

# BPI-R2 SATA interface

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BPI-R2 support 2 sata interface and onboard power port.

you can use sata line connect your hardisk on BPI-R2.

- Test a SAMSUNG SSD DISK, the Read/Write performance are below:  
Read from disk: 230MB/s \(\command: dd if=/dev/sda of=/dev/zero bs=1M count=10240\  
Write to disk: 192MB/s \(\command: dd if=/dev/zero of=/dev/sda bs=1M count=1024  
oflag=direct\  
oflag=direct\)

- Note:

if you use 3.5 big hardisk ,you may need power with outside power. on board power maybe can not support enough current

## Development

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Let's get start to develop on BPI-R2, see amazing things happen.

### Basic Development

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#### Prepare to develop

- \* Prepare 16G/above TF card, USB-Serial interface, Ubuntu System
- \* Using your USB-Serial Connect debug console on R2

\* BananaPi R2 - Debug-UART : <http://www.fw-web.de/dokuwiki/doku.php?id=en:bpi-r2:debug-uart>

#### Load your first image on R2

- 1.You could download latest image from our forum  
\* Here is the example image link: <http://forum.banana-pi.org/t/bpi-r2-new-image-release-ubuntu-16-04-v1-3-2018-3-30/5293>

- 2.Install bpi-tools on your Ubuntu. If you can't access this URL or any other problems, please go to [bpi-tools repo](#) and install this tools manually.

- \* apt-get install pv

```
* curl -sL https://github.com/BPI-SINOVOIP/bpi-tools/raw/master/bpi-tools | sudo -E bash
```

3. After you download the image, insert your TF card into your Ubuntu

\* Execute "bpi-copy xxx.img /dev/sdx" to install image on your TF card

4. After step 3, then you can insert your TF card into R2, and press power button for around 10s to setup R2

### Update Your Ubuntu On SD Card

1. Clone Bsp project from Github

\* Execute "git clone git@github.com:BPI-SINOVOIP/BPI-R2-bsp.git"

2. Execute "./build.sh", to build your own uboot and kernel.

```
root@JackBpi:~/Code/projects/BPI-R2/BPI-R2-bsp# ./build.sh
NOTICE:
new build.sh default select BPI-R2-720P and pack all boards
supported boards:
BPI-R2-720P

BPI-R2-720P configured. Now run `make`
This tool support following building mode(s):
-----
1. Build all, uboot and kernel and pack to download images.
2. Build uboot only.
3. Build kernel only.
4. kernel configure.
5. Pack the builds to target download image, this step must execute after u-boot,
   kernel and rootfs build out
6. update files for SD
7. Clean all build.
-----
Please choose a mode(1-7): █
```

3. After finish built, Execute "cd SD", plug your Ubuntu TFcard in PC.

4. Execute "bpi-update -c bpi-r2.conf -d /dev/sdX", to update the compiled kernel to your TFcard.

### Ubuntu On Emmc

1. If you want to install Ubuntu on EMMC, follow these steps :

\* Burn an image to sd card, and set up R64 with sd card.

\* Copy the image which name contains "xxx-emmc-xxx" to U disk.

\* mount U disk to R64, then use bpi-copy to burn image to Emmc.

```
bpi-copy <XXX.img.zip>
```

\* XXX.img.zip is ubuntu image we can get it from

<http://www.banana-pi.org/r2-download.html>

- \* power off
- \* remove SD & power on

## OpenWrt On SD & Emmc Steps

1. Clone OpenWrt project from Github.

\* Execute "git clone [https://github.com/garywangcn/bpi-r2\\_lede.git](https://github.com/garywangcn/bpi-r2_lede.git)"

2. You need to have installed gcc, binutils, bzip2, flex, python, perl, make, find, grep, diff, unzip, gawk, getopt, subversion, libz-dev and libc headers.

3. Run "./scripts/feeds update -a" to get all the latest package definitions defined in feeds.conf / feeds.conf.default respectively and "./scripts/feeds install -a" to install symlinks of all of them into package/feeds/.

