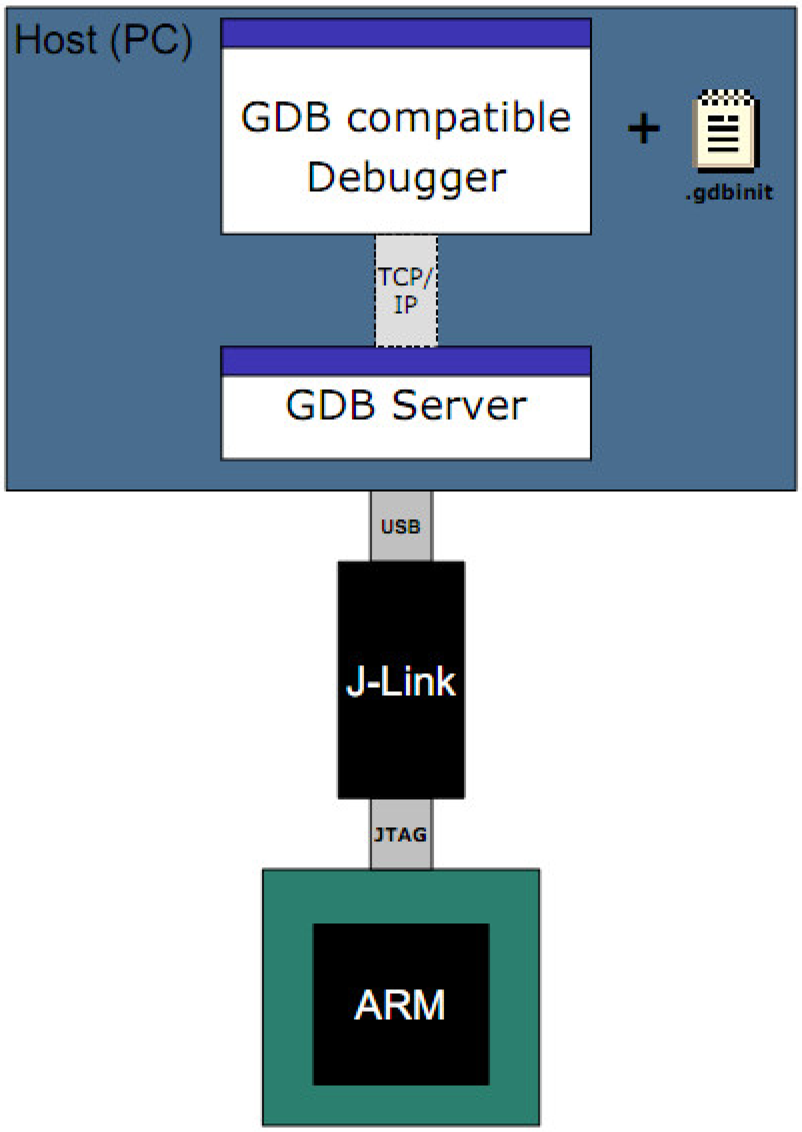
安裝JLlink驅動軟件後，通過附帶的J-Llink GDB Server軟件可以實現利用gdb調試開發板。經過數天的摸索，終於試驗成功，並可以通過這種方式調試U-boot。

一、 原理

借用一下JlinkGdbServer用戶手冊中的一副圖片，說明一下gdb、gdbserver、jlink和開發板之間的聯繫。gdb在開始運行時會首先在用戶目錄下尋找.gdbinit文件，並執行文件裡面記錄的初始化命令，執行完畢之後再轉入正常的流程，接受用戶輸入的命令。

由於gdb和gdb server都有Linux和Windows的版本，這裡面我為了方便，gdb選用的是虛擬機Linux環境下3.14版本的arm-linux-gdb，通過TCP/IP的方式連接到主機上的J-Llink GDB Server。



二、.gdbinit文件

利用gdb調試開發板的時候需要先執行一些初始化命令，否則有可能不能正常調試。初始化命令其實也就是 禁止看門狗，初始化時鐘等等，類似於uboot的start.s文件，參考GDB Server用戶手冊中給出的格式和一些網上資源，自己寫了一個.gdbinit文件。

