

NAME

ral - Ralink Technology IEEE 802.11a/g/n wireless network device

SYNOPSIS

To compile this driver into the kernel, place the following lines in your kernel configuration file:

```
device ral  
device ralfw  
device wlan  
device wlan_amrr  
device firmware
```

Alternatively, to load the driver as a module at boot time, place the following line in loader.conf(5):

```
if_ral_load="YES"
```

DESCRIPTION

The **ral** driver supports PCI/PCIe/CardBus wireless adapters based on the Ralink RT2500, RT2501, RT2600, RT2700, RT2800, RT3090 and RT3900E chipsets.

The RT2500 chipset is the first generation of 802.11b/g adapters from Ralink. It consists of two integrated chips, an RT2560 MAC/BBP and an RT2525 radio transceiver.

The RT2501 chipset is the second generation of 802.11a/b/g adapters from Ralink. It consists of two integrated chips, an RT2561 MAC/BBP and an RT2527 radio transceiver. This chipset provides support for the IEEE 802.11e standard with multiple hardware transmission queues and allows scatter/gather for efficient DMA operations.

The RT2600 chipset consists of two integrated chips, an RT2661 MAC/BBP and an RT2529 radio transceiver. This chipset uses the MIMO (multiple-input multiple-output) technology with multiple radio transceivers to extend the operating range of the adapter and to achieve higher throughput. However, the RT2600 chipset does not support any of the 802.11n features.

The RT2700 chipset is a low-cost version of the RT2800 chipset. It supports a single transmit path and two receiver paths (1T2R). It consists of two integrated chips, an RT2760 or RT2790 (PCIe) MAC/BBP and an RT2720 (2.4GHz) or RT2750 (2.4GHz/5GHz) radio transceiver.

The RT2800 chipset is the first generation of 802.11n adapters from Ralink. It consists of two integrated chips, an RT2860 or RT2890 (PCIe) MAC/BBP and an RT2820 (2.4GHz) or RT2850 (2.4GHz/5GHz) radio transceiver. The RT2800 chipset supports two transmit paths and up to three receiver paths

(2T2R/2T3R). It can achieve speeds up to 144Mbps (20MHz bandwidth) and 300Mbps (40MHz bandwidth.)

The RT3090 chipset is the first generation of single-chip 802.11n adapters from Ralink. **ral** supports **station**, **adhoc**, **hostap**, **mesh**, **wds**, and **monitor** mode operation. Only one **hostap** or **mesh** virtual interface may be configured at a time. Any number of **wds** virtual interfaces may be configured together with a **hostap** interface. Multiple **station** interfaces may be operated together with a **hostap** interface to construct a wireless repeater device.

The RT3900E chipset is a single-chip 802.11n adapters from Ralink. The MAC/Baseband Processor can be an RT5390 or RT5392. The RT5390 chip operates in the 2GHz spectrum and supports 1 transmit path and 1 receiver path (1T1R). The RT5392 chip operates in the 2GHz spectrum and supports up to 2 transmit paths and 2 receiver paths (2T2R).

The transmit speed is user-selectable or can be adapted automatically by the driver depending on the number of hardware transmission retries. For more information on configuring this device, see `ifconfig(8)`.

HARDWARE

The **ral** driver supports PCI/PCIe/CardBus wireless adapters based on Ralink Technology chipsets, including:

| <i>Card</i> | <i>MAC/BBP</i> | <i>Bus</i> |
|---------------------------|----------------|------------|
| A-Link WL54H | RT2560 | PCI |
| A-Link WL54PC | RT2560 | CardBus |
| AirLink101 AWLC5025 | RT2661 | CardBus |
| AirLink101 AWLH5025 | RT2661 | PCI |
| Amigo AWI-914W | RT2560 | CardBus |
| Amigo AWI-922W | RT2560 | mini-PCI |
| Amigo AWI-926W | RT2560 | PCI |
| AMIT WL531C | RT2560 | CardBus |
| AMIT WL531P | RT2560 | PCI |
| AOpen AOI-831 | RT2560 | PCI |
| ASUS WL-107G | RT2560 | CardBus |
| ASUS WL-130g | RT2560 | PCI |
| Atlantis Land A02-PCI-W54 | RT2560 | PCI |
| Atlantis Land A02-PCM-W54 | RT2560 | CardBus |
| Belkin F5D7000 v3 | RT2560 | PCI |
| Belkin F5D7010 v2 | RT2560 | CardBus |
| Billionton MIWLGRL | RT2560 | mini-PCI |

