Falling down from FreeBSD

RubyKaigi2021

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FreeBSD support of small devices

FreeBSD remove support of some devices

armv4 support deleted before 12R

armv5 support deleted before 13R

Admtek SoCs support deleted before 12R

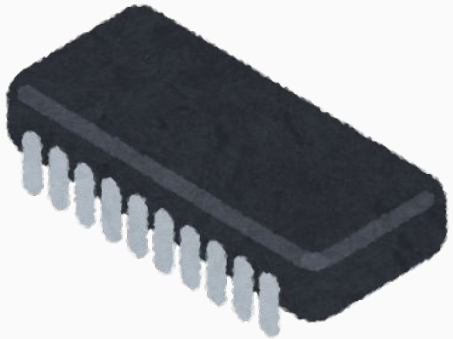
Realtek is too old MIPS version. So it can't be ported.

Older module resources

FreeBSD need more than 32M bytes of RAM and 8M bytes of flash

8MB RAM is too small for FreeBSD

2MB flash is too small for FreeBSD



Is it really garbage?

It's real 32Bit architecure

It have Ethernet support

Chip is not broken

Power consumption is low

Save the earth!

Let's reduce garbage dumping

Protect nature

We have not so much resources

Rare metal recycling is conspiracy

We have no time

So I started mruby on YABM

mruby

Lightweight ruby language

Developed with C language

Almost fully written by matsumoto-san(matz)

For Embedded target

compile to bytecode and execute

Extend by C or Ruby code, named mrbgems

Bare Metal port

Not use any OS

Directly executed from boot loader

YABM is Yet Another Bare Metal

Targets

Realtek RTL8196C,E... (Lexra:MIPS I)

Broadcom BCM4712...(MIPS 4K)

Admtek ADM5120(MIPS 4K)

Kinden KS8695(ARMV4)

FreeBSD have Broadcom/mips support. But still not support network.

How to get target

Japanese great second hands shop named “Hardoff” have so many target

Every city have “Hardoff” shop

Only 110 yen or 330 yen

How to build

Development environment

Linux ELF toolchain on FreeBSD Linux emulation

FreeBSD Cross compiler Collection package

all gcc is version 4

All target bootloader support tftp firmware upgrade

Not support float

Reuse ZRouter.org knowledge

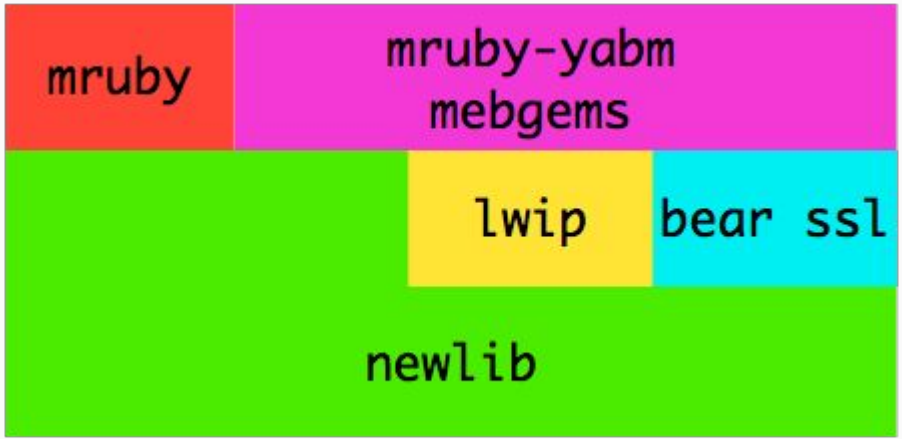
Used libraries

newlib (only libc)