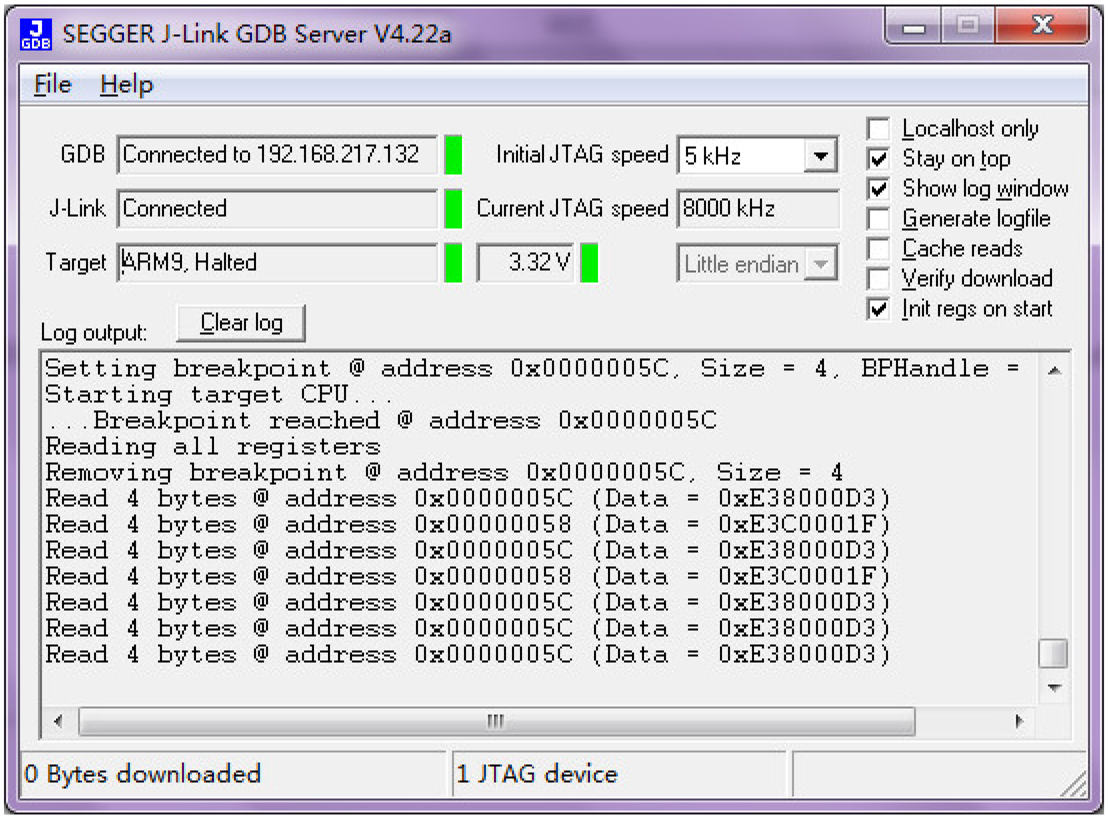
```
#
```

```
# J-LINK GDB SERVER initialization

#

# This connects to a GDB Server listening

# for commands on localhost at tcp port 2331

target remote 192.168.217.1:2331 #首先連接主機的GDB Server，端口都是2331。

#注意主機的GDB Server勾掉"Localhost only"選項，否則連接不上

# Set JTAG speed to 30 kHz

monitor speed 30



# Set GDBServer to little endian

monitor endian little



# Reset the chip to get to a known state.

monitor reset



#

# CPU core initialization

#



# Set the processor mode

monitor reg cpsr = 0xd3
```

```
#disable watchdog

monitor MemU32 0x53000000 = 0x00000000


#disable interrupt

monitor MemU32 0x4A000008 = 0xFFFFFFFF #INTMSK

monitor MemU32 0x4A00000C = 0x00007FFF #INTSUBMSK


#set clock

monitor MemU32 0x4C000000 = 0x00FFFFFF

monitor MemU32 0x4C000014 = 0x00000005

monitor MemU32 0x4C000004 = 0x0005C011


#config sdram

monitor MemU32 0x48000000 = 0x22011110 #conw

monitor MemU32 0x48000004 = 0x00000700 #bank0

monitor MemU32 0x48000008 = 0x00000700 #bank1

monitor MemU32 0x4800000C = 0x00000700 #bank2

monitor MemU32 0x48000010 = 0x00000700 #bank3

monitor MemU32 0x48000014 = 0x00000700 #bank4

monitor MemU32 0x48000018 = 0x00000700 #bank5
monitor MemU32 0x4800001C = 0x00018005 #bank6

monitor MemU32 0x48000020 = 0x00018005 #bank7

monitor MemU32 0x48000024 = 0x008E04F4 #vREFRESH

monitor MemU32 0x48000028 = 0xB1 #vBANKSIZE -- 128M/128M --- should

monitor MemU32 0x4800002c = 0x30 #vMRSRB6

monitor MemU32 0x48000030 = 0x30 #vMRSRB7


# Set auto JTAG speed

monitor speed auto


# Setup GDB FOR FASTER DOWNLOADS

set remote memory-write-packet-size 1024

set remote memory-write-packet-size fixed


# Load the program executable called "image.elf"

# load image.elf

b _start

load

continue
```