| | | |
|------------------------|---------|----------|
| Canyon CN-WF511 | RT2560 | PCI |
| Canyon CN-WF513 | RT2560 | CardBus |
| CC&C WL-2102 | RT2560 | CardBus |
| CNet CWC-854 | RT2560 | CardBus |
| CNet CWP-854 | RT2560 | PCI |
| Compex WL54G | RT2560 | CardBus |
| Compex WLP54G | RT2560 | PCI |
| Conceptronic C54RC | RT2560 | CardBus |
| Conceptronic C54Ri | RT2560 | PCI |
| D-Link DWA-525 rev A2 | RT5392 | PCI |
| Digitus DN-7001G-RA | RT2560 | CardBus |
| Digitus DN-7006G-RA | RT2560 | PCI |
| E-Tech WGPC02 | RT2560 | CardBus |
| E-Tech WGPI02 | RT2560 | PCI |
| Edimax EW-7108PCg | RT2560 | CardBus |
| Edimax EW-7128g | RT2560 | PCI |
| Eminent EM3036 | RT2560 | CardBus |
| Eminent EM3037 | RT2560 | PCI |
| Encore ENLWI-G-RLAM | RT2560 | PCI |
| Encore ENPWI-G-RLAM | RT2560 | CardBus |
| Fiberline WL-400P | RT2560 | PCI |
| Fibreline WL-400X | RT2560 | CardBus |
| Gigabyte GN-WI01GS | RT2561S | mini-PCI |
| Gigabyte GN-WIKG | RT2560 | mini-PCI |
| Gigabyte GN-WMKG | RT2560 | CardBus |
| Gigabyte GN-WP01GS | RT2561S | PCI |
| Gigabyte GN-WPKG | RT2560 | PCI |
| Hawking HWC54GR | RT2560 | CardBus |
| Hawking HWP54GR | RT2560 | PCI |
| iNexQ CR054g-009 (R03) | RT2560 | PCI |
| JAHT WN-4054P | RT2560 | CardBus |
| JAHT WN-4054PCI | RT2560 | PCI |
| LevelOne WNC-0301 v2 | RT2560 | PCI |
| LevelOne WPC-0301 v2 | RT2560 | CardBus |
| Linksys WMP54G v4 | RT2560 | PCI |
| Micronet SP906GK | RT2560 | PCI |
| Micronet SP908GK V3 | RT2560 | CardBus |
| Minitar MN54GCB-R | RT2560 | CardBus |
| Minitar MN54GPC-R | RT2560 | PCI |
| MSI CB54G2 | RT2560 | CardBus |

| | | |
|---------------------|--------|----------|
| MSI MP54G2 | RT2560 | mini-PCI |
| MSI PC54G2 | RT2560 | PCI |
| OvisLink EVO-W54PCI | RT2560 | PCI |
| PheeNet HWL-PCIG/RA | RT2560 | PCI |
| Planex GW-NS300N | RT2860 | CardBus |
| Pro-Nets CB80211G | RT2560 | CardBus |
| Pro-Nets PC80211G | RT2560 | PCI |
| Repotec RP-WB7108 | RT2560 | CardBus |
| Repotec RP-WP0854 | RT2560 | PCI |
| SATech SN-54C | RT2560 | CardBus |
| SATech SN-54P | RT2560 | PCI |
| Sitecom WL-112 | RT2560 | CardBus |
| Sitecom WL-115 | RT2560 | PCI |
| SMC SMCWCB-GM | RT2661 | CardBus |
| SMC SMCWPCI-GM | RT2661 | PCI |
| SparkLAN WL-685R | RT2560 | CardBus |
| Surecom EP-9321-g | RT2560 | PCI |
| Surecom EP-9321-g1 | RT2560 | PCI |
| Surecom EP-9428-g | RT2560 | CardBus |
| Sweex LC500050 | RT2560 | CardBus |
| Sweex LC700030 | RT2560 | PCI |
| TekComm NE-9321-g | RT2560 | PCI |
| TekComm NE-9428-g | RT2560 | CardBus |
| Unex CR054g-R02 | RT2560 | PCI |
| Unex MR054g-R02 | RT2560 | CardBus |
| Zinwell ZWX-G160 | RT2560 | CardBus |
| Zinwell ZWX-G360 | RT2560 | mini-PCI |
| Zinwell ZWX-G361 | RT2560 | PCI |
| Zonet ZEW1500 | RT2560 | CardBus |
| Zonet ZEW1600 | RT2560 | PCI |

EXAMPLES

Join an existing BSS network (i.e., connect to an access point):

```
ifconfig wlan create wlandev ral0 inet 192.168.0.20 netmask 0xfffff00
```

Join a specific BSS network with network name "my_net":

```
ifconfig wlan create wlandev ral0 inet 192.168.0.20 \
netmask 0xfffff00 ssid my_net
```

Join a specific BSS network with 40-bit WEP encryption:

```
ifconfig wlan create wlandev ral0 inet 192.168.0.20 \  
netmask 0xfffff00 ssid my_net \  
wepmode on wepkey 0x1234567890 weptxkey 1
```

Join a specific BSS network with 104-bit WEP encryption:

```
ifconfig wlan create wlandev ral0 inet 192.168.0.20 \  
netmask 0xfffff00 ssid my_net \  
wepmode on wepkey 0x01020304050607080910111213 weptxkey 1
```

DIAGNOSTICS

ral%d: could not load 8051 microcode An error occurred while attempting to upload the microcode to the onboard 8051 microcontroller unit.

ral%d: timeout waiting for MCU to initialize The onboard 8051 microcontroller unit failed to initialize in time.

ral%d: device timeout A frame dispatched to the hardware for transmission did not complete in time. The driver will reset the hardware. This should not happen.

SEE ALSO

cardbus(4), intro(4), wlan(4), wlan_ccmp(4), wlan_tkip(4), wlan_wep(4), wlan_xauth(4), hostapd(8), ifconfig(8), wpa_supplicant(8)

HISTORY

The **ral** driver first appeared in OpenBSD 3.7. Support for the RT2501 and RT2600 chipsets was added in OpenBSD 3.9. Support for the RT2800 chipset was added in OpenBSD 4.3. Support for the RT2700 chipset was added in OpenBSD 4.4. Support for the RT3090 chipset was added in OpenBSD 4.9.

AUTHORS

The original **ral** driver was written by Damien Bergamini <damien@openbsd.org>.

CAVEATS

The **ral** driver does not make use of the hardware cryptographic engine.

The **ral** driver does not support any of the 802.11n capabilities offered by the RT2700 and RT2800 chipsets. Additional work is required in before those features can be supported.

Host AP mode does not support power saving. Clients attempting to use power saving mode may experience significant packet loss (disabling power saving on the client will fix this).

Some PCI **ral** adapters strictly require a system supporting PCI 2.2 or greater. Check the board's PCI version before purchasing the card as it is likely these adapters will not work in systems based on older revisions of the PCI specification.