4. Use "make menuconfig" to configure your image.

\* Choose "Target System" to config as "MediaTek Ralink ARM"

\* Choose "Boot Loaders" to config as "u-boot-bpi\_r2"

5. Execute "make -j1 V=s" to build your own OpenWrt image.

6. After built, we have two ways to install image.

(1) Plug your TFcard in Ubuntu PC, and enter to "build\_dir/target-arm\_cortex-a7+neon-vfpv4\_musl\_eabi/linux-mediatek\_32/",

you will find two images:

\* mtk-bpi-r2-EMMC.img

\* mtk-bpi-r2-SD.img

(2) Write image to TF card, execute "dd if=mtk-bpi-r2-SD.img of=/dev/sdX"

(3) If you want to install image to EMMC, We need another system which is running on SD card to program EMMC image to EMMC, please follow below steps to do:

\* Copy EMMC image to a running system which is from SD card

\* Program EMMC image to User Data Area of EMMC: dd if=mtk-bpi-r2-EMMC.img of=/dev/mmcblk0 (assume /dev/mmcblk0 is for EMMC)

```
* Unlock EMMC boot0 block: echo 0 >
/sys/block/mmcblk0boot0/force_ro
* Program preloader to EMMC boot0 block: dd if=mtk-bpi-r2-
EMMC.img of=/dev/mmcblk0boot0 bs=1M count=1
* Change the Partition configuration of EMMC is 48h: reboot
the system which is running SD, and enter the U-boot command
line, run command emmc pconf 48 (for this steps, we can change
partition configuration in userspace by using mmc-utils, see more
information in BPI-R2 OpenWrt (LEDE) Source code : 2018-04-11)
* Power off, remove SD card, and then power on R2 board
```

7. This step is for upgrade, if you don't want to install image after you built, you could use runtime upgrade.

```
* Copy "bin/targets/mediatek/32/lede-mediatek-32-bananapi,bpi-
r2-sysupgrade.tar" to R2 board which is running OpenWrt system (no
matter where (SD or EMMC) it boots from), and then run command
"sysupgrade lede-mediatek-32-bananapi,bpi-r2-sysupgrade.tar" to
update both kernel and rootfs.
```

- 1, Banana Pi R2 install openWRT: <https://www.cnblogs.com/topbin/p/8794152.html>
- 2, Banana Pi R2 Openwrt Network port configuration analysis : <https://www.cnblogs.com/topbin/p/9518279.html>
- 3, Banana Pi R2 developing a simple router based on Openwrt : <https://www.cnblogs.com/topbin/p/9519881.html>
- 4, Banana Pi R2 Openwrt Luci : <https://www.cnblogs.com/topbin/p/9519875.html>

## Network-Configuration

- Network-Configuration : <http://www.fw-web.de/dokuwiki/doku.php?id=en:bpi-r2:network:start>

## Advanced Development

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### GPIO

#### GPIO Control

- echo xxx > /sys/class/gpio/export
- echo in/out > /sys/class/gpio/gpioxxx/direction
- echo 0/1 > /sys/class/gpio/gpioxxx/value

Check the base gpio, you could see mine is 233

```

root@LEDE:~#
root@LEDE:~#
root@LEDE:~# ls /sys/class/gpio/
export          gpiochip233    unexport
root@LEDE:~# cd /sys/class/gpio/
root@LEDE:~# ls

```

For example: if you want to change gpio 22 as out highlevel, you need input commands like this :

- echo 255 (22+233) > /sys/class/gpio/export
- echo out > /sys/class/gpio/gpio255/direction
- echo 1 > /sys/class/gpio/gpio255/value

### PWM Control

- echo x > /sys/class/pwm/pwmchip0/export
- echo 200000 > /sys/class/pwm/pwmchip0/pwmx/period
- echo 100000 > /sys/class/pwm/pwmchip0/pwmx/duty\_cycle
- echo 1 > /sys/class/pwm/pwmchip0/pwmx/enable

More about GPIO : <http://www.fw-web.de/dokuwiki/doku.php?id=en:bpi-r2:gpio>

### Install RPi.GPIO

- Execute "git clone <https://github.com/BPI-SINOVOIP/RPi.GPIO>"
- after clone the repo, cd RPi.GPIO
- Execute "sudo apt-get update"
- Execute "sudo apt-get install python-dev python3-dev"
- Execute "sudo python setup.py install" or "sudo python3 setup.py install" to install the module

### Using RPi.GPIO

- cd /usr/local/bin
- Execute "./g40.py" to test RPi.GPIO

## Develop 4G module with R2

Gets more info from here:

[Using 4G module with BananaPi](#)

## WiFi and Ap mode on R2 Ubuntu

### STA

- wmt\_loader (ignore errors)
- stp\_uart\_launcher -p /etc/firmware &
- ip link set wlan0 up
- iw dev wlan0 scan | grep SSID
- vim /etc/wpa\_supplicant/wpa\_supplicant.conf

```

network={
ssid="ssid"

