOs.

Define RALINK_GPIO_LED_LOW_ACT to 1 at $SDK/linux-2.4.x/drivers/char/ralink_gpio.h if the LEDs are inactive. Otherwise, define it as 0.

#make menuconfig
Kernel/Library/Defaults Selection --->
[*] Customize Kernel Settings (NEW)
Character devices --->
[*] Ralink RT2880 GPIO Support
[*] Ralink GPIO LED Support

The LED can be set to blink in different ways if RALINK_GPIO_LED has been built enabled. The argument for RALINK_GPIO_LED_SET is ralink_gpio_led_info structure:

```
typedef struct {
    int gpio
    unsigned int on
    unsigned int off
    unsigned int blinks
    unsigned int rests;
    unsigned int times;

} ralink_gpio_led_info;
```

Write the application to set the LED frequency through the ioctl interface of the GPIO device. Use the example application, gpio.

#make menuconfig
Kernel/Library/Defaults Selection --->
[*] Customize Vendor/User Settings
Ralink RT288x Application --->
[ ] RT2880 GPIO Test

Usage:

gpio / <gpio> <on> <off> <blinks> <rests> <times>

- gpio: GPIO number of the board
- on: number of ticks that the LED will be bright
- off: number of ticks that the LED will be dark
- blinks: number of on-offs that the LED will blink
- rests: number of on-offs that the LED will rest
- times: number of blinks before the LED stops

Note: 1 tick is equal to 100ms. The maximum number is 4000 at this time.

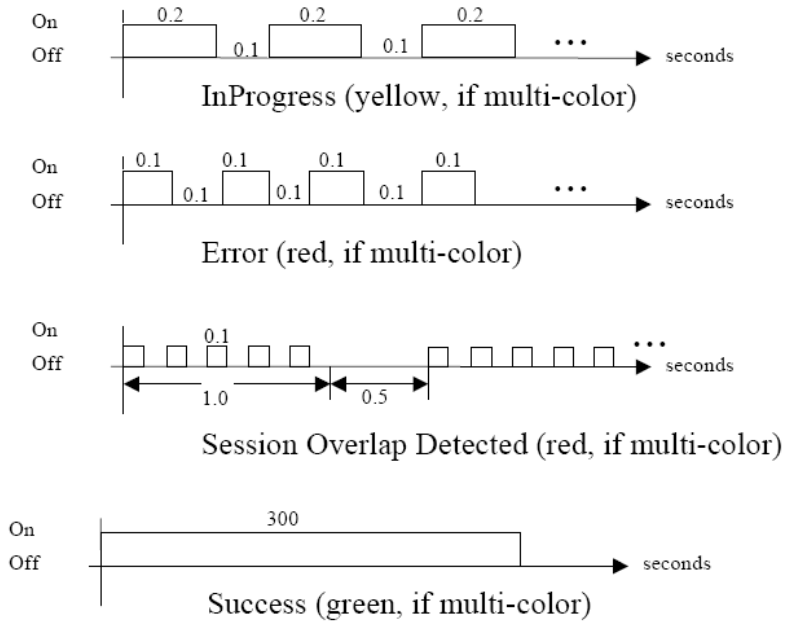


Figure 18 LED Definition of WPS Specification

Using the WPS PBC status LED as an example, the configurations would be:

- InProgress: gpio l <gpio> 2 1 4000 0 4000 (i.e. 2 ticks bright, 1 tick dark, blinking forever.)
- Error: gpio l <gpio> 1 1 4000 0 4000 (i.e. 1 tick bright, 1 tick dark, blinking forever.)
- Session Overlap Detected: gpio l <gpio> 1 1 10 5 4000 (i.e. 1 tick bright, 1 tick dark, blinking for 10 on-offs, resting for 5 on-offs, and never stops.)
- Success: gpio l <gpio> 3000 1 1 1 1 (i.e. 3000 ticks bright, 1 tick dark, blinking for one on-offs and one time.)
- To turn the LED on and keep it on: gpio l <gpio> 4000 0 1 0 4000
- To turn the LED off and keep it off: gpio l <gpio> 0 4000 0 1 4000

11.9 Use LED firmware to turn on LED

1. enable LED firmware

#make menuconfig
Kernel/Library/Defaults Selection --->
[*] Customize Kernel Settings
Network device support --->
Ralink Driver --->

```
<M>   Ralink RT2860 802.11n AP support - 2860v2, (RBUS and PCI)
(RBUS) Bus Type
[ ]    Dual Band
[*]    LED Support
[*]    WSC (WiFi Simple Config)
[*]    LLTD (Link Layer Topology Discovery Protocol)
[*]    ATE
[*]    WDS
[*]    MBSSID
[ ]    AP-CLient Support
[ ]    IGMP snooping Support
[ ]    NETIF Block
[ ]    DFS Support
[ ]    Carrier Detect Support
```

2. Fill out flash content to control the LED behavior because the LED firmware will read the configuration from flash.

Table 18 RT2880 LED Parameters in Flash

Address	Bit	LED Mode	Mode Description	Comment
3Bh	[6:0]	0	HW control	The default mode. Driver sets MAC register and MAC controls LED.
		1	FW default mode	The firmware controls how LED blinks.
		2	8sec scan	Same as LED mode 1 except that fast blink for 8sec when doing scanning.
		3-63	-	Reserved for future
		64	Signal strength setting	Besides mode 1, additionally set LED signal strength. LedParam1[0] = GPIO polarity (0 is negative) LedParam0 = Signal strength (Valid value are 0, 1,3,7,15,31. 0 is the weakest.)
	7	GPIO Polarity		

Address	States	Bit	RT2860 Pin-127_LED behavior
3Eh	Radio off	[1:0]	00: Reserved 01: Solid on 10: Blink when transmitting data and management packet 11: Blink when transmitting data, management packet and beacon
		2	0: Solid on when no traffic 1: Slow blink when no traffic
		3	Reserved
	Radio on but link down	[5:4]	00: Reserved 01: Solid on 10: Blink when transmitting data and management packet 11: Blink when transmitting data, management packet and beacon
		6	0: Solid on when no traffic 1: Slow blink when no traffic
		7	Reserved
3Fh	Radio on and link to G	[9:8]	00: Reserved 01: Solid on 10: Blink when transmitting data and management packet 11: Blink when transmitting data, management packet and beacon
		10	0: Solid on when no traffic 1: Slow blink when no traffic
		11	Reserved
	Radio on and link to A	[13:12]	00: Reserved 01: Solid on 10: Blink when transmitting data and management packet 11: Blink when transmitting data, management packet and beacon
		14	0: Solid on when no traffic 1: Slow blink when no traffic
		15	Reserved

Address	States	Bit	LED behavior	
40h	Radio off	[3:0]	bit 0: LED G	1: Positive polarity 0: Negative polarity
			bit 1: LED A	
			bit 2: LED Act	
			bit 3: 0: Reserved	1: LED ACT polarity inversion when link to A
	Radio on but link down	[7:4]	bit 0: LED G	1: Positive polarity 0: Negative polarity
			bit 1: LED A	
			bit 2: LED Act	
			bit 3: 0: Reserved	1: LED ACT polarity inversion when link to A
41h	Radio on and link to G	[11:8]	bit 0: LED G	1: Positive polarity 0: Negative polarity
			bit 1: LED A	
			bit 2: LED Act	
			bit 3: 0: Reserved	1: LED ACT polarity inversion when link to A
	Radio on and link to A	[15:12]	bit 0: LED G	1: Positive polarity 0: Negative polarity
			bit 1: LED A	
			bit 2: LED Act	
			bit 3: 0: Reserved	1: LED ACT polarity inversion when link to A

The current Ralink default flash hex values are subsequently shown.

RT2880 Flash Base Address=0x40000

- 4003B: 1 controlled by firmware

- 4003C: 55 LED A/G don't care
- 4003D: 77 LED A/G don't care
- 4003E: A8 LED ACT radio off = solid on/off
- 4003F: AA LED ACT blink when transmitting data & management packet
- 40040: 8C LED Act positive polarity when radio off -> solid off
- 40041: 88 LED Act negative polarity when link to A/G -> blink

11.10 How to start the telnet server

Check RT288x_SDK/source/user/busybox/.config

11.10.1 busybox setting

CONFIG_FEATURE_DEVPTS=y ⎓ General Configuration

CONFIG_FEATURE_SUID=y ⎓ General Configuration

CONFIG_LOGIN=y ⎓ Login/Password Management Utilities

CONFIG_TELNETD=y ⎓ Networking utilities

CONFIG_FEATURE_TELNETD_STANDALONE=y

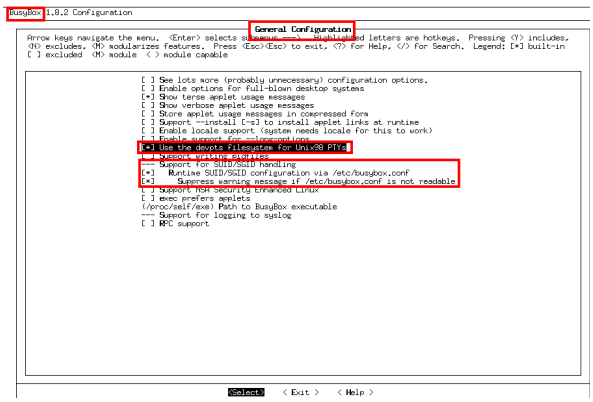
Check RT288x_SDK/source/linux-2.4.x/.config

11.10.2 Linux setting

CONFIG_UNIX98_PTYS=y ⎓ Character devices

CONFIG_UNIX98_PTY_COUNT=256

CONFIG_DEVPTS_FS=y ⎓ File systems



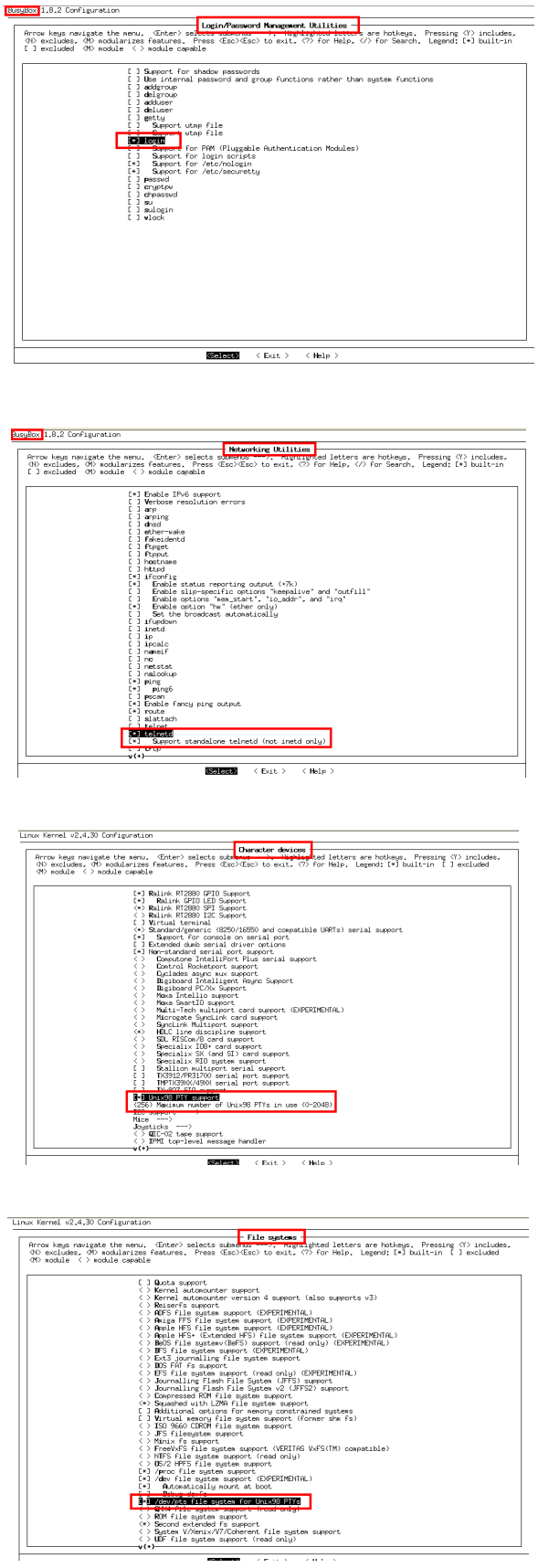


Figure 20 Configuration Procedure of Telnet Server

11.11 11n bit rate derivation

1 The 11n bit rate is calculated by the MAC driver. The MAC driver refers to the three subsequent factors.

a. MCS

b. BW

c. GI

Note: the bit rate is primarily given by the PHY layer.

2 Bandwidth: Data subcarriers on different bandwidths, 20MHz and 40MHz.

a N_{SD}: Number of data subcarriers.

N_{SD}[40Mhz] = 108

N_{SD}[20Mhz] = 52

N_{SD}[40Mhz]/N_{SD}[20MHz] = 108/52

= 2.076923076923076923076923076923

b Example:

MCS=15, GI=800ns, BW=20MHz, DataRate = 130Mbps

MCS=15, GI=800ns, BW=40MHz, DataRate = 130 * [$N_{sd(40Mhz)}$ / $N_{sd(20Mhz)}$]

= 130 * [108 / 52]

= 270Mbps

c Please refer to "IEEE P802.11n/D2.04, June 2007" on page 314 for subsequent table.

Table 207—MCS parameters for optional 20 MHz, N_{SS} = 2, N_{ES} = 1, EQM (#665)

MCS Index	Modulation	R	$N_{BPSCS(iSS)}$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI See NOTE
8	BPSK	1/2	1	52	4	104	52	13.0	14.4
9	QPSK	1/2	2	52	4	208	104	26.0	28.9
10	QPSK	3/4	2	52	4	208	156	39.0	43.3
11	16-QAM	1/2	4	52	4	416	208	52.0	57.8
12	16-QAM	3/4	4	52	4	416	312	78.0	86.7
13	64-QAM	2/3	6	52	4	624	416	104.0	115.6
14	64-QAM	3/4	6	52	4	624	468	117.0	130.0
15	64-QAM	5/6	6	52	4	624	520	130.0	144.4

NOTE—The 400 ns GI rate values are rounded to 1 decimal place

3 Guard Interval:

a Definition:

T_{sym}: 4ㄴ s ;Symbol Interval

T_{syms}: 3.6ㄴ s ;Symbol interval of Short GI.

b Ratio of symbol interval on GI, refer to below EWC PHY Sepc.

Tsym / Tsyms = 4ㄴ sec / 3.6ㄴ sec = 10/9

c Example:

MCS=15, 40MHz Bandwidth, and 400ns Short Guard Interval.

270.0 * (10/9) = 300.0 for Short GI.

d Reference:

1 IEEE 802.11n draft 2.04, page 316 and

Table 211—MCS parameters for optional 40 MHz, NSS = 2, NES = 1, EQM (#665)

MCS Index	Modulation	R	NBPSCS(iSS)	NSD	NSP	NCBPS	NDBPS	Data rate (Mb/s)	
								800 ns GI	400 ns GI

8	BPSK	1/2	1	108	6	216	108	27.0	30.0
9	QPSK	1/2	2	108	6	432	216	54.0	60.0
10	QPSK	3/4	2	108	6	432	324	81.0	90.0
11	16-QAM	1/2	4	108	6	864	432	108.0	120.0
12	16-QAM	3/4	4	108	6	864	648	162.0	180.0
13	64-QAM	2/3	6	108	6	1296	864	216.0	240.0
14	64-QAM	3/4	6	108	6	1296	972	243.0	270.0
15	64-QAM	5/6	6	108	6	1296	1080	270.0	300.0

2 EWC PHY spec. page 13.

EWC PHY spec, v1.27

Parameter	Value in legacy 20MHz channel	Value in 20MHz HT channel	Value in 40MHz channel	
			HT format	Legacy Duplicate
frequency spacing				
T_{FFT}: IFFT/FFT period	3.2µsec	3.2µsec	3.2µsec	
T_{GI}: Guard Interval length	0.8µsec= $T_{FFT}/4$	0.8µsec	0.8µsec	
T_{GI2}: Double GI	1.6µsec	1.6µsec	1.6µsec	
T_{GIS}: Short Guard Interval length	0.4µsec= $T_{FFT}/8$	0.4µsec	0.4µsec	
T_{L-STF}: Legacy Short training sequence length	8µsec=10× $T_{FFT}/4$	8µsec	8µsec	
T_{L-LTF}: Legacy Long training sequence length	8µsec=2× $T_{FFT}+T_{GI2}$	8µsec	8µsec	
T_{SYM}: Symbol Interval	4µsec= $T_{FFT}+T_{GI}$	4µsec	4µsec	
T_{SYMS}: Short GI Symbol Interval	3.6µsec= $T_{FFT}+T_{GIS}$	3.6µsec	3.6µsec	
T_{L-SIG}	4µsec= T_{SYM}	4µsec	4µsec	

Tsym/Tsyms = 4u/3.6u = 10/9

3 EWC PHY spec. page 13.

transmission for a period of corresponding to the length of the rest of the packet. When L-SIG TXOP Protection is not used (see "L-SIG TXOP Protection" section of the EWC MAC spec), the value to be transmitted is $l = 3(\lceil N_{data} \rceil + N_{LTF} + 3) - 3$ where N_{data} is the number of **4usec** symbols in the data part of the packet. While using short GI N_{data} is equal to the actual number of symbols in the data part of the packet multiplied by $\frac{9}{10}$. N_{LTF} is the number of HT training symbols. The symbol $\lceil x \rceil$ denotes the lowest integer greater or equal to x.

11.12 How to build a single image for the flash programmer

Example: Make a 4M single image for the rt2880 platform (the Uboot partition is 192K, user configuration partition is 64K, and RF partition is 64K)

 # RT288x_SDK/tools/single_img

#vi Makefile.4M

#

 # Change uboot/kernel size if necessary

#

UBOOT_SIZE = 0x50000

KERNEL_SIZE = 0x3B0000

#--

USER_NAME = $(shell whoami)

#

 # Uboot Image Information

#

UBOOT_DIR = .

UBOOT_IMAGE = uboot.bin

#

 # Linux Kernel Image Information

#

KERNEL_DIR = .

KERNEL_IMAGE = steven_uImage

#

 # Single Image Information

#

PACKED_DIR = .

PACKED_IMAGE = steven_uImage.img

#cp /tftpboot/uboot.bin .

#cp /tftpboot/steven_uImage .

#make –f Makefile.4M

Flash layout:

```
 +-----------+--------+--------+----------------------------+
 | Uboot | UsrCfg |  RF |  Linux Kernel Image |
 +-----------+--------+--------+----------------------------+


 |<--------0x50000-------->|<-------0x3B0000------>|
```

-Original Uboot Image Size

149372 ./uboot.bin

- Original Kernel Image Size

2779348 ./steven_uImage

- Packed Image Size

4194304 ./steven_uImage.img

#ls –l

-rw-r--r-- 1 steven users 3831 Jun 24 19:00 Makefile.16M

-rw-r--r-- 1 steven users 2865 Jun 27 13:27 Makefile.4M

-rw-r--r-- 1 steven users 3744 Jun 24 19:00 Makefile.8M

-rw-r--r-- 1 steven users 2779348 Jun 27 13:34 steven_uImage

*-rwxr-xr-x 1 steven users 4194304 Jun 27 13:36 steven_uImage.img**

*-rwxr-xr-x 1 steven users 149372 Jun 27 13:34 uboot.bin**

The single image can now be burned using the flash programmer.

11.13 How to power down the RT3x5x build-in 10/100 PHYs

	1	2
	L	L

MII control register

Bit	Name	Description	Read/Write	Default
15	mr_main_reset	1=Reset: 0=Normal, reset all digital logic, except phy_reg	R/ W; SC	1'h0
14	loopback_mii	Mii loop back	R/W	1'h0
13	force_speed	1 = 100Mbps: 0=10Mbps, when mr_autoneg_enable = 1'b0	R/W	1'h1
12	mr_autoneg_enable	1= Enabled: 0=Normal	R/W	1'h1
11	powerDown	phy into power down (power down analog TX analog RX, analog AD)	R/W	1'h0
10	reserved		RO	1'h0
9	mr_restart_negotiation	1 = Restart Auto-Negotiation: 0 = Normal	R/W; SC	1'h0

8	force_duplex	1 = Full Duplex: 0 = Half Duplex, when mr_autoneg_enable = 1'b0	R/W;PC	1'h1
7:0	RESERVED		RO	8h00

User Space:

 # mii_mgr -s -p 0 -r 0 -v 0x3900 //set port 0 register0 bit11

Set: phy[0].reg[0] = 3900

 # mii_mgr -s -p 1 -r 0 -v 0x3900 //set port 1 register0 bit11

Set: phy[1].reg[0] = 3900

 # mii_mgr -s -p 2 -r 0 -v 0x3900 //set port 2 register0 bit11

Set: phy[2].reg[0] = 3900

 # mii_mgr -s -p 3 -r 0 -v 0x3900 //set port 3 register0 bit11

Set: phy[3].reg[0] = 3900

 # mii_mgr -s -p 4 -r 0 -v 0x3900 //set port 4 register0 bit11

Set: phy[4].reg[0] = 3900

Kernel Space:

*extern u32 mii_mgr_read(unsigned int , unsigned int, unsigned int *);*

extern u32 mii_mgr_write(unsigned int, unsigned int, unsigned int);

mii_mgr_write(0, 0, 0x3900) //set port 0 register0 bit11

mii_mgr_write(1, 0, 0x3900) //set port 1 register0 bit11

mii_mgr_write(2, 0, 0x3900) //set port 2 register0 bit11

mii_mgr_write(3, 0, 0x3900) //set port 3 register0 bit11

mii_mgr_write(4, 0, 0x3900) //set port 4 register0 bit11

You also need to set POC[27:23] to disable Phy port.