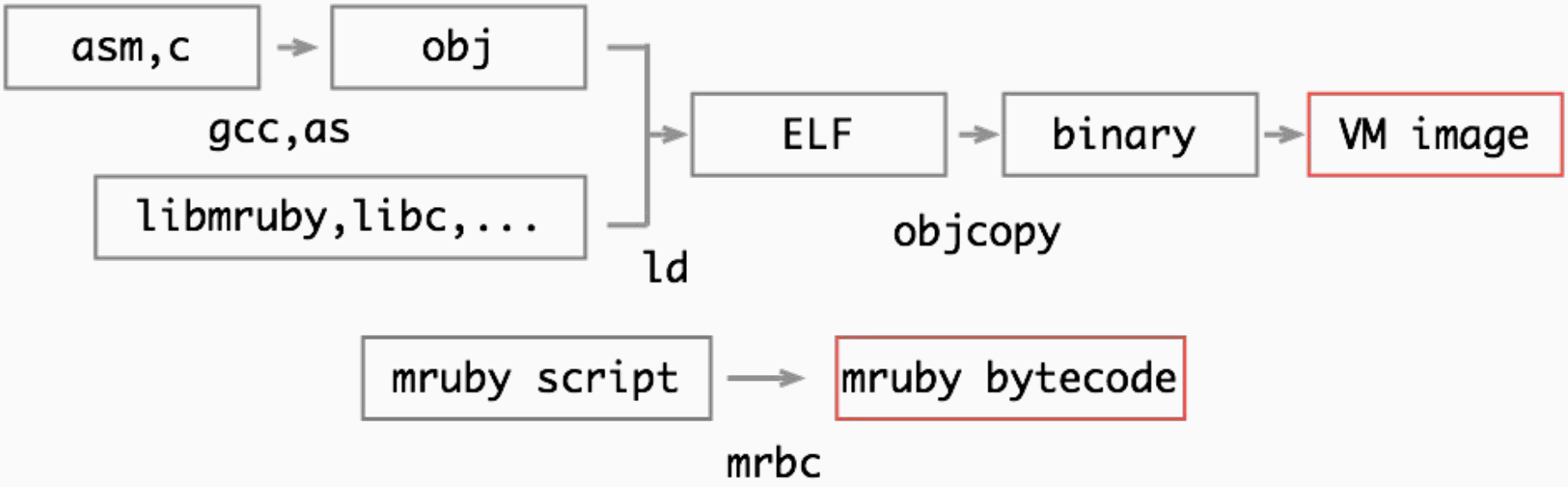
lwip

bearssl

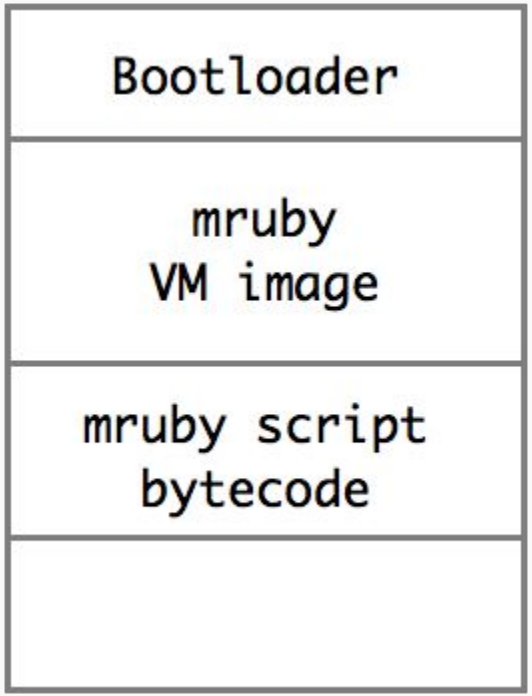
Header is important



How to build

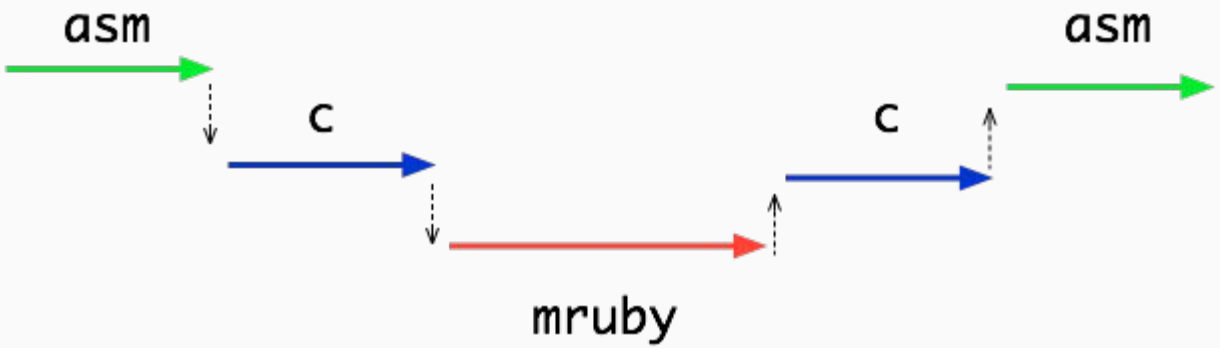

asm,c
obj
gcc,as
libmruby,libc,...
ld
ELF
binary
VM image
objcopy
mruby script
mruby bytecode
mrbc

Flash image



Boot sequence

bootloader copy VM image to memory then ...