```

```
psk="password"
priority=1
}
```

- wpa\_supplicant -i wlan0 -c /etc/wpa\_supplicant/wpa\_supplicant.conf
- dhclient wlan0

### AP mode

- wmt\_loader (ignore errors)
- stp\_uart\_launcher -p /etc/firmware &
- echo A >/dev/wmtWifi
- create your hostapd.conf: "vim /etc/hostapd/hostapd.conf "

```
interface=ap0
bridge=br0
ssid=test_r2
driver=nl80211
country_code=US
hw_mode=b
channel=1
max_num_sta=5
wpa=2
auth_algs=1
rsn_pairwise=CCMP
wpa_key_mgmt=WPA-PSK
wpa_passphrase=ledetest
logger_stdout=-1
logger_stdout_level=2
```

- According to your network interface(can search internet) to config ap0:

my network interface which can search internet is wan, and ip is 192.168.30.102, so I config ap0 as follows:

```
"ifconfig ap0 192.168.30.188 netmask 255.255.255.0"
```

- Run hostapd : "hostapd -d /etc/hostapd/hostapd.conf"
- Config dhcp file : "vim /etc/dhcp/dhcpd.conf"

```
subnet 192.168.30.0 netmask 255.255.255.0 {
range 192.168.30.2 192.168.30.250;
option domain-name-servers 8.8.8.8;
```

```
option routers 192.168.30.1; }
```

- Config dhcp of ap0, then the devices which connect ap0 could get IP:  
"dhcpd ap0 -pf /var/run/dhcpd.pid "
- And a bridge
- brctl addbr br0
- brctl addif br0 ap0
- brctl addif br wan
- Config br0 : "ifconfig br0 192.168.30.180 netmask 255.255.255.0"
- Add br0 gw as : "route add -net default netmask 255.255.255.0 gw 192.168.30.1 dev br0"

## Ap Mode FAQ

If you meet problem like this :

```
root@bpi-iot-ros-ai:~# hostapd -d /etc/hostapd/hostapd.conf
random: Trying to read entropy from /dev/random
Configuration file: /etc/hostapd/hostapd.conf
rfkill: initial event: idx=0 type=2 op=0 soft=1 hard=0
rfkill: initial event: idx=1 type=1 op=0 soft=0 hard=0
rfkill: initial event: idx=2 type=1 op=0 soft=0 hard=0
nl80211: TDS supported
nl80211: Supported cipher 00-0f-ac:1
nl80211: Supported cipher 00-0f-ac:5
nl80211: Supported cipher 00-0f-ac:2
nl80211: Supported cipher 00-0f-ac:4
nl80211: Supported cipher 00-0f-ac:6
nl80211: Using driver-based off-channel TX
nl80211: Use separate P2P group interface (driver advertised support)
nl80211: Enable multi-channel concurrent (driver advertised support)
nl80211: use P2P_DEVICE support
nl80211: Disable use_monitor with device_ap_sme since no monitor mode support de
nl80211: interface wlan0 in phy phy0
nl80211: Set mode ifindex 9 iftype 3 (AP)
nl80211: Setup AP(wlan0) - device_ap_sme=1 use_monitor=0
nl80211: Subscribe to mgmt frames with AP handle 0x555da681e0 (device SME)
nl80211: Register frame type=0xd0 (WLAN_FC_STYPE_ACTION) nl_handle=0x555da681e0
nl80211: Register frame command failed (type=208): ret=-114 (Operation already i
s)
nl80211: Register frame match - hexdump(len=0): [NULL]
nl80211: could not configure driver mode
```

Then, you could solve by following command :

- nmcli radio wifi off

```
root@bpi-iot-ros-ai:~# rfkill list
0: sunxi-bt: Bluetooth
   Soft blocked: yes
   Hard blocked: no
1: phy0: wireless LAN
   Soft blocked: yes
   Hard blocked: no
2: brcmfmac-wifi: wireless LAN
   Soft blocked: yes
   Hard blocked: no
```

- rfkill unblock 1

- rfkill unblock 2
- ifconfig ap0 up
- hostapd -d hostapd.conf

```
root@bpi-iot-ros-ai:~#
root@bpi-iot-ros-ai:~# hostapd /etc/hostapd/hostapd.conf
Configuration file: /etc/hostapd/hostapd.conf
Using interface wlan0 with hwaddr 8c:f7:10:1d:e4:80 and ssid "test"
wlan0: interface state UNINITIALIZED->ENABLED
wlan0: AP-ENABLED
```