RT288x_SDK/source/linux-2.6.21.x/drivers/net/raeth/rather.c)

```
*(unsigned long *)(0xb0110090) = 0x0??07f7f;
```

POC1: Port Control 0 (offset: 0x90)

Bits	Type	Name	Description	Initial value
31:30	R/W	HASH_ADDR_SHIFT	Address table hashing algorithm option for member set index	2'b0
29	R/W	DIS_GMII_PORT_1	Disable port 6 1: port disable (if dumb mode, default = 0)	1'b1
28	R/W	DIS_GMII_PORT_0	Disable port 5 1: port disable (if dumb mode, default = 0)	1'b1
27:23	R/W	DIS_PORT	Disable phy port 1: port disable (if dumb mode, default = 0)	5'h1f
22:16	R/W	DISRMC2_CPU	1: disable RMC packet to cpu	7'h0
15	RO	-	Reserved	1'b0
14:8	R/W	EN_FC	Enable pause flow control enable 802.3x flow control	7'h7f
7	RO	-	Reserved	1'b0
6:0	R/W	Reserved	Enable back pressure 1: enable back pressure (but need to qualify BP_mode)	7'h7f

11.14 How to power down the RT6855/RT6856 build-in 10/100 PHYs

Please modify GPC1[29:24] to disable PHY ports.

GPC1: GIGA Port-I Control (offset: 0x7014)

Bits	Type	Name	Description	Initial value
31:30	-	-	Reserved	0x0
29:24	RW	PHY_DIS	**Disable Internal 5-port EPHY.**	0x0

11.15 How to enable NFS client

#make menuconfig

Kernel/Library/Defaults Selection--->

Networking options --->

[*] IP: kernel level autoconfiguration

File systems --->

Network File Systems --->

Linux 2.4:

<*> NFS file system support

[*] Provide NFSv3 client support

[*] Allow direct I/O on NFS files (EXPERIMENTAL)

[*] Root file system on NFS

Linux 2.6

<> NFS file system support*

[*] Provide NFSv3 client support

[*] Provide client support for the NFSv3 ACL protocol extension

[*] Provide NFSv4 client support (EXPERIMENTAL)

[*] Allow direct I/O on NFS files

Kernel/Library/Defaults Selection--->

[*] Customize Kernel Settings (NEW)

[*] Customize Busybox Settings

Linux System Utilities--->

[*] mount

[ ] Support mount helpers

[*] Support mounting NFS file systems

Example:

```
# mount -o nolock 192.168.18.21:/tftpboot /mnt

# mount

……

/dev/sda1 on /media/sda1 type vfat

(rw,fmask=0000,dmask=0000,codepage=cp437,iocharset=iso8859-1)

192.168.18.21:/tftpboot on /mnt type nfs

(rw,vers=3,rsize=32768,wsize=32768,hard,nolock,proto=udp,timeo=7,retrans=3,sec=sys,addr=192.16
8.18.21)
```

11.16 How to add a new language to the web UI

The following instructions are an example and show how to add the Korean language to the web UI.

1. Copy all the xml files under RT288x_SDK/source/user/goahead/web/lang/en to RT288x_SDK/source/user/goahead/web/lang/kr and translate the "msgstr" part in those files.
   (Note: the translation should be UTF-8 encoded)

2. Add an entry to RT288x_SDK/source/config/config.in:
   ```
   dep_bool '  language pack - Korean'     CONFIG_USER_GOAHEAD_LANG_KR
   $CONFIG_USER_GOAHEAD_HTTPD
   ```

3. Add an entry toRT288x_SDK/source/user/goahead/Makefile:
   ```
   ifneq ("$(CONFIG_USER_GOAHEAD_LANG_KR)", "y")
      rm -rf $(ROMFSDIR)/$(ROOT_DIRECTORY)/lang/kr
   endif
   ```

4. RT288x_SDK/source/user/goahead/src/utils.c:
   Add to 'getLangBuilt' function:
   ```
      else if (!strncmp(lang, "kr", 5))
   #ifdef CONFIG_USER_GOAHEAD_LANG_KR
      return websWrite(wp, T("1"));
   #else
      return websWrite(wp, T("0"));
   #endif
   ```

5. RT288x_SDK/source/user/goahead/web/overview.asp
   Add to 'initValue' function:
   ```
   var lang_kr = "<% getLangBuilt("kr"); %>";
   if (lang_kr == "1")
       lang_element.options[lang_element.length] = new Option('Korean', 'kr');
   ```

6. RT288x_SDK/source/user/goahead/web/adm/management.asp
   Add to 'initValue' function:
   ```
   var lang_kr = "<% getLangBuilt("kr"); %>";
   if (lang_kr == "1")
       lang_element.options[lang_element.length] = new Option('Korean', 'kr');
   ```

7. RT288x_SDK/source/user/goahead/web/home.asp
   Fix 'initLanguage' function

8. make menuconfig
   Customize Vendor/User Settings ---> Network Applications ---> select Korean language pack

11.17 How to enable watchdog

- User mode Watchdog:

  $ make menuconfig

  Kernel/Library/Defaults Selection --->

  [*] Customize Kernel Settings

  Device Drivers --->

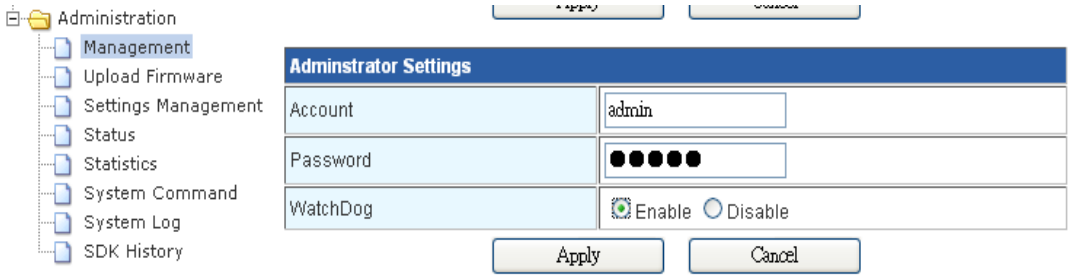
  Character devices --->

  Watchdog Cards --->

  [*] Customize Vendor/User Settings

  Miscellaneous Applications --->

  Finally, Enable watchdog in WebUI.



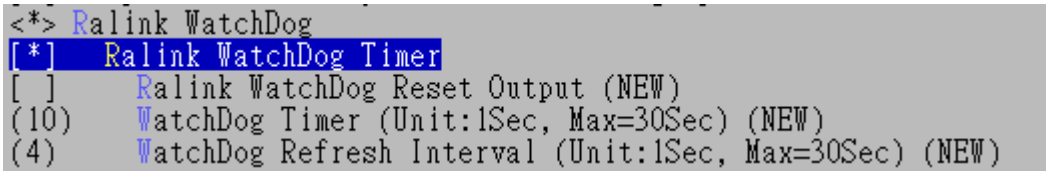
- Kernel mode Watchdog:

  $ make menuconfig

  Kernel/Library/Defaults Selection --->

  [*] Customize Kernel Settings

  Machine selection --->



11.18 How to enable USB storage on the RT305x platform

#make menuconfig

Kernel/Library/Defaults Selection --->

[*] Customize Kernel Settings (NEW)

Device Drivers --->

SCSI device support --->

<*> SCSI device support

<*> SCSI disk support

USB support --->

<*> Support for Host-side USB

[*] USB verbose debug messages

[*] USB device filesystem

<*> USB Mass Storage support

[*] USB Mass Storage verbose debug

File systems --->

<*> Filesystem in Userspace support

DOS/FAT/NT Filesystems --->

<*> VFAT (Windows-95) fs support

(437) Default codepage for FAT (NEW)

(iso8859-1) Default iocharset for FAT (NEW)

Partition Types --->

[*] Advanced partition selection

[*] PC BIOS (MSDOS partition tables) support (NEW)

Native Language Support --->

(iso8859-1) Default NLS Option

<*> Codepage 437 (United States, Canada)

<*> Traditional Chinese charset (Big5)

<*> NLS ISO 8859-1 (Latin 1; Western European Languages)

<*> NLS UTF-8

Ralink Module --->

<M> RALINK DWC_OTG support

[ ] enable debug mode

[*] HOST ONLY MODE

[ ] DEVICE ONLY MODE

CAUTION: THE KERNEL SIZE CANNOT BE BIGGER THAN THE MTD KERNEL PARTITION SIZE IN ROOTFS IN FLASH MODE.

#==

Original Kernel Image Size

1033369 /home/steven/rt3052/RT288x_SDK/source/images/zImage.lzma

Padded Kernel Image Size

1048512 /home/steven/rt3052/RT288x_SDK/source/images/zImage.lzma

Original RootFs Size

.....

11.19 How to enable USB automount on the RT305x platform

#make menuconfig

Kernel/Library/Defaults Selection --->

[*] Customize Busybox Settings

Linux System Utilities --->

[*] mdev

[*] Support /etc/mdev.conf

[ ] Support subdirs/symlinks (NEW)

[*] Support command execution at device addition/removal

[*] Customize Vendor/User Settings

Miscellaneous Applications --->

[*] ntfs-3g

11.20 How to enable software QoS

To support the Ralink SW QoS, many menuconfig options in Ralink SDK must be enabled, including in kernel and application configs.

Kernel IMQ config:

Since the Intermediate Queueing (IMQ) pseudo device are used to support Ralink SW QoS, it must be enabled first, or some needed options in Netfilter configs won't show up due to dependency.

Networking --->

Device Drivers --->

Network device support --->

<*> IMQ (intermediate queueing device) support

IMQ behavior (PRE/POSTROUTING) (IMQ AB)

(2) Number of IMQ devices

Kernel Netfilter configs:

In order to support Ralink SW QoS, several necessary Netfilter modules are used, including Netfilter match and target modules. These modules must be enabled to let Ralink SW QoS work correctly. But first of all, a proprietary Ralink option in Netfilter has to be enabled.

To completely fit the requirement of Ralink SW QoS some changes are made in Linux Netfilter architecture. For this changes, a Ralink proprietary Netfilter option **Netfilter Ralink SWQoS support** is introduced. This Ralink proprietary Netfilter option must be enabled to support Ralink SW QoS, or the classification of IP address may not work properly. If the Ralink SW QoS is not required, of course, it is recommended to leave this option blank to keep the Linux Netfilter architecture unchanged and expected.

-> Networking

-> Networking support (NET [=y])

-> Networking options

-> Network packet filtering framework (Netfilter) (NETFILTER [=y]

-> Core Netfilter Configuration

[*] **Netfilter Ralink SWQoS support(Marking after NAT)**

Then please enable the following necessary netfilter and iptables modules to support Ralink SW QoS:

-> Networking

-> Networking support (NET [=y])

-> Networking options

-> Network packet filtering framework (Netfilter) (NETFILTER [=y]

-> Core Netfilter Configuration

<*> Netfilter connection tracking support

<*> "conntrack" connection tracking match support

<*> "DSCP" target support

<*> "MARK" target support

<*> "DSCP" match support

<*> "helper" match support

<*> "length" match support

<*> "mac" address match support

<*> "state" match support

<*> "layer7" match support

<*> "Ethernet port for incoming packets" match support

And,

-> Networking

-> Networking support (NET [=y])

-> Networking options

-> Network packet filtering framework (Netfilter) (NETFILTER [=y]

->IP: Netfilter Configuration --->

<*> IP tables support (required for filtering/masq/NAT)

<*> Packet mangling

<*> IMQ target support

Application configs:

Besides kernel configs, there are also several application menuconfigs which has to be enabled to support Ralink SW QoS.

[*] Customize Vendor/User Settings

Library Configuration --->

[*] Build libresolv

Network Applications --->

[*] iptables

[*] iproute2

[*] tc

Ralink Proprietary Application --->

[*] Software QoS

11.21 Software QoS information

11.21.1 Software QoS – Preface

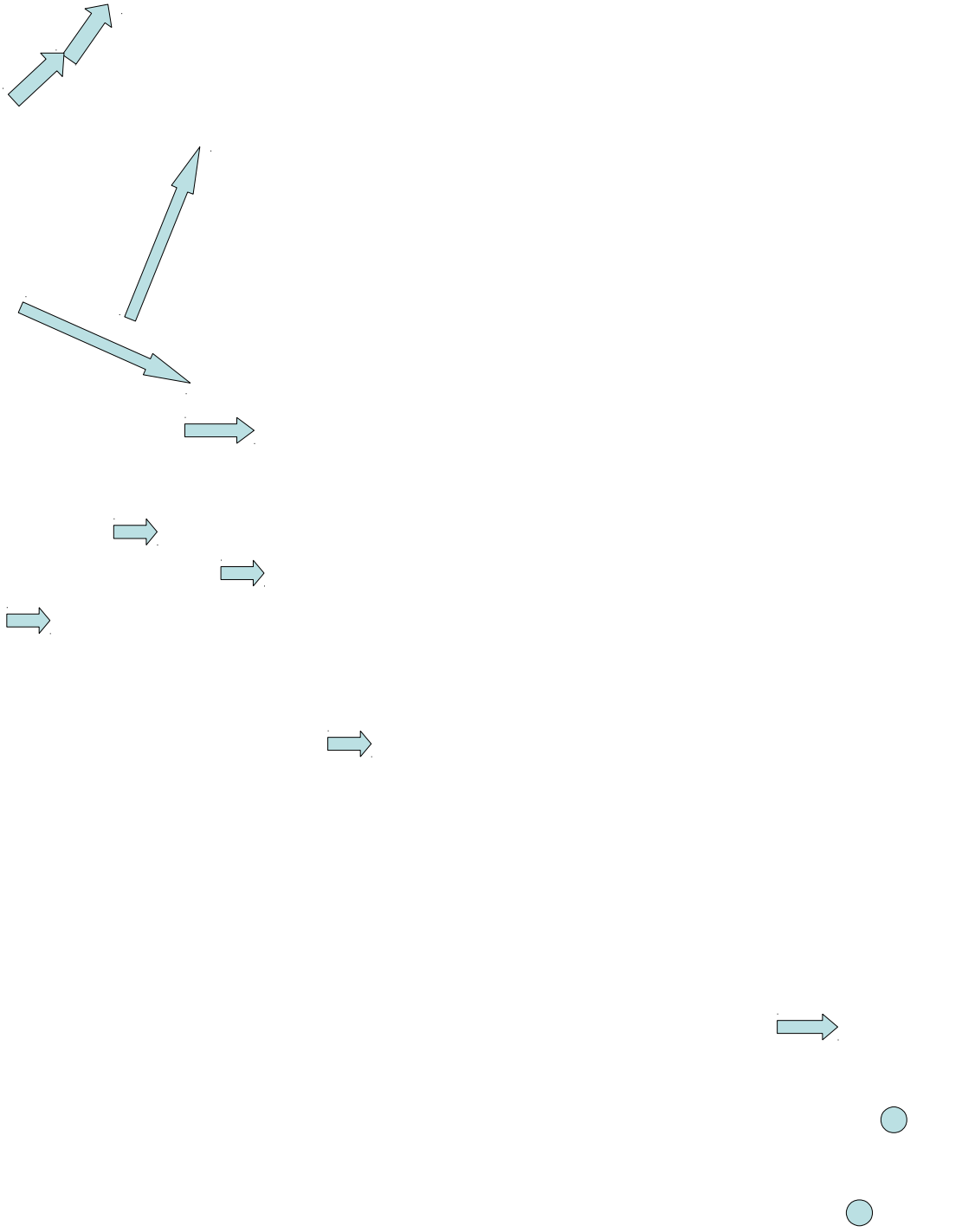
The Ralink SoC SW QoS supports many different types of classification, rate limitation, and DSCP remarking. Ralink SoC SW QoS is based on the Linux Qdiscs, TC, and iptables. Ralink SoC SW QoS supports download and upload stream on a WAN interface.

11.21.2 QoS – Concept

The Ralink SoC SW QoS architecture is shown in the subsequent figure. The Classifier module classifies incoming packets into the Shaper module. The Shaper module has 4 queues (groups) to do rate limitation, and then the Remark module rewrites the DSCP field of the packet if it is necessary.

SW QoS

packets

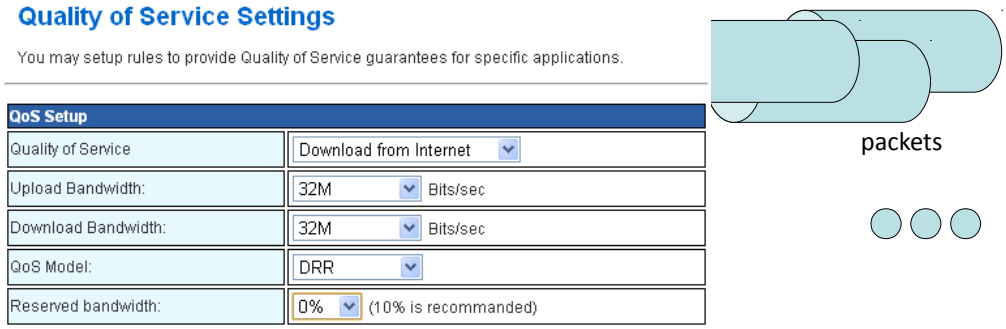


Remark

11.21.3 Software QoS – Usage

Conceptually, there are three main settings in Ralink SW QoS have to be specified : Global settings, Group settings, and Rule settings.

Global settings:



1. Select "upload to Internet " or "download from Internet" on the web UI to enable the Ralink SW QoS.

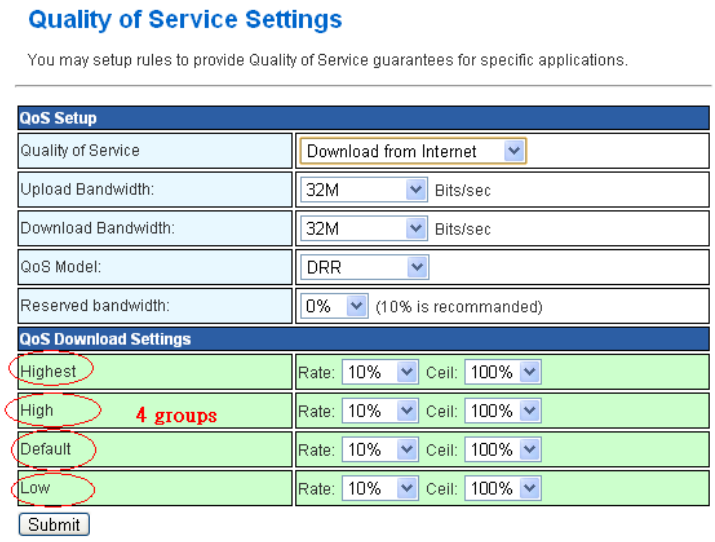
2. Enter the upload and download bandwidth details to make a good fit with the user's network environment (e.g. ADSL 512k/64k, Cable Modem 10M/10M….)

3. Select a QoS model: DRR (Deficit Round Robin), SPQ(Strict Priority Queue), DRR+SPQ.

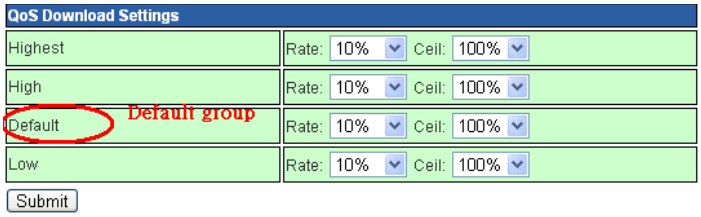
4. Select reserved bandwidth. The reserved bandwidth is out of the control of Ralink SW QoS.

Group settings:

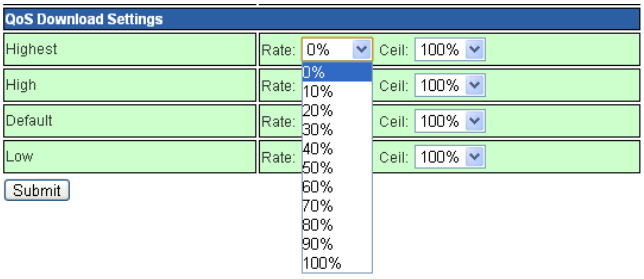
Four QoS groups are shown after specifying Global settings in Ralink SW QoS. Now all packets through this gateway are classified into these four QoS groups according to the user's QoS rules settings. The four QoS groups are subsequently shown.



The default group is the group named Default(the third group), that means the packet would be classified into this group if it doesn't match with any rules.



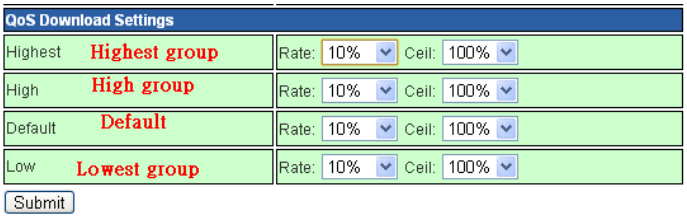
In each QoS group there are two attributes Rate and Ceil as shown in the subsequent figure.



a. Rate: Set the guaranteed minimum bandwidth that this group can use.

b. Ceil: Set the maximum bandwidth that this group can use.

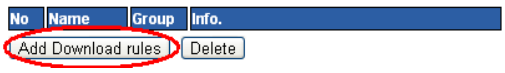
The first group named Highest has the highest priority. The next group named High has the second priority. The third group named Default is the default group. The last group named Low has the lowest priority.