Support devices

Interrupt

Ethernet

UART

I2C by GPIO bitbang

Timer

GPIO

Flash

Bootloader

RTL8196C - Original

BCM4712 - CFE

ADM5120 - u-boot

KS8695 - u-boot

some bootloader build on FreeBSD Linux emulation

MMU support

Not using MMU on a MIPS target

On ARM SoCs use MMU, because of performance issue

but only use single mapping one-to-one addresses

ethernet buffer use on no cache memory

IoT

Network Support

Ethernet driver code reference boot loader, Linux or FreeBSD

all target support TCP/IP and TLS by BearSSL

support DHCP or static IP

support NTP, HTTP and HTTPS

support IPv6

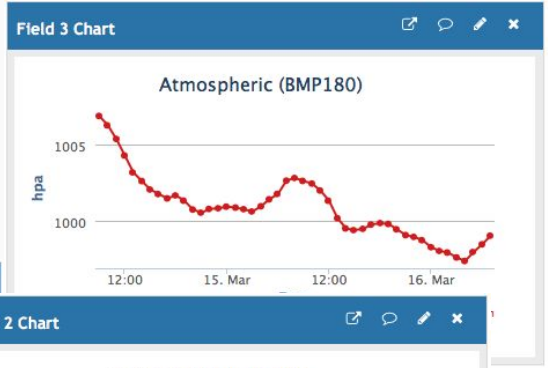
not support of MQTT

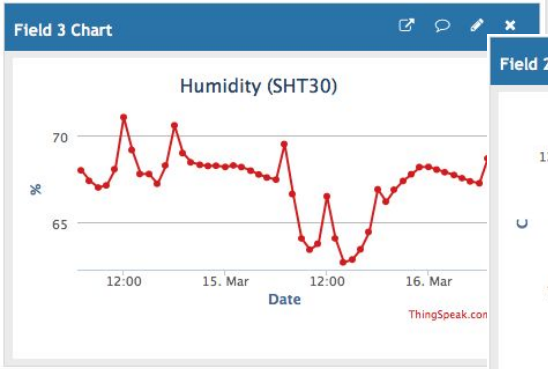
Internet of Test

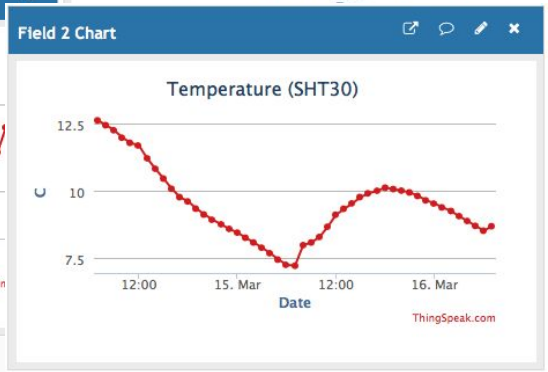
ThingSpeak provide free plan

I made weather station used I2C sensor

update 20 sec interval







Part of Script

```
val = @y.i2cread(BMPADDR, addr) << 8 | @y.i2cread(BMPADDR, addr + 1)
```

```
para = "api_key=" + APIKEY + "&field1=" + count.to_s + "&field2=" + btstr
+ "&field3=" + bpstr

res = SimpleHttp.new("https", "api.thingspeak.com", 443).request("GET",
"/update?" + para, {'User-Agent' => "test-agent"})
```

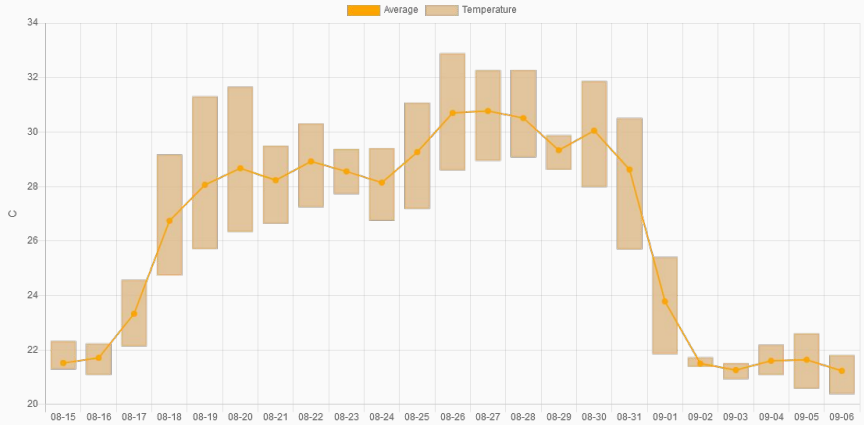
With mruby on FreeBSD

Ouchi monitor (omon)

Used mips small module

Build mruby by ZRouter ports.

mruby on YABM post data by HTTP



Let’s start

How do I do ?

Go HardOff

check Qiita

checkout source code from github

Source code

https://github.com/yamori813/rtlbm-mruby

https://github.com/yamori813/bcmbm-mruby

https://github.com/yamori813/admbm-mruby

https://github.com/yamori813/ksbm-mruby

https://github.com/yamori813/mruby-yabm

Thanks ray,matz,friend

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