## WiFi and Ap mode on R2 Openwrt

### AP mode

#### 1. Make a bash script

- vim setup.sh

```
#!/bin/ash
wmt_loader &
sleep 3
stp_uart_launcher -p /etc/firmware &
sleep 5
echo A > /dev/wmtWifi &
sleep 5
hostapd -d hostapd.conf
```

#### 2. Create your hostapd.conf

- vim hostapd.conf

```
interface=ap0
bridge=br-lan
ssid=BPI_R2
driver=nl80211
country_code=CN
hw_mode=g
channel=1
max_num_sta=5
wpa=2
auth_algs=1
rsn_pairwise=CCMP
wpa_key_mgmt=WPA-PSK
wpa_passphrase=ledetest
logger_stdout=-1
```

```
logger_stdout_level=2
```

### 3. Make it run

- ./setup.sh

### 4. Add it to starting progress

- vim /etc/rc.local

```
cd /root/  
sleep 6  
./setup.sh &
```

### 5. If your Ap is not stable, please limit the speed, here I limit download speed as 8Mbit/s, upload as 4Mbit/s

- tc qdisc add dev ap0 root handle 1: htb default 11
- tc class add dev ap0 parent 1:1 classid 1:2 htb rate 8Mbit ceil 4Mbit prio 2

## Make your own image

- Prepare a SD card which have installed Ubuntu system
- Boot your SD card with R2, after R2 finish starting, copy your files and config your Ubuntu, then poweroff R2
- Plug your SD card in Linux PC, "cd /media", then "ln -s <your account> pi"
- Execute "bpi-migrate -c bpi-r2.conf -c ubuntu-mate-from-sd.conf -d /dev/sdx"
- Then you could get your own image now

## FAQ

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- 1.Banana Pi BPI-R2 Razberry board OpenHab2

<https://community.openhab.org/t/banana-pi-bpi-r2-razberry-board-openhab2-help/37222/8>

### Resources

#### Source code

- OpenWRT 18.06 source code on Github: <https://github.com/BPI-SINOVOIP/BPI-R2-OPENWRT-18.06>
- BPI-R2 github BSP : <https://github.com/BPI-SINOVOIP/BPI-R2-bsp>
- OpenWRT LEDE: [https://github.com/garywangcn/bpi-r2\\_lede/tree/bpi-r2-on-lede-v1](https://github.com/garywangcn/bpi-r2_lede/tree/bpi-r2-on-lede-v1)
- BPI-R2 linux kernel 4.14 : <https://github.com/frank-w/BPI-R2-4.14>
- OpenMPTCProuter : <https://github.com/Ysurac/openmptcprouter>

- BPI-R2 FreeBSD support/ZRouter.org  
support : <https://gist.github.com/rayddteam/3461964e69f1fcc727b1b68ec9d6d0c8>

#### Documents

- BPI-R2 Schematics : [BPI-R2 V1.2 hardware schematic diagram](#)
- BPI-R2 Schematics : [BPI-R2 V1.1 hardware schematic diagram](#)
- Dimensional diagram [BPI-R2 DXF design file](#)
- MTK MT7623N datasheet

#### [MTK 7623N datasheet for development board programming guide v1.1 new update](#)

- FW-Web Wiki : <http://fw-web.de/dokuwiki/doku.php?id=en:bpi-r2:start>
- Banana pi BPI-R2 CE,FCC,RoHS:

#### [CE,FCC,RoHS](#)

- Banana Pi BPI-R2 Razberry board OpenHab2

#### <https://community.openhab.org/t/banana-pi-bpi-r2-razberry-board-openhab2-help/37222/8>

- gitbook online documents: <https://bananapi.gitbooks.io/banana-pi-bpi-r2-open-source-smart-router/content/>
- The best news is that the final patchset version for HNAT framework was accepted ( kernel 4.16) and it's based on nftables.:<https://www.spinics.net/lists/netfilter-devel/msg50973.html>
- How to build an Ubuntu/Debian SD image from scratch : <http://forum.banana-pi.org/t/how-to-build-an-ubuntu-debian-sd-image-from-scratch/6805>
- Best Banana Pi R2 Operating System Options: <https://www.electromaker.io/blog/article/best-banana-pi-r2-operating-system-options>
- Make a Banana Pi R2 Router: Banana Pi R2 OpenWRT Installation and Review:<https://www.electromaker.io/tutorial/blog/make-a-banana-pi-r2-router-banana-pi-r2-openwrt-installation-and-review>
- MTK chip mailline Linux effort :[https://mtk.bcdfs.org/doku.php?id=linux\\_mainline\\_effort](https://mtk.bcdfs.org/doku.php?id=linux_mainline_effort)