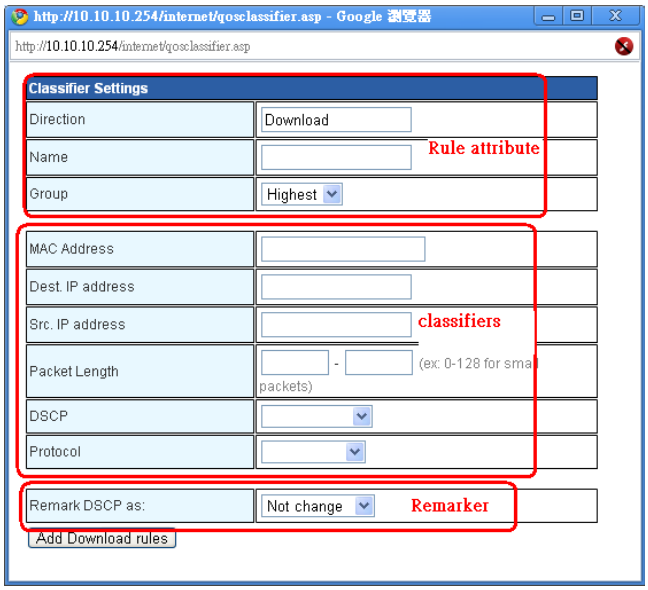


Highest priority means the left available bandwidth will serve the group first, but settings for guaranteed rate and ceil in every group are still met strictly. For example, people often hope VoIP traffic is classified as the highest priority group for short latency and good quality, and P2P traffic to be classified as the lowest priority and background traffic.

Rules settings:

The QoS rules are made to do classification, and remarking. One QoS rules are made of 3 parts: attributes, classifiers, and remaker.





1) Rule attribute:

a) Name: specifies this rules name

b) Group: specifies which group this rule is belongs to.

2) Rule classifiers:

Ralink SW QoS supports these classifiers currently:

a) SRC/DSP IP address (with netmask)

b) Packet length

c) DSCP field

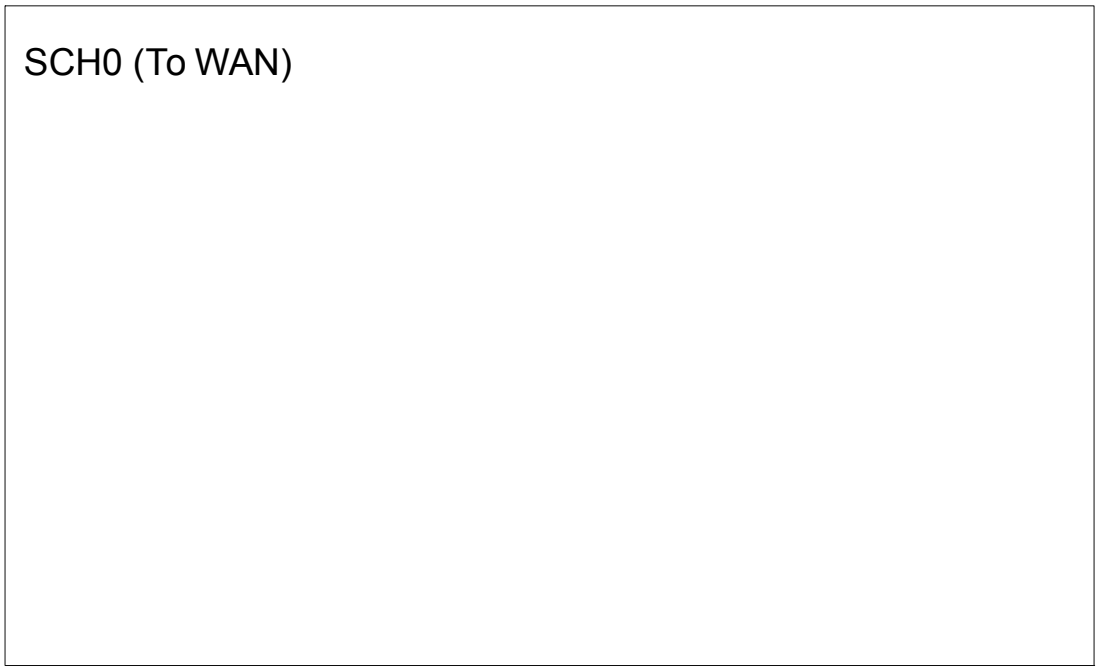
d) ICMP, TCP/UDP port range

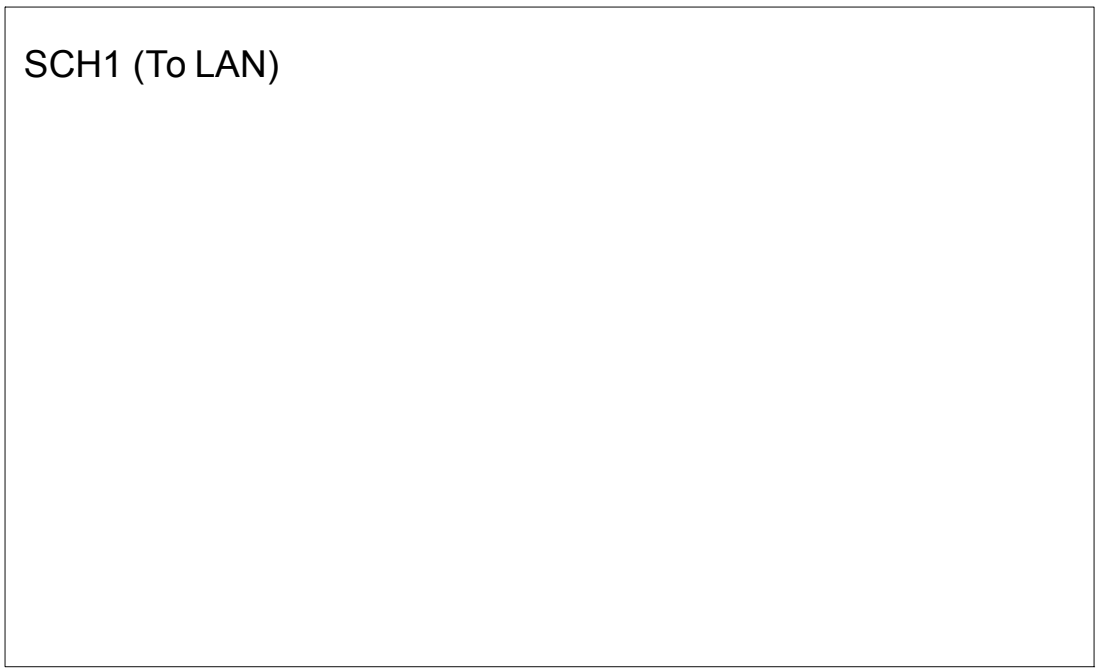
e) Layer 7 (content inspection)

3) Rule Remarker: This argument specifies what DSCP value would be added to the packet as a remark which matches the rule.

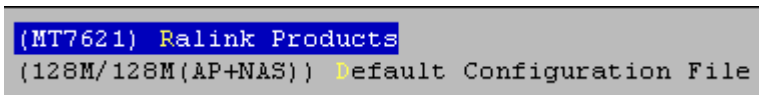
11.21.4 Hardware QoS – Usage

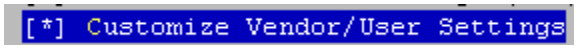
The Ralink SoC HW QoS architecture is shown in the subsequent figure.

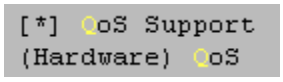




Menuconfig







11.22 How to enable USB Ethernet (example for ASIX AX88XXX)

Kernel/Library/Defaults Selection ---->
[*] Customize Kernel Settings
Device Drivers ---->
USB support ---->
USB Network Adapters ---->
<M> Multi-purpose USB Networking Framework
<M> ASIX AX88xxx Based USB 2.0 Ethernet Adapters
<M> CDC Ethernet support (smart devices such as cable modems)
CONFIG_USB_RTL8150=m

 # insmod usbnet
 # insmod cdc_ether
usbcore: registered new interface driver cdc_ether
 # insmod asix.ko
usbcore: registered new interface driver asix
usb 1-1: new high speed USB device using dwc_otg and address 2
usb 1-1: Product: USB2.0
usb 1-1: Manufacturer: ASIX Elec. Corp.
usb 1-1: SerialNumber: 01
usb 1-1: configuration #1 chosen from 1 choice
eth0: register 'asix' at usb-lm0-1, ASIX AX8817x USB 2.0 Ethernet, 00:0e:2e:41:72:9e

 # brctl addif br0 eth0
device eth0 entered promiscuous mode

 # brctl show br0

bridge name bridge id STP enabled interfaces

br0 8000.000c43414367 no ra0

eth2.1

eth0

 # ifconfig eth0 up

ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready

br0: port 3(eth0) entering learning state

eth0: link up, 100Mbps, full-duplex, lpa 0xC5E1

br0: topology change detected, propagating

br0: port 3(eth0) entering forwarding state

 # ping 10.10.10.3

PING 10.10.10.3 (10.10.10.3): 56 data bytes

64 bytes from 10.10.10.3: seq=0 ttl=128 time=3.381 ms

64 bytes from 10.10.10.3: seq=1 ttl=128 time=1.038 ms

64 bytes from 10.10.10.3: seq=2 ttl=128 time=1.067 ms

64 bytes from 10.10.10.3: seq=3 ttl=128 time=1.069 ms

11.23 How to build a single image for the RT2880 8M flash platform

#cd Uboot

#make menuconfig

```
(128Mb) DRAM Component

(32bits) DRAM Bus

(8M) Flash Size
```

#cd RT288x_SDK/source

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
  [*] Customize Kernel Settings
```

```
Machine selection  --->
 (8M) Flash Size
```

#cd RT288x_SDK/tools/single_img/RT2880

#vi Makefile.8M

```
UBOOT_IMAGE = rt2880_100phy_128Mbx16_8Mflash.uboot

KERNEL_IMAGE = rt2880_100phy_128Mbx16_8Mflash.linux

PACKED_IMAGE = rt2880_100phy_128Mbx16_8Mflash.uboot
```

#make –f Makefile.8M

Flash layout:

```
 +----------------------+---------+---------+----+-------------------------------+
 | KERNEL PartII  | Uboot |UsrCfg| RF| Kernel PartI          | +----------------------+-------+------+---
 +-------------------------------------+

 |<----0x400000-->|<----0x50000->|▁---------0x3B0000  --------->|
```

11.24 How to start a printer server (example for HP officejet 4355)

Step1: SDK Configuration

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*] Customize Kernel Settings
   Device Drivers  --->
    USB support  --->
      <*>  USB Printer support
```

[*] Customize Vendor/User Settings

Network Applications --->

[*] p910nd (small printer daemon)

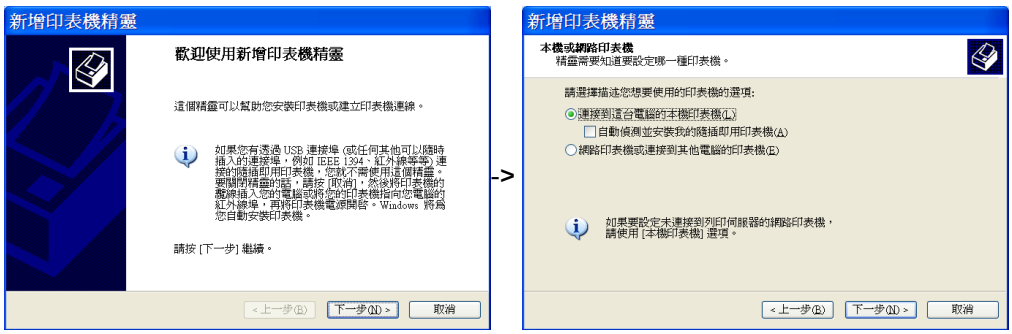
Step2: Plug in USB Printer

```
# usb 1-1: new full speed USB device using dwc_otg and address 2

usb 1-1: Product: Officejet 4300 series

usb 1-1: Manufacturer: HP

usb 1-1: SerialNumber: CN864GZ1S004GR

usb 1-1: configuration #1 chosen from 1 choice

drivers/usb/class/usblp.c: usblp0: USB Bidirectional printer dev 2 if 1 alt 0 proto 2 vid
0x03F0 pid

 0x5411
```

Step3: run the printer daemon

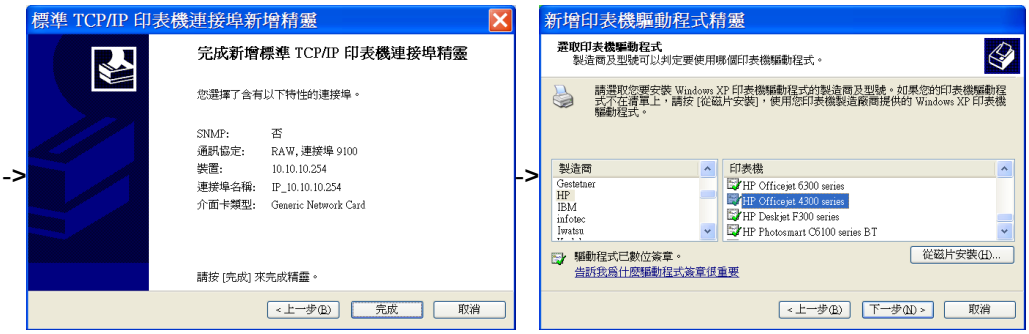
p910nd -f /dev/lp0

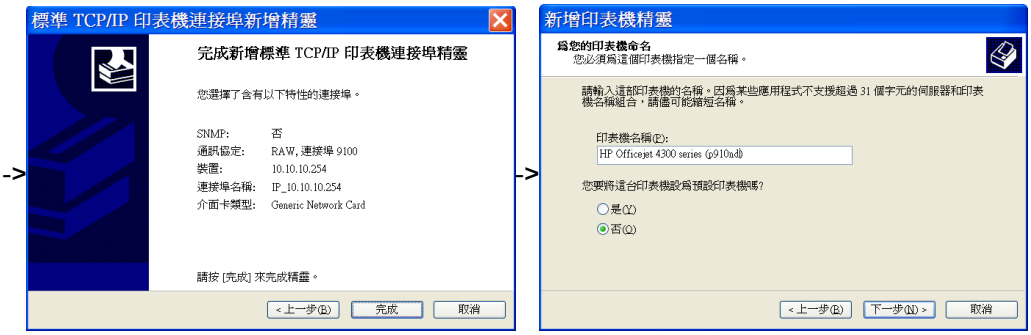
Step4: Setup the printer in Windows

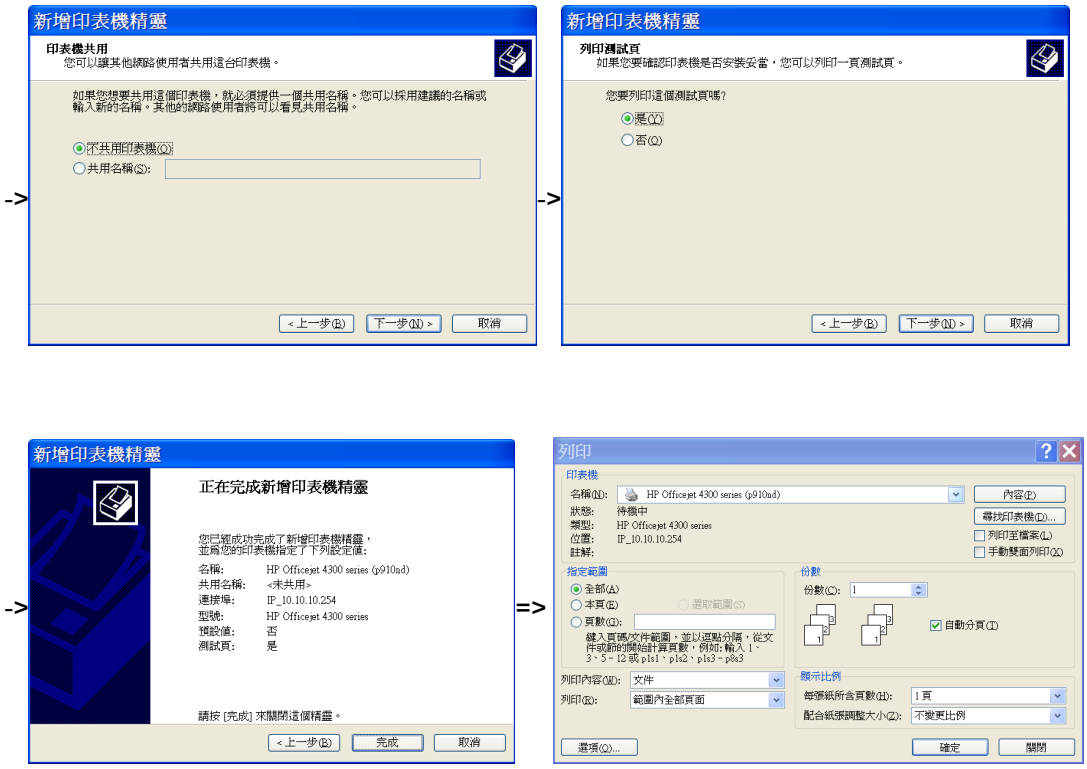



新增印表機精靈
選取一個印表機連接埠
電腦和印表機透過連接埠溝通。
請選擇您想讓印表機使用的連接埠。如果未列出該連接埠，您可以建立新的連接埠。
使用下列的連接埠(U):
LPT1: (建議的印表機連接埠)
注意事項: 大部分的電腦使用 LPT1: 連接埠來與本機印表機通訊。這個連接埠的連接器看起來應該像這樣:
建立新的連接埠(C):
連接埠類型:
Standard TCP/IP Port
< 上一步(B)
下一步(N) >
取消
標準 TCP/IP 印表機連接埠新增精靈
歡迎使用新增標準 TCP/IP 印表機連接埠精靈
您可以使用這個精靈來新增網路印表機連接埠。
在您繼續執行之前，請確定:
1. 裝置已開啟。
2. 網路已連線並設定完成。
請按 [下一步] 繼續執行。
< 上一步(B)
下一步(N) >
取消


標準 TCP/IP 印表機連接埠新增精靈
新增連接埠
您要爲那個裝置加上一個連接埠?
請輸入印表機名稱或 IP 位址，及使用的裝置連接埠名稱。
印表機名稱或 IP 位址(A):
10.10.10.254
連接埠名稱(P):
IP_10.10.10.254
< 上一步(B)
下一步(N) >
取消
標準 TCP/IP 印表機連接埠新增精靈
其他連接埠資訊
無法識別這個裝置。
偵測到的裝置類型無法辨識，請確定:
1. 裝置已正確設定。
2. 前一頁的位址正確。
回到精靈的前一畫面，更正位址並執行其他的網路搜尋。或者，如果您確定位址是正確的，請選擇裝置類型。
裝置類型
標準(S)
Generic Network Card
自訂(C)
設定(E)...
< 上一步(B)
下一步(N) >
取消


標準 TCP/IP 印表機連接埠新增精靈
完成新增標準 TCP/IP 印表機連接埠精靈
您選擇了含有以下特性的連接埠。
SNMP: 否
通訊協定: RAW, 連接埠 9100
裝置: 10.10.10.254
連接埠名稱: IP_10.10.10.254
介面卡類型: Generic Network Card
請按 [完成] 來完成精靈。
< 上一步(B)
完成
取消
新增印表機驅動程式精靈
選取印表機驅動程式
製造商及型號可以判定要使用哪個印表機驅動程式。
請選取您要安裝 Windows XP 印表機驅動程式的製造商及型號。如果您的印表機驅動程式不在清單上，請按 [從磁片安裝]，使用您印表機製造廠商提供的 Windows XP 印表機驅動程式。
製造商
Gestetner
HP
IBM
infotec
Iwatsu
印表機
HP Officejet 6300 series
HP Officejet 4300 series
HP Deskjet F300 series
HP Photosmart C6100 series BT
驅動程式已數位簽章。
告訴我爲什麼驅動程式簽章很重要
從磁片安裝(H)...
< 上一步(B)
下一步(N) >
取消


標準 TCP/IP 印表機連接埠新增精靈
完成新增標準 TCP/IP 印表機連接埠精靈
您選擇了含有以下特性的連接埠。
SNMP: 否
通訊協定: RAW, 連接埠 9100
裝置: 10.10.10.254
連接埠名稱: IP_10.10.10.254
介面卡類型: Generic Network Card
請按 [完成] 來完成精靈。
< 上一步(B)
完成
取消
新增印表機精靈
爲您的印表機命名
您必須爲這個印表機指定一個名稱。
請輸入這部印表機的名稱。因爲某些應用程式不支援超過 31 個字元的伺服器和印表機名稱組合，請儘可能縮短名稱。
印表機名稱(P):
HP Officejet 4300 series (p910nd)
您要將這台印表機設爲預設印表機嗎?
是(Y)
否(O)
< 上一步(B)
下一步(N) >
取消



11.25 How to force the RT3052 link speed

There are two kinds of force mode that refer to the configuration of the remote peer.

1. Force Mode (Both RT305x and remote peer disable auto negotiation algorithm)

   - **10MB/Full:** Set bit13=0, bit12=0,bit8=1 (reg_addr=0)
   - **10MB/Half**:Set bit13=0,bit12=0,bit8=0 (reg_addr=0)
   - **100MB/Full**:Set bit13=1,bit12=0,bit8=1 (reg_addr=0)
   - **100MB/Half**:Set bit13=1,bit12=0,bit8=0 (reg_addr=0)

CR → Address:00(d00) → Reset State:3100

Bit	Read/Write	Name	Description	Default
15	R/W;SC	MR_MAIN_RESET	1=Reset: 0=Normal, reset all digital logic, except phy_reg	1'h0
14	R/W	LOOPBACK_MII	Mii loop back	1'h0
13	R/W	FORCE_SPEED	1=100Mbps: 0=10Mbps, when mr_autoneg_enable=1'b0	1'h1
12	R/W	MR_AUTONEG_ENABLE	1=Enabled: 0=Normal	1'h1
11	R/W	POWERDOWN	phy into power down (power down analog TX analog RX, analog AD)	1'h0
10	RO	-	Reserved	1'h0
9	R/W;SC	MR_RESTART_NEGOTIATION	1=Restart Auto-Negotiation: 0=Normal	1'h0
8	R/W	FORCE_DUPLEX	1=Full Duplex: 0=Half Duplex, when mr_autoneg_enable=1'b0	1'h1
7:0	RO	-	Reserved	8h00

2. Auto negotiation (Both RT305x and remote peer enable auto negotiation algorithm)

- **10MB/Full: Set bit6=1 (reg_addr=4)**
- **10MB/Half: Set bit5=1 (reg_addr=4)**
- **100MB/Full: Set bit8=1 (reg_addr=4)**
- **100MB/Half: Set bit7=1 (reg_addr=4)**

Auto-Negotiation advertisement register

CR → Address:04(d04) → Reset State: → 05e1

Bit	Read/Write	Name	Description	Default
15	R0	Next Page Enable	1=Set to use Next Page: 0=Not to use Next Page	1'h0
14	RO	-	Reserved	1'h0
13	R/W	Remote Fault Enable	1=Auto Negotiation Fault Detected 0=No Remote Fault	1'h0
12:11	RO	Not Implemented	Technology Ability A7-A6	2'h0
10	R/W	Pause	Technology Ability A5	1'h1
9	RO	Not Implemented	Technology Ability A4	1'h0
8	R/W	100Base-TX Full Duplex Capable	1=Capable of Full Duplex 0=Not Capable	1'h1
7	R/W	100 Base-TX Half Duplex Capable	1=Capable of Half Duplex 0=Not Capable	1'h1
6	R/W	10 Base-T Full Duplex Capable	1=Capable of Full Duplex 10BASE-T 0=Not Capable	1'h1
5	R/W	10 Base-T Half Duplex Capable	1=Capable of Half Duplex 10BASE-T 0=Not Capable	1'h1
4:0	R/W	Selector Field	Identifies type of message	5'h01

User Mode:

 # mii_mgr -s -p [port_no] -r [reg_addr] -v [Value]

Kernel Space:

extern u32 mii_mgr_write(unsigned int, unsigned int, unsigned int);

mii_mgr_write([port_no], [reg_addr], [value])

NOTES: IF BOTH RT305X SWITCH AND REMOTE PEER DO NOT USE THE SAME CONFIGURATION (I.E. AUTO-NEGOTIATION OR FORCE MODE) IT CAN CAUSE A PROBLEM.

11.26 How to verify IGMP snooping function

Step1: Compiling IGMP proxy application.

#make menuconfig

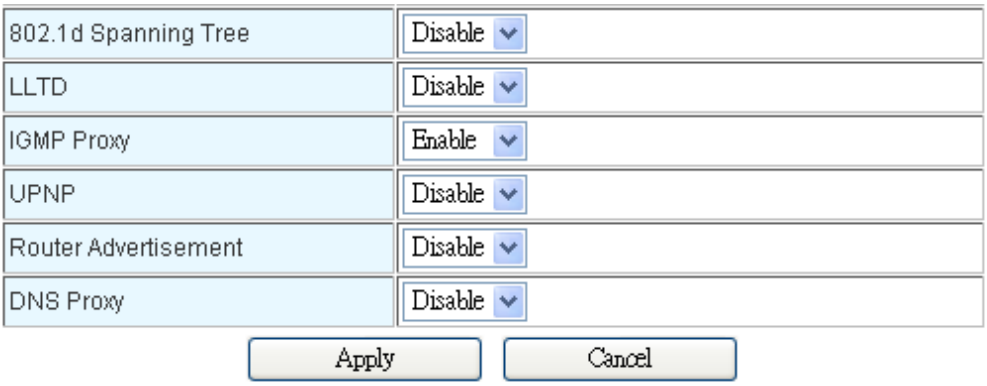
Kernel/Library/Defaults Selection --->

[*] Customize Vendor/User Settings (NEW)

Network Applications --->

[*] igmp proxy (RFC4605)

Step2: Enable IGMP Proxy in WebUI.



Step3: Install windows server 2003 resource kit tools in your PCs.

You can get the test application from the following link or Ralink SDK.

- *HTTP://WWW.MICROSOFT.COM/DOWNLOADS/DETAILS.ASPX?FAMILYID=9D467A69-57FF-4AE7-96EE-B18C4790CFFD&DISPLAYLANG=EN*

- RT288x_SDK/source/user/igmpproxy/tools/rktools.exe.

Step4: Start Multicast test

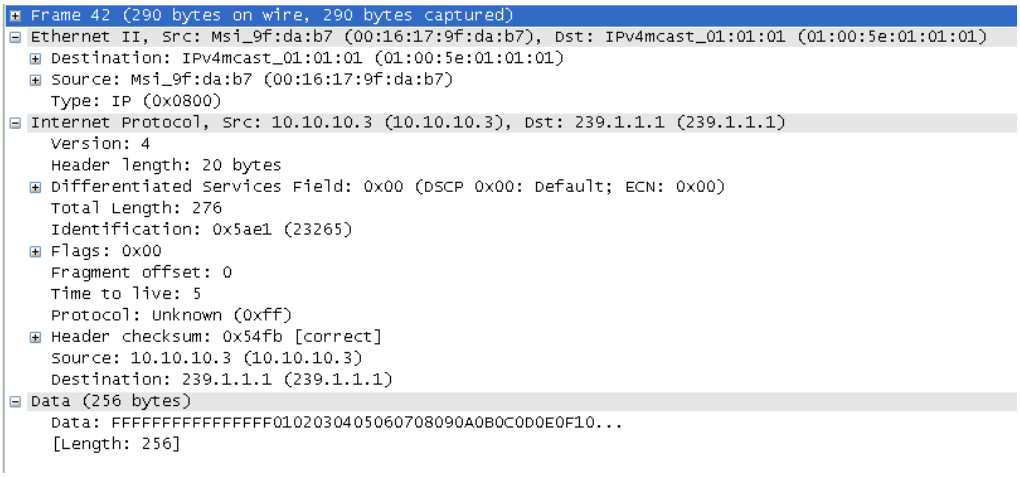
LAN

Mcast server:

C:\>mcast /GRPS:239.1.1.1 /SRCS:10.10.10.3 /NUMPKTS:1000 /INTVL:50 /SEND

(Please use "/intf" argument to specify an interface to receive or send if you have multiple network interfaces.)

Now, you can see the multicast packets will be generated by Mcast Server.



Mcast Client1:

C:\>mcast /GRPS:239.1.1.1 /RECV

Step5: Starting network sniffer on Client1 and Client2.

The right behavior is only Client1 can receive multicast packets.

11.27 EHCI/OHCI USB Power Saving

A potential issue may happen if user chooses a mixed version pair of SDK Linux and Uboot. A confirmed pair is RT3883/RT3662 SDK3.5 Uboot + SDK 3.4 Linux, this pair may cause system to freeze during boot up.

To reduce power consumption and lower the working temperature, SDK3.5 and later versions disable the USB power and clock gating during the boot-loader initialization stage. The advantage is more power-saving. The detail is SDK 3.5 Uboot would disable the USB HW module by default. And then the SDK 3.5 EHCI/OHCI Linux driver have to re-enable USB HW module before accessing USB related registers.

However, if user chooses an unexpected pair, ex. SDK3.5 Uboot + SDK 3.4 Linux, the system may freeze at OHCI initialization during boot up as following log. This is because the SDK 3.5(or later) Uboot would disable the USB HW module to save power, but then the older SDK Linux(SDK 3.4) EHCI/OHCI driver does not re-enable the USB HW module before accessing USB function.

```
…
rt3xxx-ohci rt3xxx-ohci: RT3xxx OHCI Controller
rt3xxx-ohci rt3xxx-ohci: new USB bus registered, assigned bus number 2
rt3xxx-ohci rt3xxx-ohci: irq 18, io mem 0x101c1000          <<<<<  freeze at here
```

To solve the issue(freeze at OHCI init), please disable the USB(EHCI/OHCI) power saving feature in SDK 3.5(and later) Uboot as following:

In Uboot/lib_mips/board.c

```
void board_init_r (gd_t *id, ulong dest_addr)
{
…
//void config_usb_ehciohci(void);
//config_usb_ehciohci();
…
}
```

And then rebuild Uboot.

11.28 Auto-frequency and Power Saving

The RT3352/RT5350 SOC has the capability of auto-frequency and power saving.

- CPU Auto-Frequency (RT3352/RT5350)
- SDR Power Pre-charge Power Down (RT3352/RT5350)
- DDR self Refresh Power Save (RT3352)
- Ethernet Power Down (RT3352/RT5350)
- USB Power Down (RT3352/RT5350)

- WIFI Power Down (RT3352/RT5350)

Notice: Those new features are supported by SDK 3.5.2.0 and later version.

1. Setup

- How to turn on CPU Auto-Frequnecy

  For RT3352/RT5350, We can turn on CPU auto frequency function by:

  Modifying config.mk in Uboot and rebuild uboot firmware

```
...

RALINK_DDR_CONTROLLER_OPTIMIZATION = OFF

RALINK_CPU_AUTO_FREQUENCY = ON

RALINK_SDR_PRECHARGE_POWER_DOWN = OFF

RALINK_DDR_SELF_REFRESH_POWER_SAVE_MODE = OFF

...
```

  $make

Set Linux Kernel Configuration and then rebuild linux firmware

  $make menuconfig --->

Machine selection ---> [*] Ralink External Timer

  ……

$make dep; make

- How to turn on SDR Pre-charge Power Down

  For RT3352/RT5350, We can turn on SDR power save by:

  Modifying config.mk in Uboot and rebuild uboot firmware

```
...

RALINK_DDR_CONTROLLER_OPTIMIZATION = OFF

RALINK_CPU_AUTO_FREQUENCY = OFF

RALINK_SDR_PRECHARGE_POWER_DOWN = ON

RALINK_DDR_SELF_REFRESH_POWER_SAVE_MODE = OFF

...
```

$make

- How to turn on DDR Self Refresh Power Save

  For RT3352 , We can turn on DDR power save by:

  Modifying config.mk in Uboot and rebuild uboot firmware

```
...

RALINK_DDR_CONTROLLER_OPTIMIZATION = OFF

RALINK_CPU_AUTO_FREQUENCY = OFF

RALINK_SDR_PRECHARGE_POWER_DOWN = OFF

RALINK_DDR_SELF_REFRESH_POWER_SAVE_MODE = ON
```

```
…
```

$make

2. Setup in script

```
…

 /sbin/config-powersave.sh cpu  1        - enable CPU autofrequency

 /sbin/config-powersave.sh cpu  0        - disable CPU autofrequency

 /sbin/config-powersave.sh sdr  1        - enable SDR precharge powersave

 /sbin/config-powersave.sh sdr  0        - disable SDR precharge powersave

 /sbin/config-powersave.sh ddr  1        - enable DDR self auto refresh

 /sbin/config-powersave.sh ddr  0        - disable DDR self auto refresh

 /sbin/config-powersave.sh ethernet 1 [port]     - enable Ralink ESW PHY powerdown

 /sbin/config-powersave.sh ethernet 0 [port]     - disable Ralink ESW PHY powerdown

 /sbin/config-powersave.sh usb  1        - enable usb powerdown

 /sbin/config-powersave.sh usb  0        - disable usb powerdown

 /sbin/config-powersave.sh wireless  1    - enable wireless powerdown

 /sbin/config-powersave.sh wireless  0    - disable wireless powerdown

…
```

- How to turn on CPU Auto-Frequency

  For RT3352/RT5350, We can turn on CPU auto frequency function by:

#config-powersave.sh cpu 1

- How to turn on SDR Pre-charge Power Down

  For RT3352/RT5350, We can turn on SDR power save by:

  #config-powersave.sh sdr 1

- How to turn on DDR Self Refresh Power Save

  For RT3352 , We can turn on DDR power save by:

  #config-powersave.sh ddr 1

- How to turn on Ethernet Power Down

  For RT3352 /RT5350, We can turn on Ethernet port#3 power down by:

  #config-powersave.sh ethernet 1 3

- How to turn on USB Power Down

  For RT3352 /RT5350, We can turn on USB power down by:

  #config-powersave.sh usb 1

- How to turn on WIFI Power Down

  For RT3352 /RT5350, We can turn on WIFI power down by

  #config-powersave.sh wifi 1

3. Check Function

- CPU Auto-Frequency

  Turn off:

```
#
# reg s b0000000
switch register base addr to 0xb0000000
# reg r 40
0x34501
#
```

Turn on:

```
# reg s b0000000
switch register base addr to 0xb0000000
# reg r 40
0x80035f41
#
```

- SDR Pre-charge Power Save

Turn off:

```
# reg s b0000300
switch register base addr to 0xb0000300
# reg r 1c
0x3ffff
# reg r 4
0xe1110600
#
```

Turn on:

```
# reg s b0000300
switch register base addr to 0xb0000300
# reg r 1c
0x1
# reg r 4
0xf1110600
#
```

- DDR Self Refresh Power Save

Turn off:

```
# reg s b0000300
switch register base addr to 0xb0000300
# reg r 1c
0x3ffff
# reg r 18
0x3
#
```

Turn on:

```
# reg s b0000300
switch register base addr to 0xb0000300
# reg r 1c
0x6d000001
# reg r 18
0x13
#
```

11.29 Concurrent AP porting Guide

The APSOC has the capability of working 1st wireless interface and 2nd wireless interfaces concurrently.

A. The interface1 (ra0)

B. The interface 2 (rai0)

Station can associate and execute WPS connection for any wireless interface. Moreover, user can configure the settings of any wireless interface by Web GUI.

You can refer to Ralink_AP_SDK_User's_Manual for the Detail information.

1. Setup:

If your SDK does not include RT309x/RT539x/RT3572/RT5572/RT5592/RT3593 support, please refer the following steps to install it.

Requirement:

- RT288x_SDK
- RT3090/RT5392/RT3572/RT5572/RT5592/RT3593 WiFi driver
- RT3090/RT5392/RT3572/RT5572/RT5592/RT3593 EEPROM binary files

Procedure: (RT383+RT3090 as example)

Step1.

Please copy RT309x WiFi driver to RT288x_SDK/linux-2.6.xx.x/drivers/net/wireless

ex:

```
$cp RT3090_ap RT288x_SDK/linux-2.6.xx.x/drivers/net/wireless
```

Step2.

Please modify RT288x_SDK/linux-2.6.xx.x/drivers/net/wireless/Makefile

ex:

```
…
ifneq ($(CONFIG_RT2860V2_AP),)
obj-$(CONFIG_RT2860V2_AP)       += rt2860v2_ap/
endif
ifneq ($(CONFIG_RT2860V2_STA),)
obj-$(CONFIG_RT2860V2_STA)      += rt2860v2_sta/
endif
ifneq ($(CONFIG_RT3090_AP),)
obj-$(CONFIG_RT3090_AP)         += RT3090_ap/
endif

…
```

Step3.

Please modify RT288x_SDK/linux-2.6.xx.x/ralink/Kconfig

ex:

```
…

#source "drivers/net/wireless/rt2860v2_sta/Kconfig"
```

```
#source "drivers/net/wireless/rt2860v2_apsta/Kconfig"

source "drivers/net/wireless/RT3090_ap/Kconfig"

config  RT3090_AP_RF_OFFSET

        depends on RT3090_AP

        hex

        default 0x48000

…
```

Step4.

If wifi driver support *FLASH_SUPPORT*, please copy EEPROM binary file to RT288x_SDK/source/vendors/Ralink/RT3883

ex:

```
$cp RT3092_PCIe_LNA_2T2R_ALC_V1_2.bin RT288x_SDK/source/vendors/Ralink/
{RT3883/RT3352/RT5350}
```

Step5.

Please modify RT288x_SDK/source/vendors/Ralink/RT3883/Makefile

ex:

```
…
$(ROMFSINST) -e CONFIG_RALINK_RT3883_3T3R RT2860_default_novlan_3s
/etc_ro/Wireless/RT2860AP/RT2860_default_novlan
$(ROMFSINST) -e CONFIG_RALINK_RT3883_3T3R RT2860_default_vlan_3s
/etc_ro/Wireless/RT2860AP/RT2860_default_vlan
```

```
$(ROMFSINST) -e CONFIG_RALINK_RT3662_2T2R
/etc_ro/Wireless/RT2860AP/RT2860_default_novlan
$(ROMFSINST) -e CONFIG_RALINK_RT3662_2T2R
/etc_ro/Wireless/RT2860AP/RT2860_default_vlan

$(ROMFSINST) -e CONFIG_RT3090_AP /etc_ro/Wireless/iNIC/RT2860AP.dat
$(ROMFSINST) -e CONFIG_RT3090_AP
/etc_ro/Wireless/RT2860AP/RT3092_PCIe_LNA_2T2R_ALC_V1_2.bin


…
```

Step6.

Please modify RT288x_SDK/source/user/rt2880_app/scripts/internet.sh

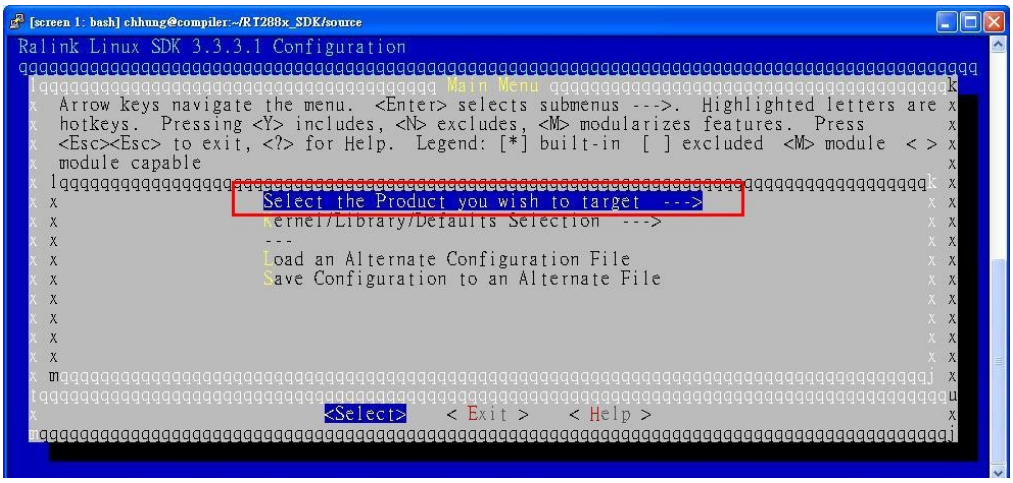
ex:

```
…
ifRaxWdsxDown
if [ "$CONFIG_RTDEV" != "" -o "$CONFIG_RT2561_AP" != "" ]; then
        ifRaixWdsxDown
fi
if [ "$CONFIG_RT2860V2_AP" != "" ]; then
        rmmod rt2860v2_ap_net
        rmmod rt2860v2_ap
        rmmod rt2860v2_ap_util
fi
if [ "$CONFIG_RT2860V2_STA" != "" ]; then
        rmmod rt2860v2_sta_net
        rmmod rt2860v2_sta
        rmmod rt2860v2_sta_util
fi
if [ "$RT2880v2_INIC_PCI" != "" ]; then
        rmmod iNIC_pci
fi
if [ "$CONFIG_RT3090_AP" != "" ]; then
```

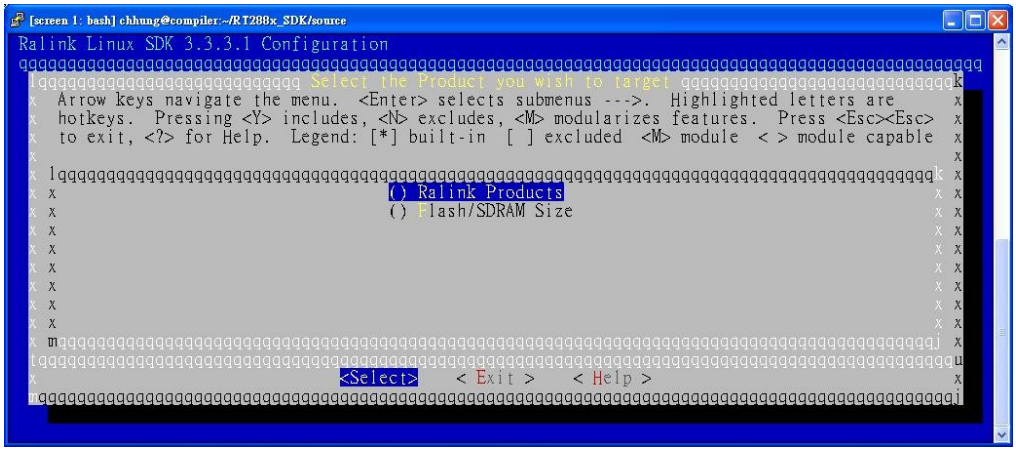
```
        rmmod RT3090_ap_net
        rmmod RT3090_ap
        rmmod RT3090_ap_util
fi
…

# RTDEV_PCI support

if [ "$RT2880v2_INIC_PCI" != "" ]; then

        insmod -q iNIC_pci

fi

if [ "$CONFIG_RT3090_AP" != "" ]; then

        insmod -q RT3090_ap_util

        insmod -q RT3090_ap

        insmod -q RT3090_ap_net

fi
…
```

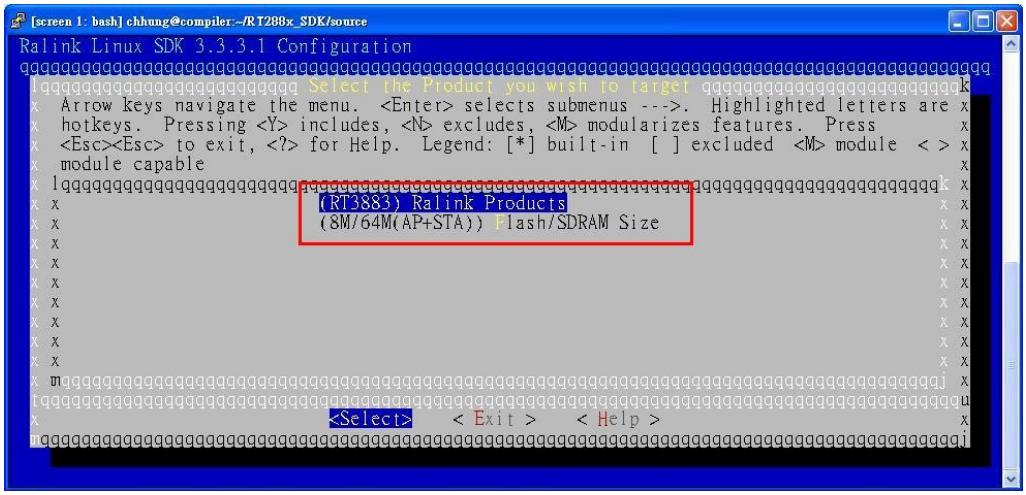
Step7.