#### Release

##### Android 6.0

- baidu cloud : <https://pan.baidu.com/s/1pMrroy3>
- discuss on forum : <http://forum.banana-pi.org/t/bpi-r2-new-image-release-android-6-0-v1-0/4630>

##### Ubuntu with kernel 4.4

- Source code(BSP): <https://github.com/BPI-SINOVOIP/BPI-R2-bsp>

- BPI-R2 Ubuntu 16.04 Kernel4.4 V1.3

Image Release : <http://forum.banana-pi.org/t/topic/5293>

Ubuntu with kernel 4.14

- Source code(BSP): <https://github.com/BPI-SINOVOIP/BPI-R2-bsp-4.14>
- Image Release

BPI-R2 Ubuntu 16.04 Kernel4.14 V1.0: <http://forum.banana-pi.org/t/topic/5548>

OpenWrt(LEDE)

- Official OpenWR 18.06.4 for Banana Pi BPI-R2 image released 2019-7-04

image download:<https://downloads.openwrt.org/releases/18.06.4/targets/mediatek/mt7623/>

Forum pthread:<http://forum.banana-pi.org/t/official-openwr-18-06-4-for-banana-pi-bpi-r2-image-released-2019-7-04/9459>

- BananaPI BPI-R2 Openwrt18.06 Image Release and source code 2019-03-06

source code on Github: <https://github.com/BPI-SINOVOIP/BPI-R2-OPENWRT-18.06>

image download: <https://dev.banana-pi.org.cn/Image/BPI-R2/Openwrt/1806/>

MD5SUM

mtk-bpi-r2-EMMC.img : 5d1537c45679de352dd25d8dda46b9ad

mtk-bpi-r2-SD.img : 71fce303abdceed4f1c3548d5a3fc207

forum Pthread: <http://forum.banana-pi.org/t/bananapi-bpi-r2-openwrt18-06-demo-image-release-2019-03-06/8562>

- Official OpenWRT 18.06.0 image :

<https://downloads.openwrt.org/releases/18.06.0/targets/mediatek/mt7623/>

- Source code: [https://github.com/garywangcn/bpi-r2\\_lede/tree/bpi-r2-on-lede-v1](https://github.com/garywangcn/bpi-r2_lede/tree/bpi-r2-on-lede-v1)
- Image Release

BPI-R2 OpenWrt(LEDE) 20180509: <http://forum.banana-pi.org/t/topic/5646>

BPI-R2 OpenWrt(LEDE) 20180411: <http://forum.banana-pi.org/t/topic/5395>

BPI-R2 OpenWrt(LEDE) 20170908: <http://forum.banana-pi.org/t/topic/3797>

OpenMPTCProuter

- 2018-10-12 update, OpenMPTCProuter use MultiPath TCP (MPTCP) to aggregate multiple Internet connections and OpenWrt. and have official support BPI-R2.

image download:<https://www.openmptcprouter.com/download>

source code on github:<https://github.com/Ysurac/openmptcprouter>

forum pthread: <http://forum.banana-pi.org/t/banana-pi-bpi-r2-new-image-openmptcprouter-official-support/7229>

Armbian

- Armbian preview image for Bananapi R2 / K4.19.y

<https://www.armbian.com/bananapi-r2/>

Centos 7

- Source code(BSP): <https://github.com/BPI-SINOVOIP/BPI-R2-bsp>
- Image Release

BPI-R2 Centos 7 Kernel4.4 20180112: <http://forum.banana-pi.org/t/topic/5124>

how to install: <https://www.electromaker.io/tutorial/blog/getting-started-with-centos-on-the-banana-pi-r2-how-to-install-centos-on-banana-pi-r2>

Debian

- 2019-8-12 update.[BPI-R2] debian 10 buster image with Kernel 4.19.62, shared by frank-w