You must switch directory to RT2888x_SDK/source and execute "make menuconfig," like below:

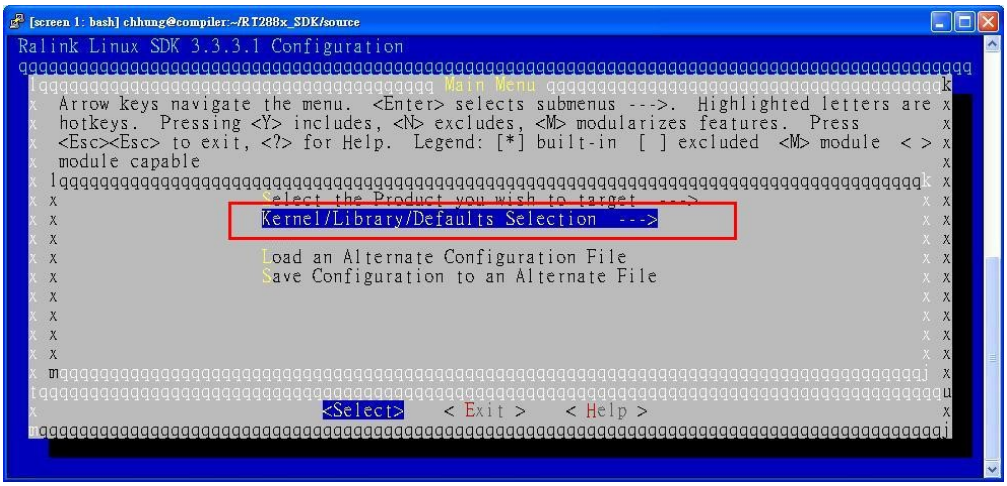


Please choose "Select the Product you wish to target" option to configure the main settings of your target platform. ***<<Please select 4M/32M or 8M/64M Flash/SDRAM size>>***

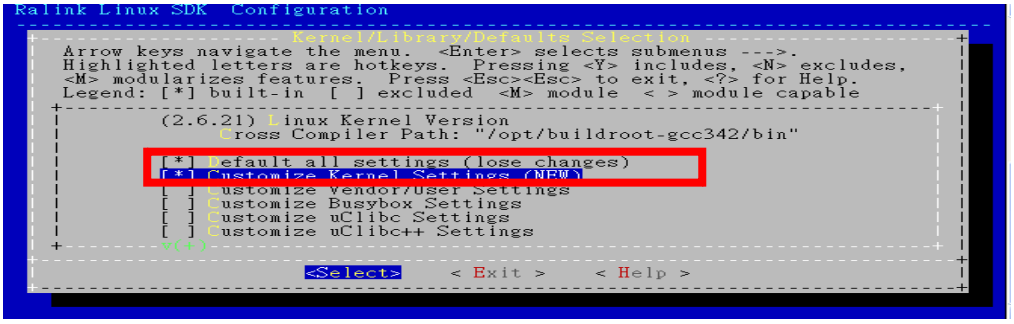




And then, please exit "Select the Product you wish to target" option and enter "Kernel/Library/Defaults Selection" option.



You must select "Default all settings" option to load default configuration first and select "Customize Kernel Settings" options to turn on 2nd interface.



Exit ---> yes.

Step8.

After load default, you can enter kernel configured main menu.

If 2nd wireless uses PCIE interface:

Please enter "Machine selection" and choice" RT3883 PCI architecture" to "PCIE RC ONLY" mode.

```
    System type (Ralink RT3883 board)  --->
    Soc Hardware Type (RT3883/RT3662-ASIC)  --->
    RT3883 PCI architecture (PCIE RC ONLY)  --->
    DRAM Size (64M)  --->
    Flash Type (NOR)  --->
[ ] Dual Image
    Root File System Type (RootFS_in_RAM)  --->
(16384) Default RAM disk size
[*] Compress ramdisk by lzma instead of gzip
[ ] Ralink DFS Timer
```

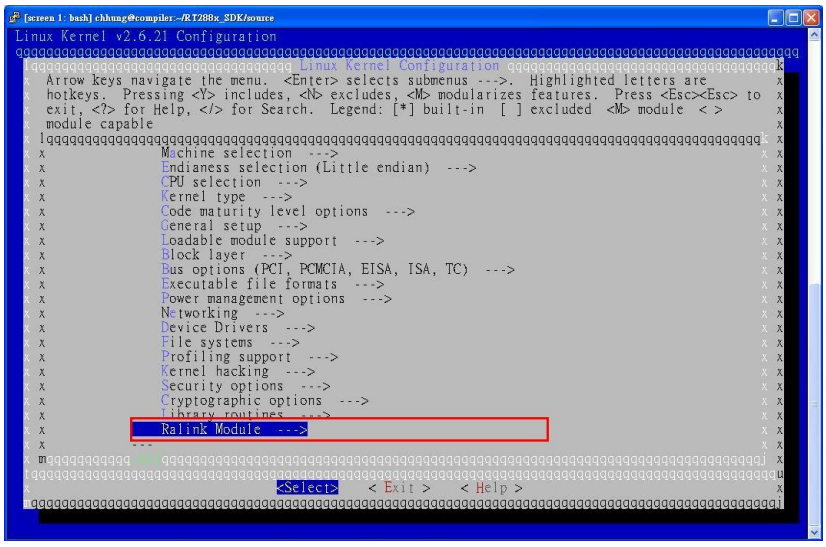
Leave "Machine selection" option.

Please enter "Bus options (PCI, PCMCIA, EISA, ISA, TC)" option and check whether PCI/PCIE support or not, like below:

```
[*] Support for PCI controller
[*]   PCI Express support
    PCCARD (PCMCIA/CardBus) support  --->
    PCI Hotplug Support  --->
```

Leave "Bus options (PCI, PCMCIA, EISA, ISA, TC)" option.

Please enter "Ralink Module" option



You must enter "WiFi Driver Support" and select RT3090 moudule to to act 2nd WiFi interface, but one of them could be selected.

```
  <*> Ralink Reg Debug Module
  <*> Ralink GMAC
  [ ]   Use Rx Polling (NAPI)
        Network BottomHalves (Tasklet)  --->
  [*]   SKB Recycle_2K(Proprietary)
  [ ]   Jumbo Frame up to 4K bytes
  [*]   TCP/UDP/IP checksum offload
  [ ]   Transmit VLAN HW (DoubleVLAN is not supported)
      GMAC is connected to (RGMII_FORCE_1000 (GigaSW, CPU))  --->
      Switch Board Layout Type (W/LLLL)  --->
  [ ] GMAC2 Support
  [*] WiFi Driver Support  --->
      Ralink NAT Type (None)  --->
```

```
--- WiFi Driver Support
      RF Type (2T3R (RT3662))  --->
<*>   Ralink RT2860 802.11n AP support
[*]     LED Support
[*]     WSC (WiFi Simple Config)
[*]       WSC 2.0(WiFi Simple Config 2.0)
[*]     LLTD (Link Layer Topology Discovery Protocol)
[*]     WDS
[ ]     Nintendo (NEW)
[*]     MBSSID
[ ]       New MBSSID MODE (NEW)
[*]     AP-CLient Support
[*]     IGMP snooping
[ ]     NETIF Block (NEW)
[ ]     DFS (NEW)
[ ]     Carrier Detect (NEW)
[*]     DLS ((Direct-Link Setup) Support
[ ]     IDS (Intrusion Detection System) Support (NEW)
[ ]     MESH Support (NEW)
[ ]     WAPI Support (NEW)
[ ]     Green AP Support (NEW)
[ ]     Memory Optimization (NEW)
[ ]     Video Turbine support (NEW)
[*]     802.11n Draft3
[ ]     Intelligent Rate Adaption (NEW)
[ ]     Tx Bean Forming Support (Only 3883) (NEW)
<M>   Ralink RT3090 802.11n AP support
[*]     Flash Support
[*]     LED Support
[*]     WSC (WiFi Simple Config)
[*]     LLTD (Link Layer Topology Discovery Protocol)
[*]     WDS
[*]     MBSSID
[ ]     NETIF Block (NEW)
[*]     DLS ((Direct-Link Setup) Support
[ ]     IDS (Intrusion Detection System) Support (NEW)
[*]     802.11n Draft3
```

Leave "Ralink Module" option and then exit "Linux Kernel Configuration".

Exit ---> yes

Step9.

Final, you can execute "make dep" and "make" to build image under the RT288x_SDK/source.

```
$make dep

$make
```

2. Usage:

If the firmware is built successfully, you can upgrade it into your RT3052/RT3883/RT3352/RT5350/RT6855/RT6856 reference board by TFTP Server or Web GUI.

After firmware upgrade, you can use Web GUI or command line to to check if two wifi interfaces are successfully inserted and brought up or not.

- Web GUI

- Command line:

  1st WiFi interface name: ra0

  2nd WiFi interface name: rai0

  ra0's profile is located on /etc/Wireless/RT2860/RT2860.dat and rai0's profile is located on /etc/Wireless/iNIC/iNIC_ap.dat. To change rai0's wireless settings, you can edit its profile and re-bring up it, like ra0.

  Certainly, ra0 and rai0 are shown their detail information or configured settings by iwpriv command, for example:

  ra0:

```
#iwprive ra0 set SSID=RT3883AP

#iwprive ra0 stat

…
```

rai0:

```
#iwprive rai0 set SSID=RTDEV_AP

#iwprive rai0 stat

…
```

11.30 SuperDMZ usage guide

Usage:

super_dmz [-f] [-l lan_ifname] [-w wan_ifname] [-t tcp_port] [-t tcp_port1:tcp_port2] [-u udp_port] [-u udp_port1:udp_port2]

-f : flush & clear super_dmz functions from system.

-l lan_ifname: Explicitly assign the LAN interface name, ex. "br0" or "eth2.2". In Ralink SDK this argument is assigned automatically based on the current operation mode if it is not assigned explicitly.

-w wan_ifname: Explicitly assign the WAN interface name, ex "eth2.2" or "ppp0". In Ralink SDK this argument is assigned automatically based on the current WAN mode if it is not assigned explicitly.

-t tcp_port: TCP port tcp_port is the exception of DMZ forwarding, ex "80" or "23". The most case here is "80" for AP web remote access.

-t tcp_port1:tcp_port2 : TCP port from tcp_port1 to tcp_port2 is the exception of DMZ forwarding.

-u udp_port: UDP port udp_port is the exception of DMZ forwarding.

-u udp_port1:udp_port2 : UDP port from udp_port1 to udp_port2 is the exception of DMZ forwarding.

Example:

1) # super_dmz -f

   Clear Super DMZ function from system.

2) # super_dmz

   Enable Super DMZ function.

3) # super_dmz -l eth0 -t 80

   Enable Super DMZ function. Assign "eth0" as LAN interface. Avoid tcp port 80 is forwarding.(To make web server on router reachable from WAN side)

4) # super_dmz -w eth2 -t 45:123 -t 3128 -u 10000 -u 500:600

Enable Super DMZ function. Assign "eth2" as WAN interface. Avoid tcp port 45 to 123, tcp port 3128, udp port 10000, and udp port 500 to 600 are forwarding.

Implementation note:

1. When

   1) system boot up

   2) WAN IP is acquired or changed (Ex. PPPoE or DHCP on WAN)

   3) Virtual Server(Port forwarding) settings change

   the super_dmz have to re-run:

   # super_dmz –f

   # super_dmz

11.31 How to support IPv6 Ready Logo

The IPv6 Forum (http://www.ipv6forum.com) IPv6 Ready Logo Program is a conformance and interoperability testing program intended to increase user confidence by demonstrating that IPv6 is available now and is ready to be used.

To pass Ipv6 Ready Logo (Phase-2), please enable additional three applicantions:

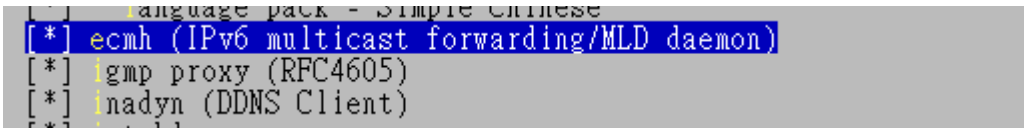
- **ecmh**

  Easy Cast du Multi Hub (ecmh) is a networking daemon that acts as a full IPv6 MLDv1 and MLDv2 Multicast "Router".

  $ make menuconfig

  [*] Customize Vendor/User Settings

Miscellaneous Applications --->



Exit ---> Yes

- **ip** command in iproute2

to flush neighbor cache during running test log

$ make menuconfig

[*] Customize Vendor/User Settings

Network Applications --->

Exit ---> Yes

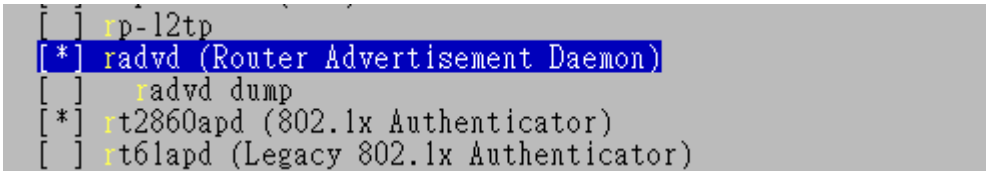
- **radvd**

radvd, the Router Advertisement Daemon, is an open-source software product that implements link-local advertisements of IPv6 router addresses and IPv6 routing prefixes using the Neighbor Discovery Protocol (NDP) as specified in RFC 2461.[2] The Router Advertisement Daemon is used by system administrators in stateless autoconfiguration methods of network hosts on Internet Protocol version 6 networks.

$ make menuconfig

[*] Customize Vendor/User Settings

Network Applications --->



Exit ---> Yes

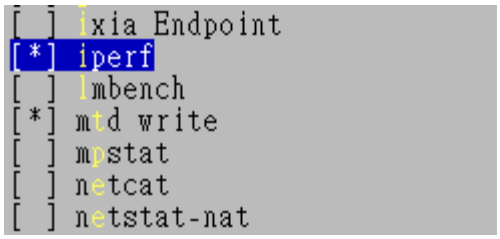
11.32 How to enable iPerf tool

iPerf was developed by NLANR/DAST as a modern alternative for measuring maximum TCP and UDP bandwidth performance. iPerf allows the tuning of various parameters and UDP characteristics. iPerf reports bandwidth, delay jitter, datagram loss.

$ make menuconfig

[*] Customize Vendor/User Settings

Miscellaneous Applications --->



Exit ---> Yes

Uasage:

Server sied: iperf -s

Client side: iperf -c [server's ip] –w 128k –t 30 –i 10

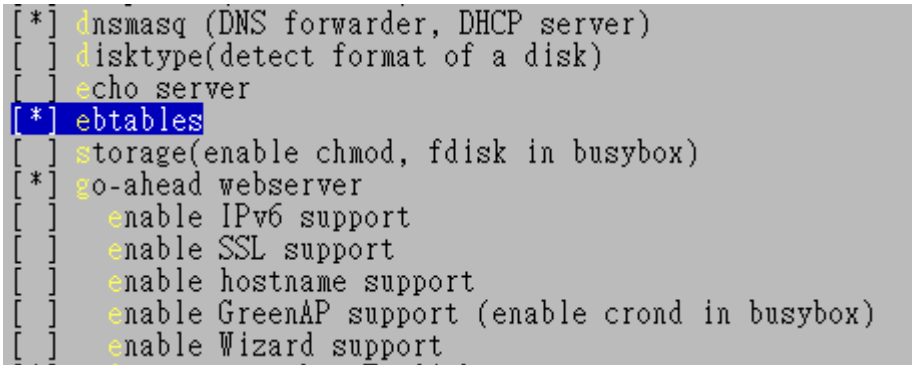
11.33 How to enable ebtables

The ebtables program is a filtering tool for a Linux-based bridging firewall. It enables transparent filtering of network traffic passing through a Linux bridge.

$ make menuconfig

[*] Customize Vendor/User Settings

Network Applications --->



Exit ---> Yes

Usage:

If router would like to block all packets of a host from intranet to internet:

ebtables -A FORWARD -s [host' MAC address] –j DROP

Or

ebtables -A FORWARD -p IPv4 --ip-src [host' IP address] –j DROP

11.34 How to enable IPv6 Rapid Deployment (6rd)

To enable IPv6 Rapid Deployment (6rd), please include ipv6 6rd feature support in the kernel:

make menuconfig

[*] Customize Kernel Settings

In the kernel settings, find "The IPv6 protocol" by select the following options:

[*] Networking support --->

Networking options --->

<*> The IPv6 protocol --->

<*> IPv6: IPv6-in-IPv4 tunnel (SIT driver)

[*] IPv6: IPv6 Rapid Deployment (6RD) (EXPERIMENTAL)

Please check both "IPv6: IPv6-in-IPv4 tunnel (SIT driver)" and "IPv6: IPv6 Rapid Deployment (6RD) (EXPERIMENTAL)".

To enable Ipv6 6rd, the firmware should also support iproute2 utility:

[*] Customize Vendor/User Settings

Network Applications --->

[*] iproute2

[*] ip

After compile and download the firmware, please use iproute2's ip command to configure the IPv6 6rd function:

ip tunnel add <6rd if name> mode sit local <WAN ipv4 address> ttl <ttl>

ip tunnel 6rd dev <6rd if name> 6rd-prefix <ISP's 6rd prefix>

ip addr add <6rd ipv6 address> dev <6rd if name>

ip link set <6rd if name> up

ip route add ::/0 via ::<ISP's 6rd border router ipv4 address> dev <6rd if name>

Note: the <6rd ipv6 address> should be generated from <ISP's 6rd prefix> and <WAN IPv4 address>, for example, if ISP's prefix is 2001:aaaa/32, and WAN ipv4 address is 100.1.1.1, then the 6rd address could be

2001:aaaa:6401:101::1/32

to add LAN ipv6 address, you can use the following command:

ip addr add <LAN ipv6 addr> dev <LAN if name>

Note: the LAN ipv6 address should be same as 6rd's ipv6 address, except address mask, for example, in above case, the LAN ipv6 address will be

2001:aaaa:6401:101::1/**64**

to enable ipv6 forwarding, please use this command:

echo "1" > /proc/sys/net/ipv6/conf/all/forwarding

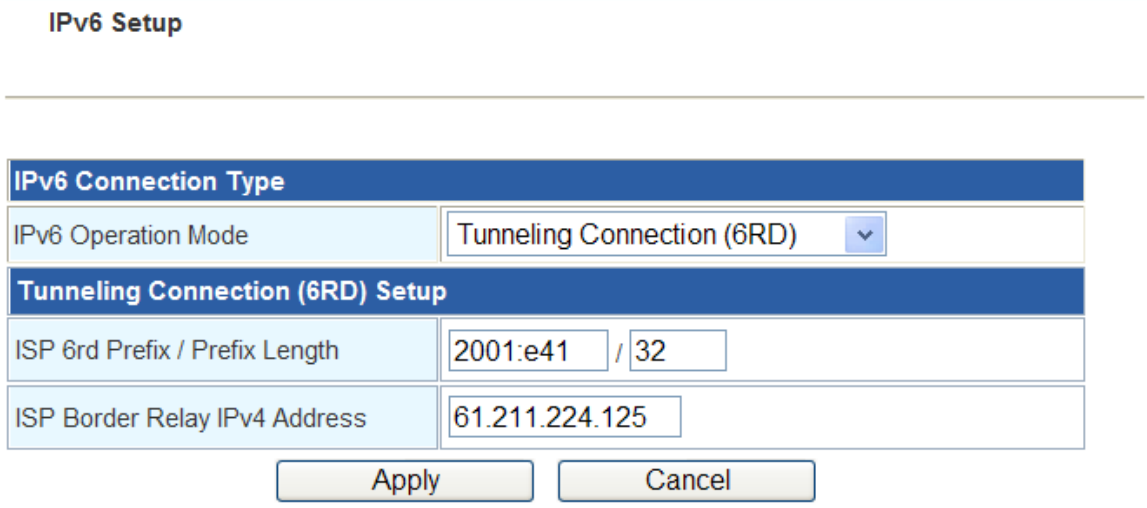
The following figure shows an example that configures IPv6 6rd:

```
#
# ip tunnel add 6rdtun mode sit local 111.80.78.220 ttl 64
# ip tunnel 6rd dev 6rdtun 6rd-prefix 2001:e41::/32
# ip addr add 2001:e41:6f50:4edc::1/32 dev 6rdtun
# ip link set 6rdtun up
# ip route add ::/0 via ::61.211.224.125 dev 6rdtun
# ip addr add 2001:e41:6f50:4edc::1/64 dev br0
# echo "1" > /proc/sys/net/ipv6/conf/all/forwarding
#
#
```

```
#
#
# ifconfig 6rdtun
6rdtun    Link encap:IPv6-in-IPv4
          inet6 addr: 2001:e41:6f50:4edc::1/32 Scope:Global
          inet6 addr: ::111.80.78.220/128 Scope:Compat
          UP RUNNING NOARP  MTU:1480  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

#
# ifconfig br0
br0       Link encap:Ethernet  HWaddr 00:0C:43:43:63:F3
          inet addr:10.10.10.254  Bcast:10.10.10.255  Mask:255.255.255.0
          inet6 addr: 2001:e41:6f50:4edc::1/64 Scope:Global
          inet6 addr: fe80::20c:43ff:fe43:63f3/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:81 errors:0 dropped:0 overruns:0 frame:0
          TX packets:12 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:8771 (8.5 KiB)  TX bytes:1072 (1.0 KiB)

#
```

This example has a WAN IPv4 address=111.80.78.220 and 6rd-prefix=2001:e41::/32, and ISP's border server ipv4 address is 61.211.224.125

User also configures IPv6 RD settings via Web GUI:



11.35 How to enable IPv6 DS-Lite

To enable IPv6 DS-Lite, please include ipv6 6rd feature support in the kernel:

make menuconfig

[*] Customize Kernel Settings

In the kernel settings, find "The IPv6 protocol" by select the following options:

[*] Networking support --->

Networking options --->

<*> The IPv6 protocol --->

<*> IPv6: IP-in-IPv6 tunnel (RFC2473)

Please check "IPv6: IPv6: IP-in-IPv6 tunnel (RFC2473)".

To enable Ipv6 DS-Lite, the firmware should also support iproute2 utility:

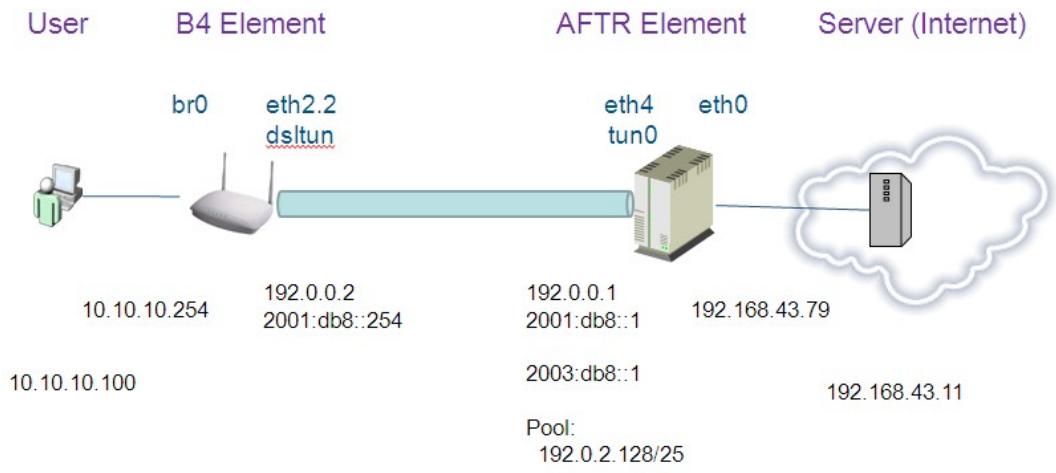
[*] Customize Vendor/User Settings

Network Applications --->

[*] iproute2

[*] ip

After compiling and downloading the firmware, please use iproute2's ip command to configure the IPv6 DS-Lite function:



- **Configuration on B4 Element**

#IPv6 Address

ip -6 addr add 2001:db8::254/32 dev eth2.2

#IPv6 Routing

echo 1 > /proc/sys/net/ipv6/conf/all/forwarding

#Create DS-Lite Interface ip -6 tunnel add dsltun mode ipip6 remote 2001:db8::1 local 2001:db8::254 dev eth2.2

ip link set dev dsltun up

adds the IPv4 default route to the server to forward all IPv4 packets to the ds-lite interface dsltun

ip route add default dev dsltun

#IPv6 Default Route

ip -6 route add default dev eth2.2

#Static IPv6 Route

ip -6 route add 2001:db8::1/128 via 2003:db8::1

- **Configuration on AFTR (http://www.isc.org/software/aftr)**

#IPv6 Address & Routing

ip -6 addr add 2003:db8::1/32 dev eth4

echo 1 > /proc/sys/net/ipv6/conf/all/forwarding

echo 1 > /proc/sys/net/ipv4/ip_forward

#Tunnel Interface Configuration (aftr.conf)

ip addr add 192.0.0.1 peer 192.0.0.2 dev tun0

ip route add 192.0.2.128/25 dev tun0

ip -6 addr add fe80::1 dev tun0

ip -6 route add 2001:db8::1 dev tun0

#Routing to B4 Element

ip -6 route add 2001:db8::254/128 dev eth4

#NAT

iptables -t nat -A POSTROUTING -o eth0 -j SNAT --to-source 192.168.43.79

iptables -t nat -A PREROUTING -i eth0 -j DNAT --to-dest 192.0.2.1

aftr.conf

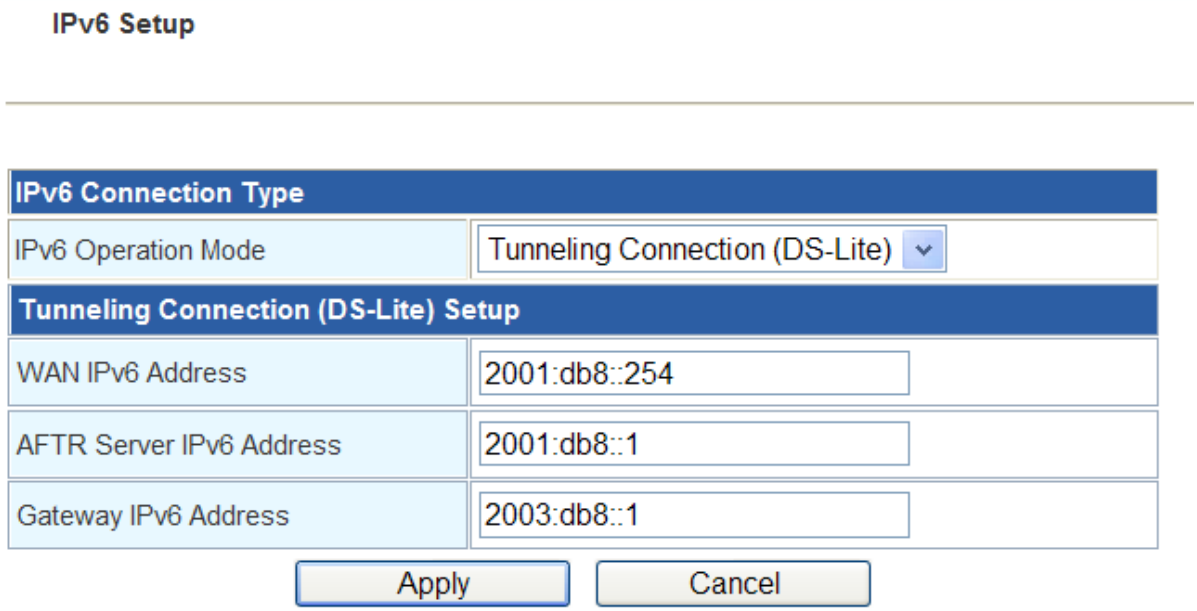
```
default tunnel mss on

defmtu 1450

address endpoint 2001:db8::1

address icmp 198.18.200.10

pool 192.0.2.128

acl6 ::0/0
```

aftr-script

```
aftr_start() {

   set –x
```

```
    ip link set tun0 up

    ip addr add 192.0.0.1 peer 192.0.0.2 dev tun0

    ip route add 192.0.2.128/25 dev tun0

    ip -6 addr add fe80::1 dev tun0

    ip -6 route add 2001:db8::1 dev tun0

}

aftr_stop() {

    set -x

    ip link set tun0 down

}
```

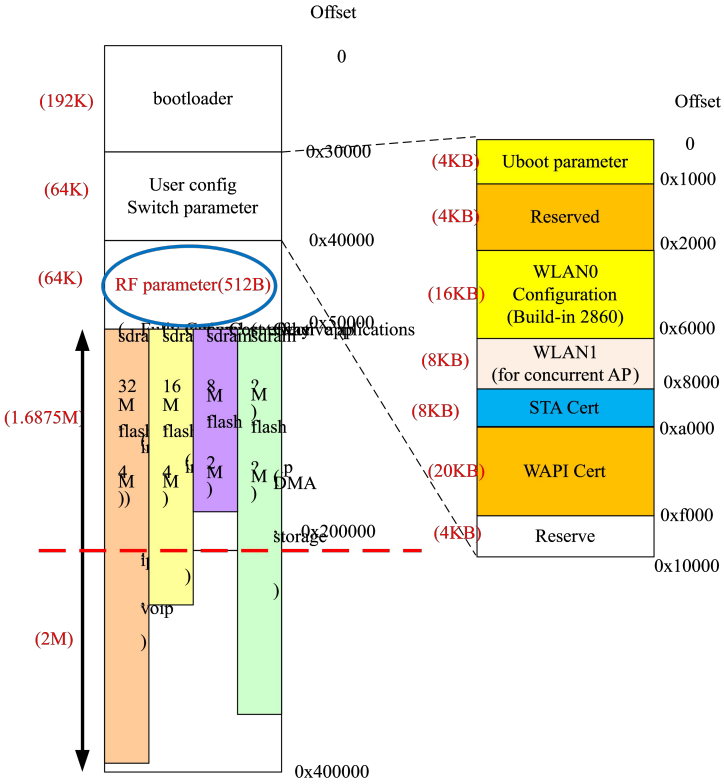
Another, user could use Web GUI to set DS-Lite:



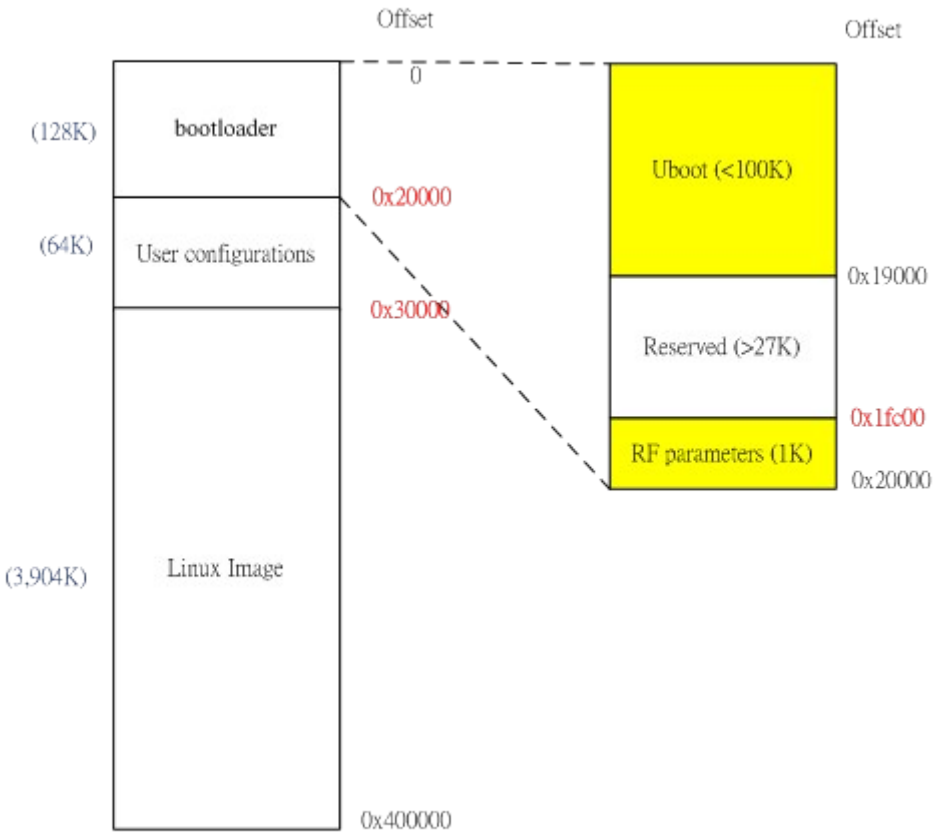
11.36 How to modify flash layout

Basically, you can make uboot and RF parameters use same flash sector t and it can save up to 3 flash sector compared to original design.

Default Flash layout:


Offset
0
(192K)
bootloader
0x30000
(64K)
User config
Switch parameter
0x40000
(64K)
RF parameter(512B)
0x50000
(1.6875M)
(2M)
0x200000
storage
0x400000
Offset
0
(4KB)
Uboot parameter
0x1000
(4KB)
Reserved
0x2000
(16KB)
WLAN0
Configuration
(Build-in 2860)
0x6000
(8KB)
WLAN1
(for concurrent AP)
0x8000
(8KB)
STA Cert
0xa000
(20KB)
WAPI Cert
0xf000
(4KB)
Reserve
0x10000

New flash layout:



1.modify rt2860v2/ os/linux/rt_linux.c to set flash partition name.

```
ra_mtd_read_nm("Bootloader", a&0xFFFF, (size_t) b, p);
```

2. Modify rt2860v2/include/iface/rtmp_rbs.h to set the offset of RF parameter.

```
#define RF_OFFSET                    0x1FC00  //last 1Kbyte in flash sector 1
```

3. Modify raeth/raether.c

```
i = ra_mtd_read_nm("Bootloader", GMAC0_OFFSET, 6, addr.sa_data);
i = ra_mtd_read_nm("Bootloader", GMAC2_OFFSET, 6, addr.sa_data);
```

4. Modify raeth/raether.h

```
#define GMAC2_OFFSET    0x1FC22
```

```
#if ! defined (CONFIG_RALINK_RT6855A)
#define GMAC0_OFFSET    0x1FC28
#else
#define GMAC0_OFFSET    0x1FC00
#endif
#define GMAC1_OFFSET    0x1FC2E
```

5. Modify lib/libnvram/flash_api.c

```
int flash_read_mac(char *buf)
{
    int fd, ret;
    if (!buf)
        return -1;
    fd = mtd_open("Bootloader", O_RDONLY);
    if (fd < 0) {
        fprintf(stderr, "Could not open mtd device\n");
        return -1;
    }
#if ! defined (NO_WIFI_SOC)
    lseek(fd, 0x1FC2E, SEEK_SET);
#else
    lseek(fd, 0x1FC06, SEEK_SET);
#endif
    ret = read(fd, buf, 6);
    close(fd);
    return ret;
}
```

6. Modify drivers/mtd/maps/ralink-flash.h

```
#define MTD_BOOT_PART_SIZE      0x20000
#define MTD_CONFIG_PART_SIZE    0x10000
#define MTD_FACTORY_PART_SIZE   0x00000
```

7. Modify drivers/mtd/ralink/ralink_spi.c , drivers/mtd/maps/ralink-flash.c, drivers/mtd/ralink/ralink_nand.c, or drivers/mtdralink/ralink_nand_rt3052.c which depended on your flash type.

```
#if 0
    }, {
        name:       "Factory",
        size:       MTD_FACTORY_PART_SIZE,
        offset:     MTDPART_OFS_APPEND
#endif
```

8. Modify Uboot/ include/configs/rt2880.h

```
#define CFG_BOOTLOADER_SIZE   0x20000
#define CFG_FACTORY_SIZE      0x000
```

11.37 How to reduce Linux FW size.

1. Modify vendors/config/mips/config.arch

```
CFLAGS  :=  $(if $(LOPT),$(LOPT),-Os) -fomit-frame-pointer
CFLAGS  :=  $(if $(UOPT),$(UOPT),-Os) -fomit-frame-pointer
```

2.Modify Kernel configuration to save Linux FW size.

```
General setup  --->
[*] Optimize for size (Look out for broken compilers!)
--- Configure standard kernel features (for small systems)  --->
[ ]  Enable printk function in the kernel
```

3. Use miniupnpd instead of linux-igd & wscd.

```
[ ] Customize Vendor/User Settings (NEW)
Network Applications  --->
[*] miniupnpd
[ ] linux-igd
[ ] wscd (WSC/WPS)
```

4.Modify user/rt2880_app/switch/switch.c or gsw_switch.c

Change all keyword from CONFIG_RT2860V2_AP_MEMORY_OPTIMIZATION to CONFIG_CC_OPTIMIZE_FOR_SIZE

5.Modify user/rt2880_app/nvram/ralink_init.c

Change all keyword from CONFIG_RT2860V2_AP_MEMORY_OPTIMIZATION to CONFIG_CC_OPTIMIZE_FOR_SIZE

6. Modify user/wireless_tools/Makefile

```
BUILD_STATIC = y
BUILD_WE_ESSENTIAL = y
```

11.38 How to change internal GSW PHY Base Address.

1. Please change internal PHY base address to > 5

RT6855/6: set 0xbfb5f014 = 0x10000c

RT7620: set 0xb0117014= 0x10000c

GPC: GIGA Port Control (offset: 0x7014)

20:16	RW	PHY_BASE	**Internal EPHY Based Address** THe base PHY address of the internal 5-port EPHY can be assigned by this regsiter value. When you change the default value, you need to reset EPHY again to get the new regsiter value.	0x0

2. Reset PHY

RT6855/6: set 0xbfb00834[24]=1 then set 0xbfb00834[24]=0

RT7620: set 0xb0000034[24]=1 then set 0xb0000034[24]=0

RSTCTRL2 (offset:0x834)

24	RW	EPHY_RST	Write 1 to this bit will reset Ethernet PHY block Write 0 to de-assert reset.	0x0

11.39 How to support new USB 3G dongle

- Step1: Switch USB 3G dongle mode

  In the general case, the 3G dongle will be recognized as a USB mass storage device when you plug it into USB port. You need to switch it to modem mode and then you can start 3G dial up. SDK uses open source application "usb_modeswitch" to accomplish this work. "usb_modeswitch" needs a configuration file for each 3G dongle. So, what you need to do is add a configuration file into SDK for the new 3G dongle. "usb_modeswitch" keeps updating its configuration file datebase to support more new 3G dongle. You can download the latest "usb_modeswitch" vesrion and find corresponded configuration file.

Example:

Support Huawei E169u 3G dongle

1. Download usb_modeswith database "usb-modeswitch-data"

2. Get the vendor ID and product ID of the new 3G dongle

   # cat /proc/bus/usb/devices

11.40 How to enable USB 3G dongle function

The RT288x_SDK supports USB 3G dongle to work as WAN interface. This requires Kernel drivers to support USB stack and dongle device, and also user-space application to establish 3G PPP connection.

Configuration:

Step1: User-space applications configuration

#cd RT288x_SDK/source

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*]Customize Vendor/User Settings
    Network Applications  --->
     [*] 3G connection
```

#cd RT288x_SDK/source

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*] Customize Busybox Settings
    Linux System Utilities  --->
     [*] mdev
```

```
[*] Support /etc/mdev.conf
[*] Support subdirs/symlinks
[*] Support regular expressions substitutions when renaming device
[*] Support command execution at device addition/removal
```

Step2: Kernel configuration

USB Host driver:

#cd RT288x_SDK/source

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*] Customize Kernel Settings
   Device Drivers  --->
    [*] USB support  --->

      <*> Support for Host-side USB
      [*] USB device filesystem
      <*> EHCI HCD (USB 2.0) support
      [*] Ralink EHCI HCD support
      <*> OHCI HCD support
      [*] Ralink OHCI HCD support
```

USB 3G dongle driver:

#cd RT288x_SDK/source

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*] Customize Kernel Settings
    Device Drivers  --->
     [*] USB support  --->


       [*] USB Serial Converter support  --->


         [*] USB driver for GSM and CDMA modems
```

PPP driver:

#cd RT288x_SDK/source

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*] Customize Kernel Settings
    Device Drivers  --->
     [*] Network device support  --->


       [*]   PPP (point-to-point protocol) support


         [*]     PPP support for async serial ports
```

Device hot plugging :

#cd RT288x_SDK/source

#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*] Customize Kernel Settings
    General setup  --->
     [*] Configure standard kernel features (for small systems)  --->


       [*]   Support for hot-pluggable devices
```

Sysfs filesystem :

#cd RT288x_SDK/source

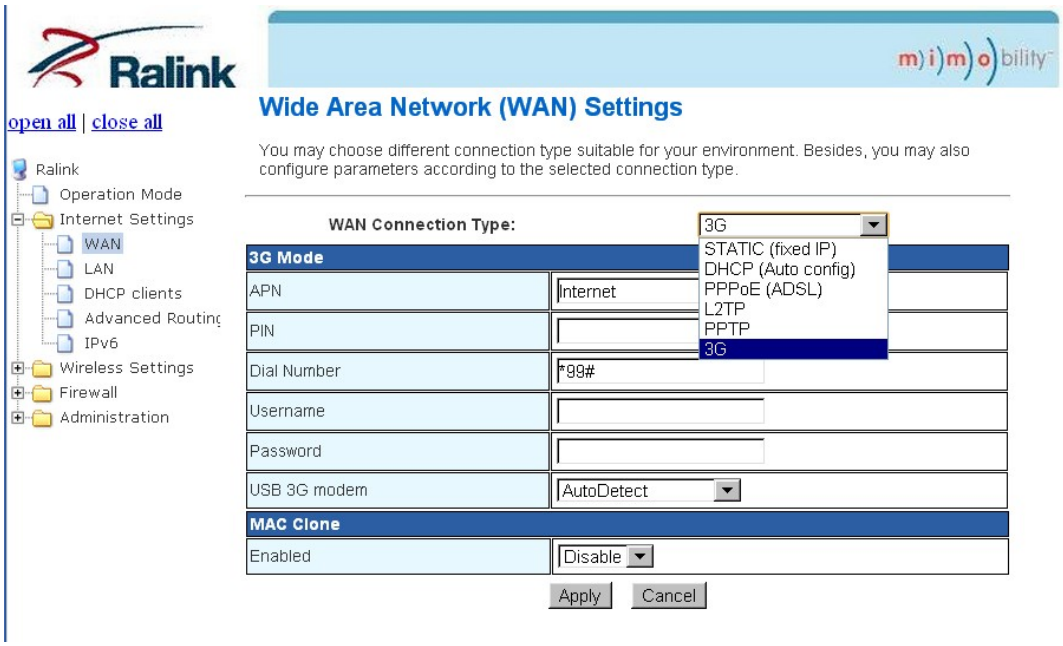
#make menuconfig

```
Kernel/Library/Defaults Selection  --->
 [*] Customize Kernel Settings
    File systems  --->
     Pseudo filesystems  --->


       [*] sysfs file system support
```

Start 3G dial up

You can start 3G dial up through Web GUI or comman line. Some parameters such like APN, Dial number are needed for connection establishment. These parameters should be provided by the ISP.