Kernel: 4.19.62,uboot 2019-07 with erase-env + sata-support,new preloader (2019-07-22),configured to ip 192.168.0.11 on lan0,openssh-server running with root-login (should be disabled afterwards),username/password: root/bananapi

google drive:[https://drive.google.com/open?id=1oP7jy1KrrIOifvImo2nQ59wx3\\_9hHkgk](https://drive.google.com/open?id=1oP7jy1KrrIOifvImo2nQ59wx3_9hHkgk)

how to : [https://www.fw-web.de/dokuwiki/doku.php?id=en:bpi-r2:storage#short\\_install\\_guide](https://www.fw-web.de/dokuwiki/doku.php?id=en:bpi-r2:storage#short_install_guide)

forum discuss:<http://forum.banana-pi.org/t/bpi-r2-debian-buster-image-with-kernel-4-19-62/9601>

- Image Release

image download : [https://drive.google.com/drive/folders/1oP7jy1KrrIOifvImo2nQ59wx3\\_9hHkgk](https://drive.google.com/drive/folders/1oP7jy1KrrIOifvImo2nQ59wx3_9hHkgk)

documents: <http://www.fw-web.de/dokuwiki/doku.php?id=en:bpi-r2:debian>

Basic Alpine Router Platform with WIFI AccessPoint on Pantavisor 005

- Image Release

release date :2018-06-17

- SD-Card images:

512M: <https://s3.amazonaws.com/bpi-pv/alpine-router/2/2018-06-16-alpine-router-pantavisor-512M-bpi-r2-sd-emmc.img.zip>

8G: <https://s3.amazonaws.com/bpi-pv/alpine-router/2/2018-06-16-alpine-router-pantavisor-8G-bpi-r2-sd-emmc.img.zip>

- PVR Command Line Tool (download to PATH directory and make executable):

Linux (amd64): <https://gitlab.com/pantacor/pvr/uploads/b0db2e9e36fa70ff09e045df9c9803d4/pvr-004-amd64.gz>

Windows (x64): <https://gitlab.com/pantacor/pvr/uploads/a7a26b603a5b8e9a98e2dc7c77b4c252/pvr-004-win10-x64.zip>

More downloads: <https://gitlab.com/pantacor/pvr/tags/004>

- Discuss on forum :

<http://forum.banana-pi.org/t/bpi-r2-new-image-basic-alpine-router-platform-with-wifi-accesspoint-on-pantavisor-005-2018-06-17/6032>

yocto Linux

- this image just for test. yocto with kernel 4.4, and GPU working fine. this GPU binary is from yocto SDK with kernel 3.18, we test it with github kernel 4.4, just change rootfs. if working fine .so, maybe can use on kernel 4.14. just need to test. and have weston command to test more.

test image : <https://drive.google.com/open?id=1le2rroD3Dgc4HkEUmGyDLZix-Llrzeen>

video demo : <https://www.youtube.com/watch?v=HhFn1Nqht1E&feature=youtu.be>

Forum pthread : <http://forum.banana-pi.org/t/banana-pi-bpi-r2-new-image-gpu-decode-test-yocto-with-kernel-4-4-just-for-test/6508>

MQLinux 19.02 beta

- update 2019-03-12, Note : this image is shared by <http://www.morequick.net/>. not support by BPI team

Main features:

Highly streamlined embedded design system, running in memory

Multiple Language (en/zh\_CN currently)

DNS Proxy/Cache

DDNS

VLAN Extension for WAN

Multiple WAN (each ethernet port can be defined)

DHCP Server

FTP Server

PPPoE Server

Samba Server

VPN client/Server (PPTP VPN, IPsecVPN, OpenVPN)

Cloud Login

Firewall

IP-MAC Locking

Port Mapping/DMZ/UPnP

Diagnose Tools ...

image download: <https://drive.google.com/file/d/1Ws2lUiCGSKKQ2dCM5XJBV-pog-hk17PM/view?usp=sharing>

MD5: 09b58f050166ed5d09803e1de56d7890

Forum pthread: <http://forum.banana-pi.org/t/banana-pi-bpi-r2-new-image-mqlinux-19-02-beta/8832>

FreeBSD

- BPI-R2 FreeBSD support/ZRouter.org support

<http://forum.banana-pi.org/t/bpi-r2-freebsd-support-zrouter-org-support/7290>

Project on BPI-R2

- BPI-R2 based DIY NAS/Router : <https://bburky.com/NAS/>

Forum pthread:<http://forum.banana-pi.org/t/bpi-r2-based-diy-nas-router/6787>