Web GUI:



Note: 3G Web GUI page doesn't exist in 2M/16M Default Configuration File.

Command line:

Usage: 3g.sh [3G_dongle_model]

Example:

#/ 3g.sh HUAWEI-E169

3G dongle model supported by current SDK are "HUAWEI-E169", "BandLuxe-C270", "MobilePeak-Titan", and "DATANG-M5731".

11.41 How to enable Port Trigger function

To support the Port Trigger function, the menuconfig options in SDK must be enabled.

Networking Support ⇌

Networking Options ⇌

Network packet filtering framework (Netfilter) ╪

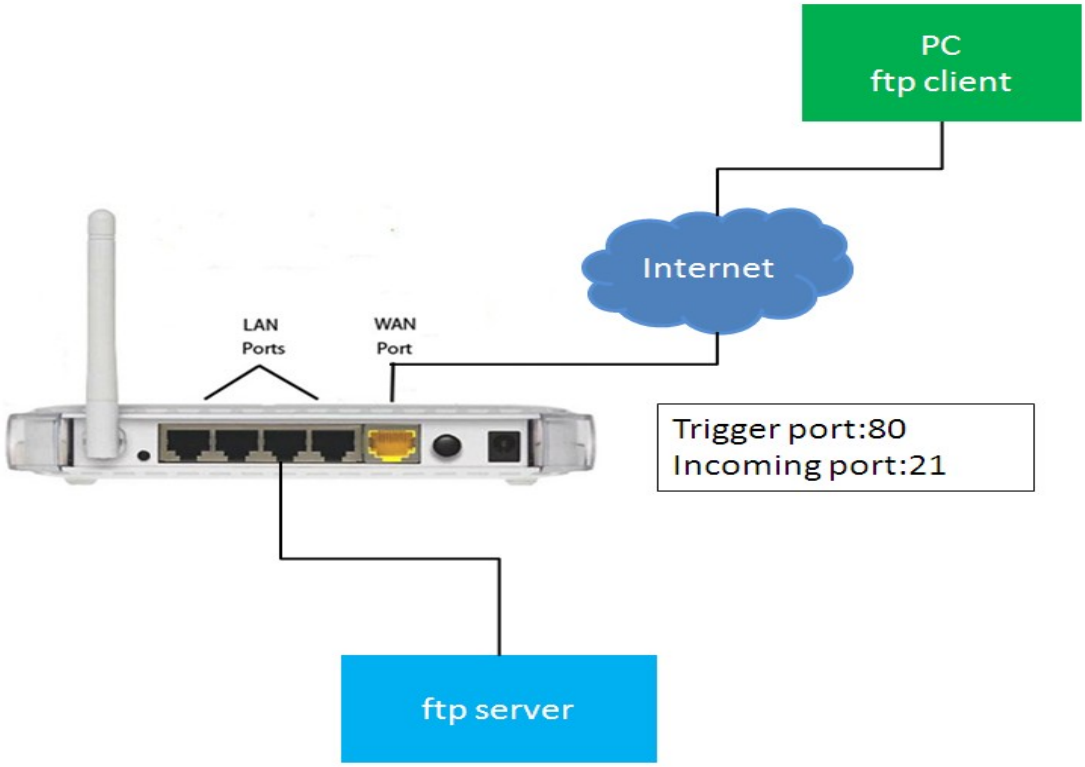
IP:Netfilter configuration ╪

<*> TRIGGER target support

11.42 Port Trigger information

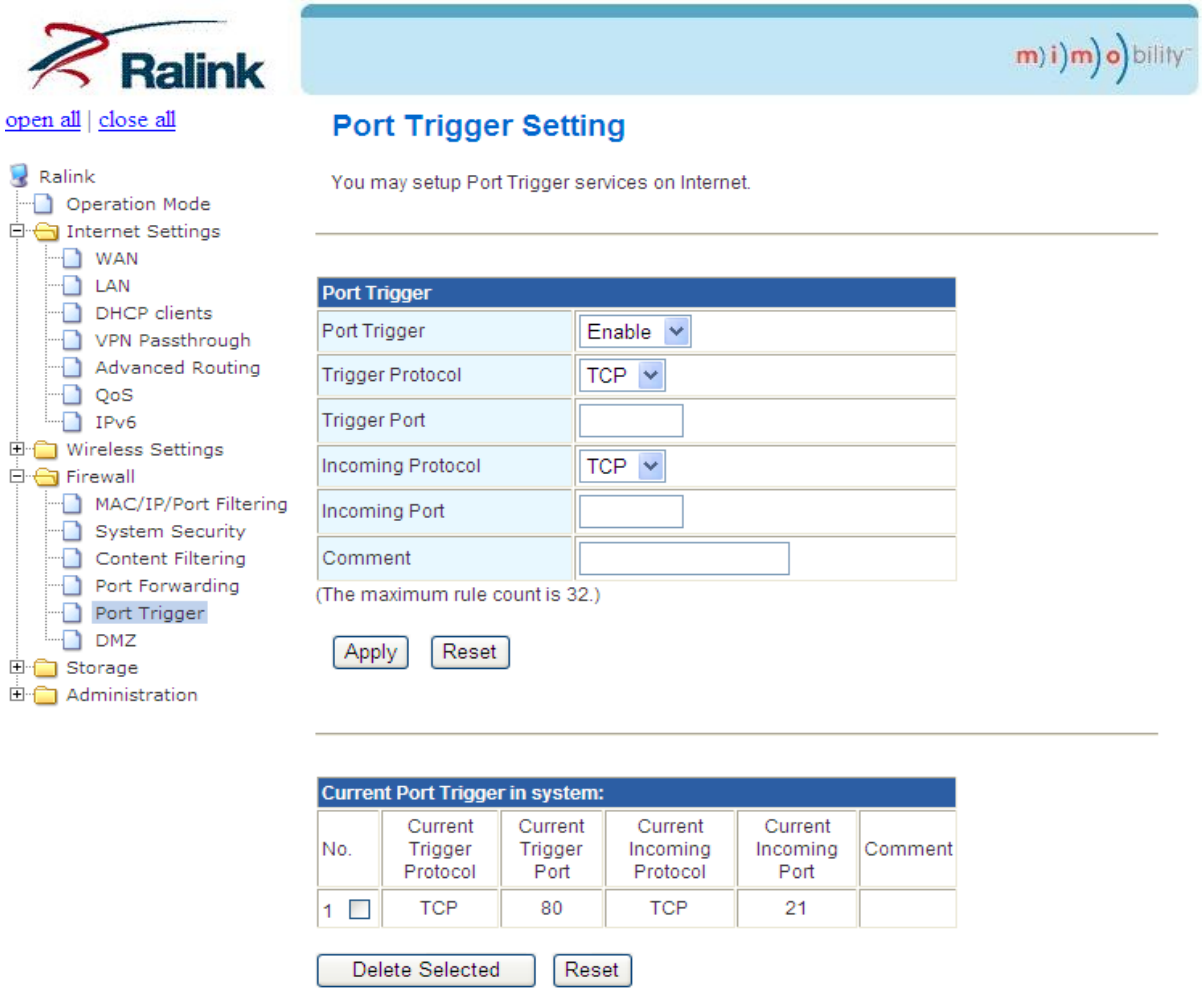
11.42.1 Port Trigger Concept

Port trigger concept is shown in the subsequent figure. Port triggering is a way to trigger port forwarding in which outbound traffic on predefined ports ('called trigger port') causes inbound traffic to specific incoming ports to be dynamically forwarded to the initiating host in a limited period of time.



11.42.2 Port Trigger Usage

WEB UI :



11.43 How to enable ALSA support?

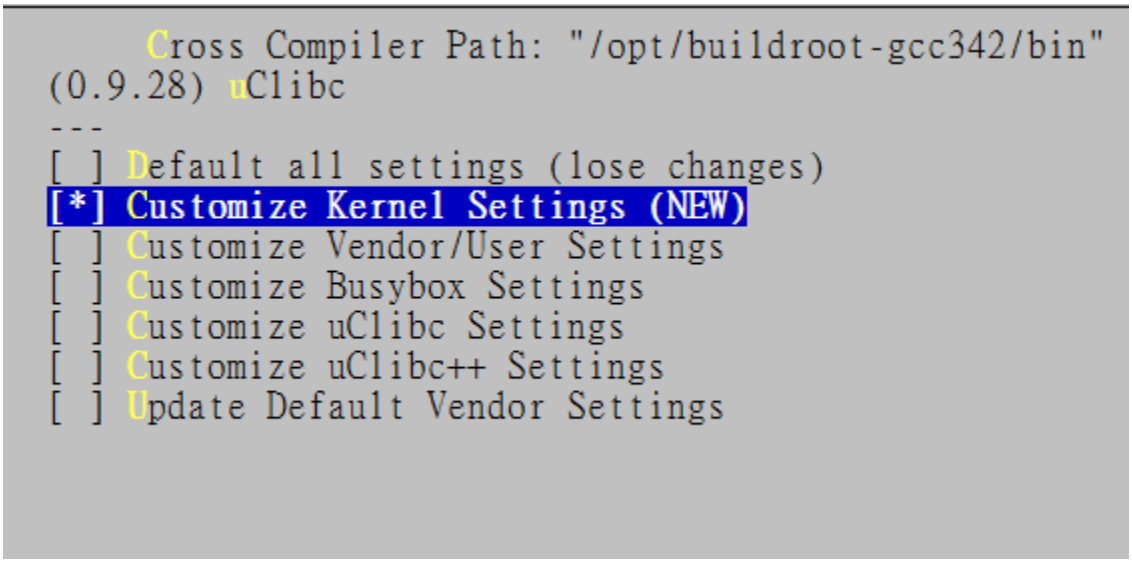
11.43.1 ALSA Concept

ALSA (Advanced Linux Sound Architecture) provides audio and MIDI functionality to the Linux operating system. It also supports SMP and thread-thread design. User could program or control it via user space library.

11.43.2 How to enable ALSA in Kernel

1 Uncompress SDK, under source directory, Enter "make menuconfig"

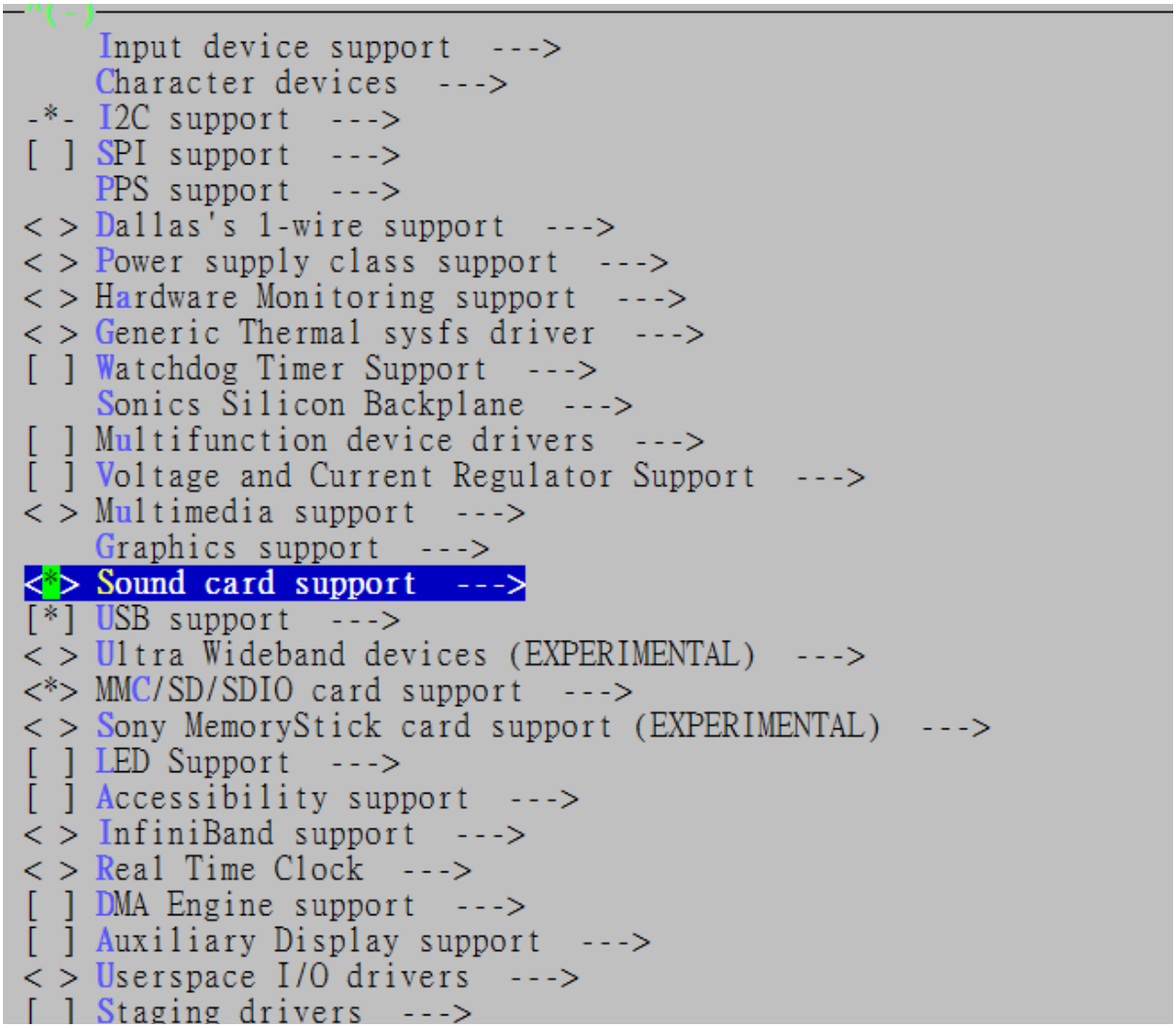
2 Choose Kernel/Library/Default Selection, and Select "Customize Kernel Setting"



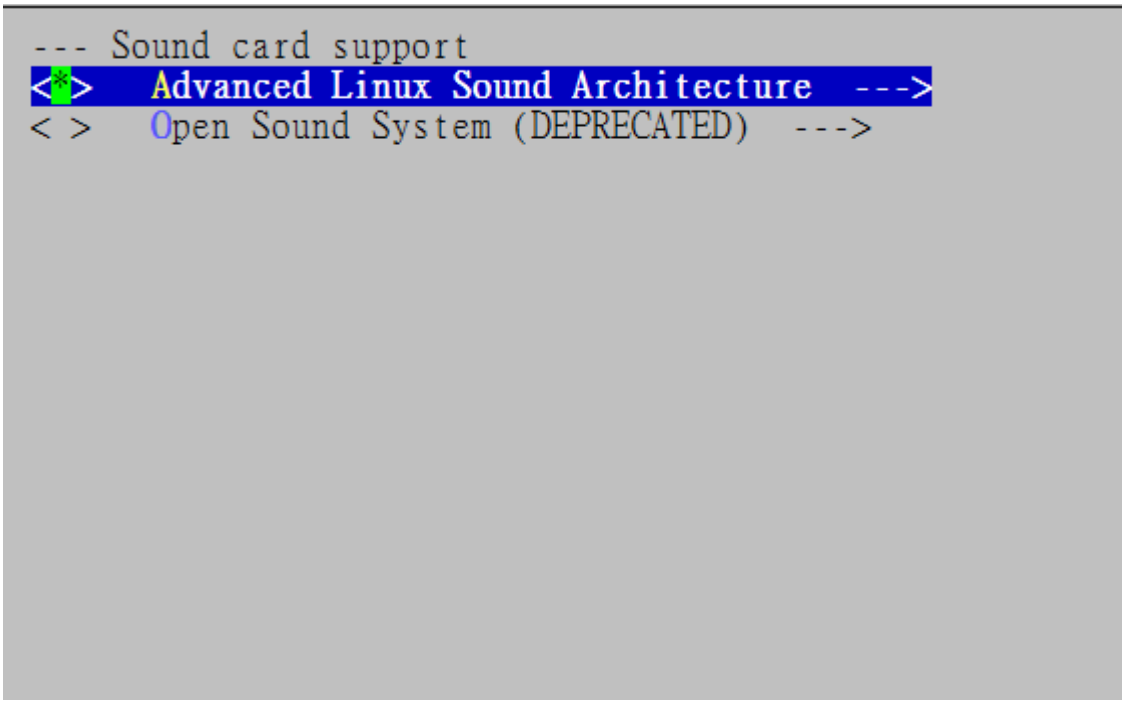
3 Save and Exit. Then it will auto-enter in Kernel menuconfig.

4 Please enable I2S support firstly. It could be selected in Device drivers.

5 Enter Device Drivers and select" Sound card support"



6 Enter Sound card support, enable "Advanced Linux Sound Architecture"



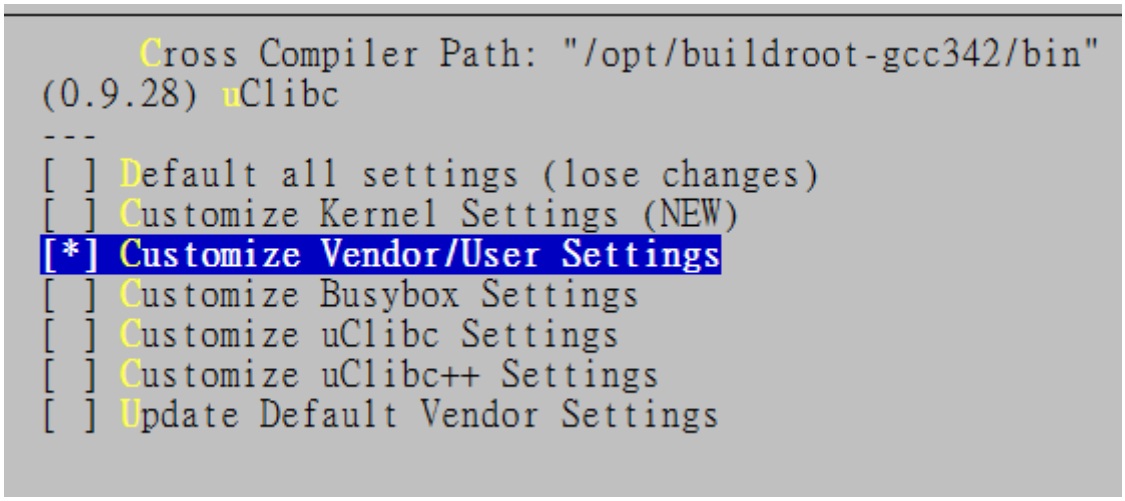
7 MediaTek Sound System will be selected by default to be one of SoC Audio Support in ALSA.

8 Now ALSA have been supported in Linux Kernel.

Note: It supported Kernel 2.6.36 version and MT7620/7621 SoC only.

11.43.3 How to enable ALSA Libs/Utility

1 Under source directory, type "make menuconfig" and Enter "Kernel/Library/Defaults Selection" to choose "customize Vendor/User Settings"



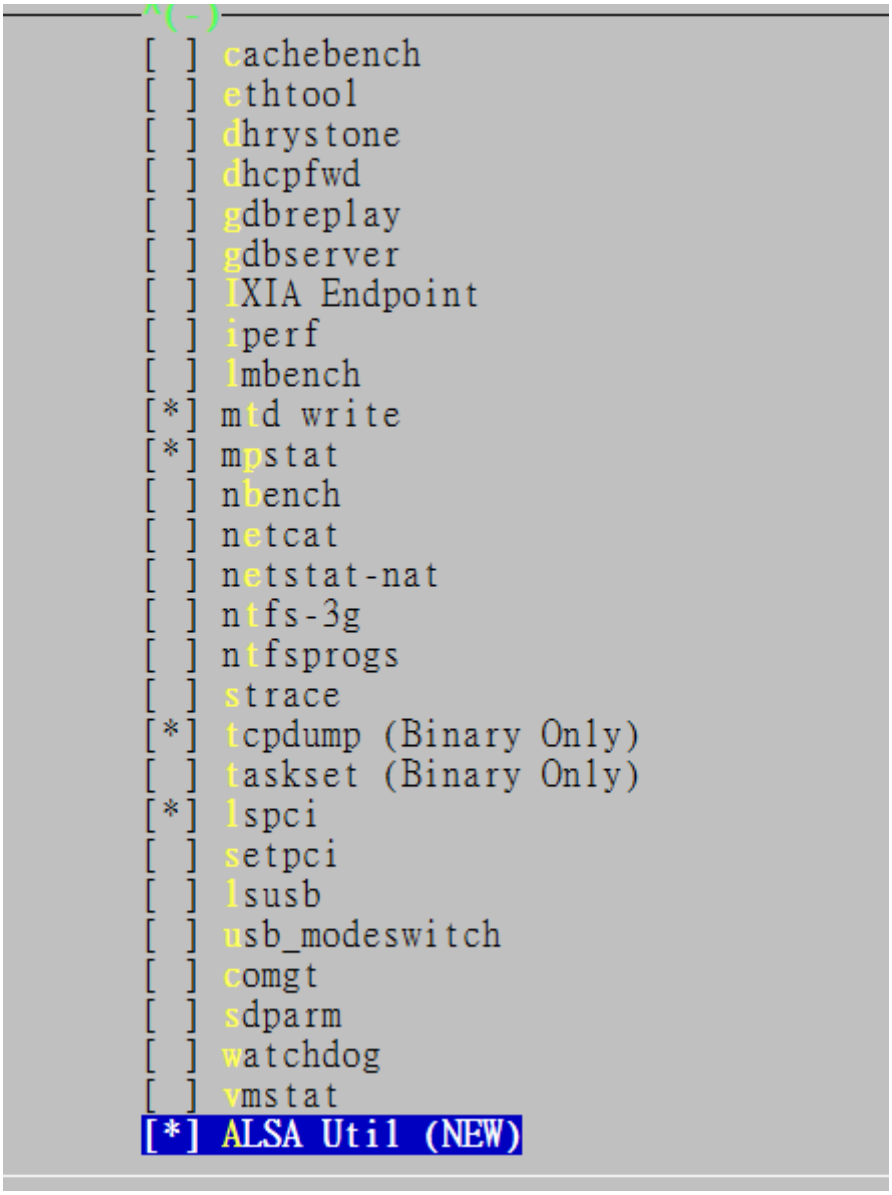
11.43.4 Pause/Resume/Stop function demo

ALSA Utils implemented pause/resume and stop function. You could use aplay under /sbin to demo these functions.

Pause/resume: Press space during playing sounds via aplay.

Stop: Press "s" before sound playing stop.

2 Enter "Miscellaneous Applications" and select "ALSA Util"



3 Save and exit. After compiling SDK, it will own the ALSA capability over MTK platform.

11.43.5 How to demo ALSA ?

We ported ALSA utility , named "aplay" and "arecord" under /sbin, which based on ALSA Lib to be communicated with ALSA in kernel. After booting up system, Enter the following command to playback or capture sound:

1 playback

"aplay <playback file location> -v -f cd -c 2"

2 capture

"arecord -v -f cd -c 2 -d 10 <capture file names>"

ALSA Util is a standard application. Other usage could be find out in help menu. It will be shown if enter "aplay" or "arecord" only.

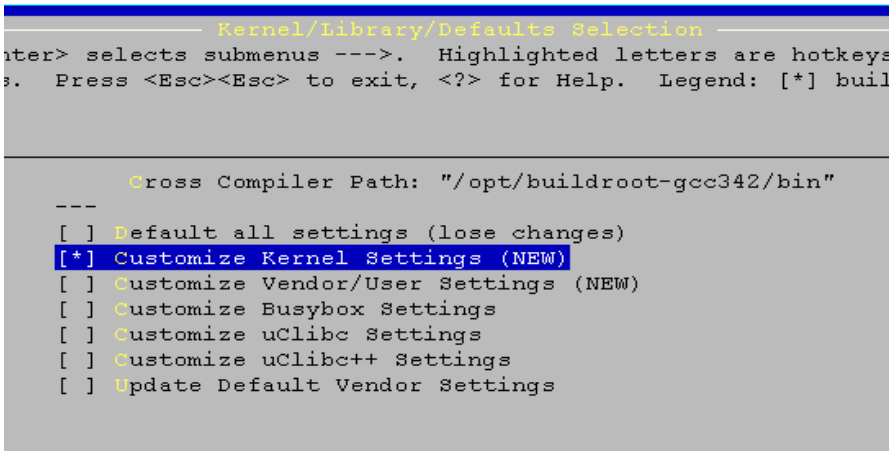
11.44 How to enable I2S+Codec support

11.44.1 I2S concept

I2S is an Audio interface. It can provide "PLAYBACK" and "RECORD" function with proper codec. This SDK support I2S+WM8960 codec. I2S is in slave mode while WM8960 codec is in master mode. This SDK also provide internal REFCLK to codec as its MCLK.

11.44.2 How to enable I2S+WM8960 codec

1. Enter menuconfig. Choose "Kernel/Library/Defaults Selection" and select "Customize Kernel Settings"



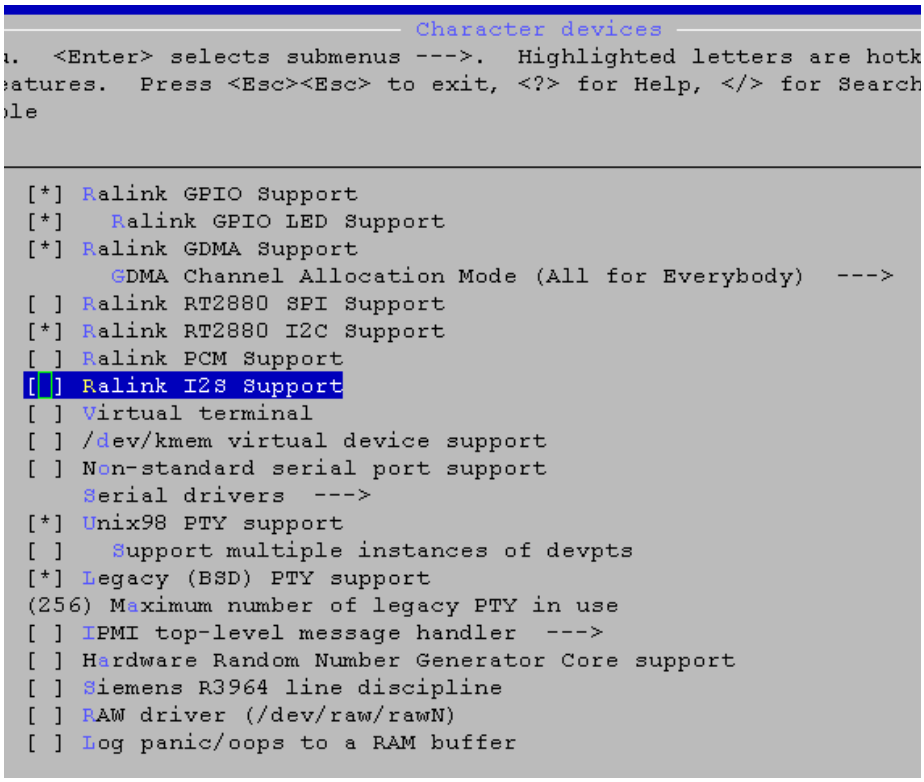
2. Enter "Device Drivers"

```
                    Linux Kernel Configuration
ienu.  <Enter> selects submenus --->.  Highlighted letters
s features.  Press <Esc><Esc> to exit, <?> for Help, </> fo
ipable

        Machine selection  --->
    [*] Enable FPU emulation
        Endianess selection (Little endian)  --->
        CPU selection  --->
        Kernel type  --->
        General setup  --->
    [ ] Enable loadable module support  --->
    [*] Enable the block layer  --->
        Bus options (PCI, PCMCIA, EISA, ISA, TC)  --->
        Executable file formats  --->
        Power management options  --->
    [*] Networking support  --->
        Device Drivers  --->
        File systems  --->
        Kernel hacking  --->
        Security options  --->
    [ ] Cryptographic API  --->
        Library routines  --->
        Ralink Module  --->
    ---
        Load an Alternate Configuration File
        Save an Alternate Configuration File
```

3. Enter "Character devices"

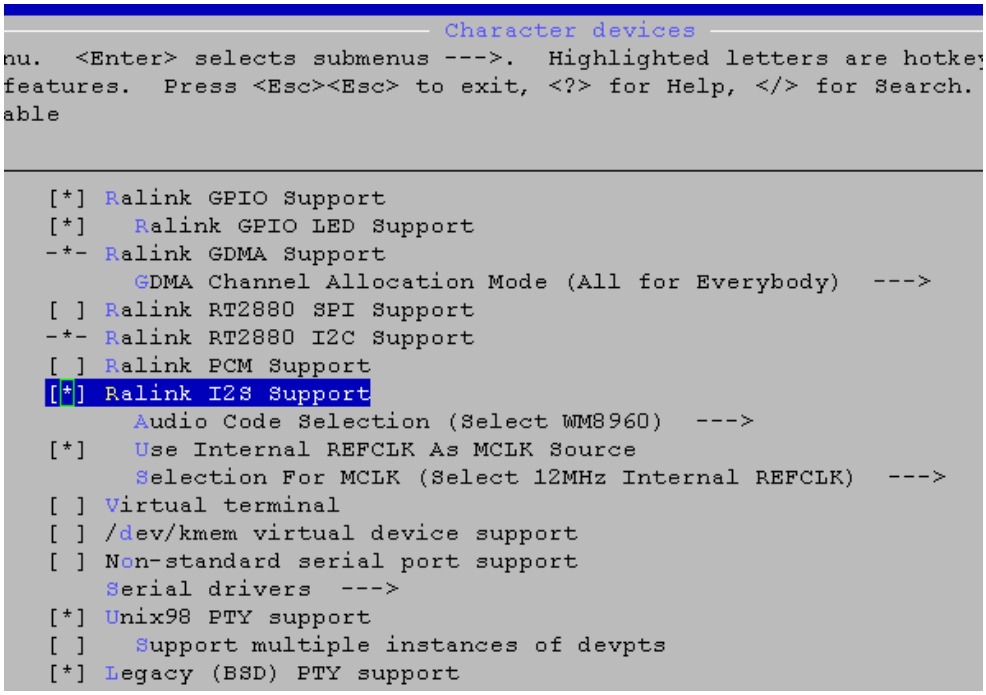
```
Configuration
                              Device Drivers
u.  <Enter> selects submenus --->.  Highlighted lette
eatures.  Press <Esc><Esc> to exit, <?> for Help, </>
ble

      Generic Driver Options  --->
  [ ] Connector - unified userspace <-> kernelspace l
  [*] Memory Technology Device (MTD) support  --->
  [ ] Parallel port support  --->
  [*] Block devices  --->
  [ ] Misc devices  --->
  [ ] ATA/ATAPI/MFM/RLL support (DEPRECATED)  --->
      SCSI device support  --->
  [ ] Serial ATA and Parallel ATA drivers  --->
  [ ] Multiple devices driver support (RAID and LVM)
  [*] Network device support  --->
  [ ] ISDN support  --->
  [ ] Telephony support  --->
      Input device support  --->
      Character devices  --->
  [ ] I2C support  --->
  [ ] SPI support  --->
      PPS support  --->
  [ ] Dallas's 1-wire support  --->
  [ ] Power supply class support  --->
  [ ] Hardware Monitoring support  --->
```

4. Choose "Ralink I2S Support"

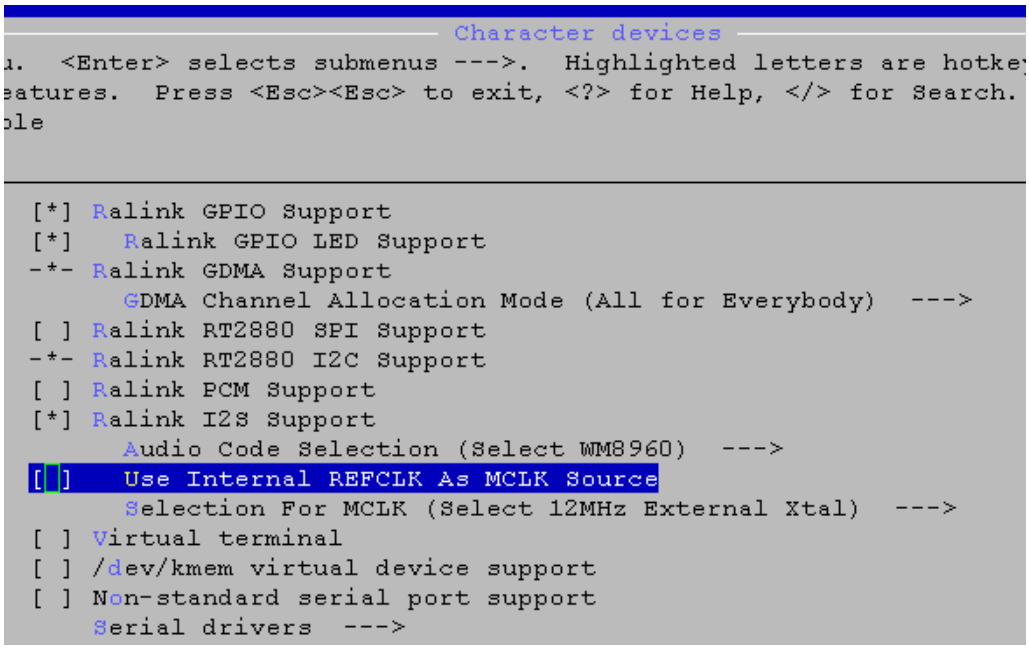


5. After choosing "Ralink I2S Support", you can see "Audio Selection". The default setting is "Select WM8960".

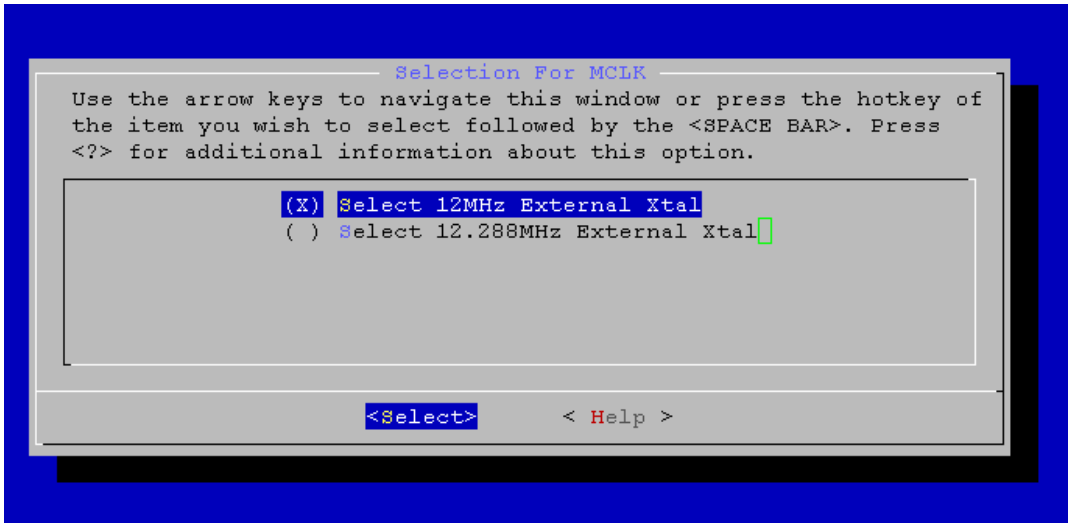
And you can also see "Use Internal REFCLK AS MCLK Source" is chosen as default config



6. If you want to use external Xtal to provide MCLK to codec, you can un-choose "Use Internal REFCLK AS MCLK Source" as the following figure. And you can see "Selection For MCLK (Select 12MHz External Xtal)"

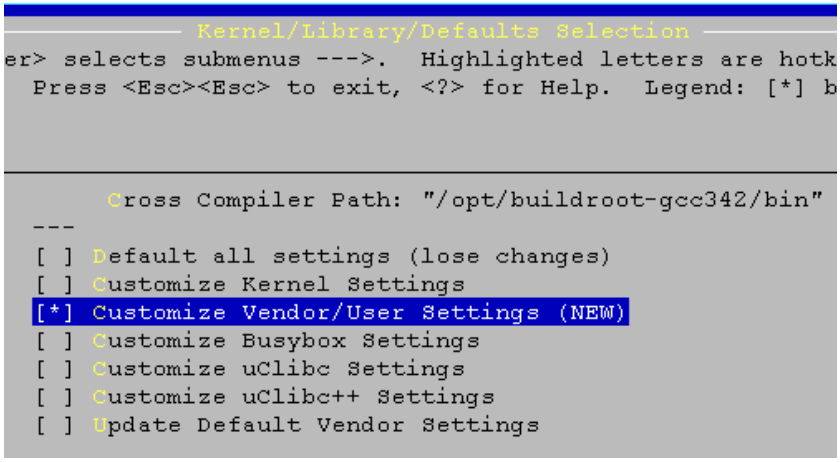


7. If you want to use 12.288MHz External Xtal, you can enter "Selection For MCLK (Select 12MHz External Xtal)" as the following figure

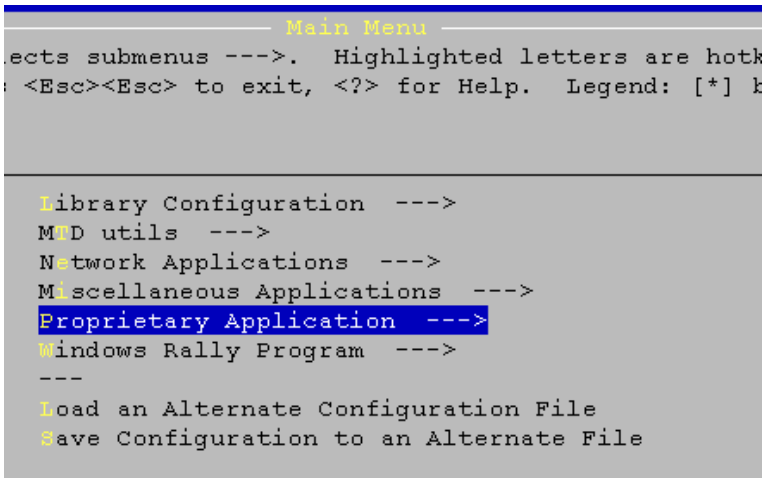


11.44.3 How to enable I2S command in user space application

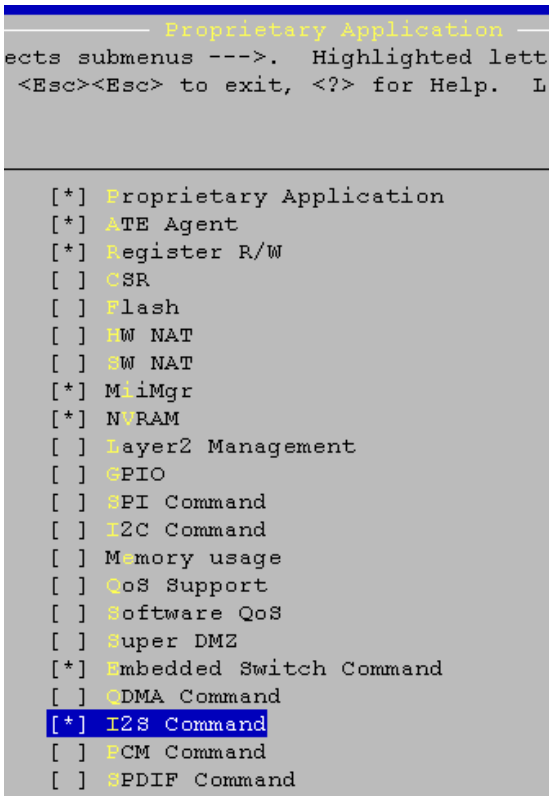
1. Enter menuconfig. Choose "Kernel/Library/Defaults Selection" and select "Customize Vendor/User Settings"



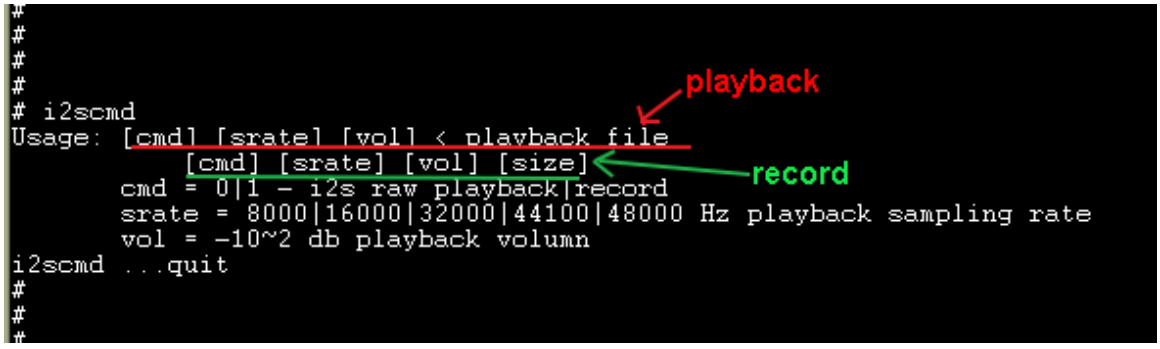
2. Enter "Proprietary Application"



3. Choose I2S command



11.44.4 I2S user command for "PLAYBACK" and "RECORD"



1. Command of "PLAYBACK" function

Example: ***i2scmd 0 48000 100 </etc_ro/test_sound.snd***

2. Command of "RECORD" function

Example: ***i2scmd 1 48000 100 5000000***