三、調試U-Boot(Flash中運行)

U-Boot默認編譯出來有幾種格式的文件，調試的時候只使用其中的兩種格式：elf格式的文件用於gdb調試，bin文件用於下載到開發板去執行。先將u-boot.bin文件經過J-Link FLASH下載到開發板的nor flash之後，linux下執行下面的命令開始調試。成功的話，有下面的結果。



GDB: Connected to 192.168.217.132
J-Link: Connected
Target: ARM9, Halted
3.32 V
Initial JTAG speed: 5 kHz
Current JTAG speed: 8000 kHz
Little endian
[ ] Localhost only
[✓] Stay on top
[✓] Show log window
[ ] Generate logfile
[ ] Cache reads
[ ] Verify download
[✓] Init regs on start

```
Setting breakpoint @ address 0x0000005C, Size = 4, BPHandle =
Starting target CPU...
...Breakpoint reached @ address 0x0000005C
Reading all registers
Removing breakpoint @ address 0x0000005C, Size = 4
Read 4 bytes @ address 0x0000005C (Data = 0xE38000D3)
Read 4 bytes @ address 0x00000058 (Data = 0xE3C0001F)
Read 4 bytes @ address 0x0000005C (Data = 0xE38000D3)
Read 4 bytes @ address 0x00000058 (Data = 0xE3C0001F)
Read 4 bytes @ address 0x0000005C (Data = 0xE38000D3)
Read 4 bytes @ address 0x0000005C (Data = 0xE38000D3)
Read 4 bytes @ address 0x0000005C (Data = 0xE38000D3)
```

0 Bytes downloaded
1 JTAG device

```
root@ desktop:/home/desktop/debug# arm-linux-gdb u-boo.elf

GNU gdb (Sourcery G++ Lite 2008q3-72) 6.8.50.20080821-cvs

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and "show warranty" for details.

This GDB was configured as "--host=i686-pc-linux-gnu --target=arm-none-linux-gnu
```

```
eabi".

    For bug reporting instructions, please see:

    <https://support.codesourcery.com/GNUToolchain/>...

    0x00000000 in ?? ()

    JTAG speed set to 30 kHz

    Target endianess set to "little endian"

    Resetting target

    Writing register (CPSR = 0x000000D3)

    Writing 0x00000000 @ address 0x53000000

    Writing 0xFFFFFFFF @ address 0x4A000008

    Writing 0x00007FFF @ address 0x4A00000C

    Writing 0x00FFFFFF @ address 0x4C000000

    Writing 0x00000005 @ address 0x4C000014

    Writing 0x0005C011 @ address 0x4C000004

    Writing 0x22011110 @ address 0x48000000

    Writing 0x00000700 @ address 0x48000004

    Writing 0x00000700 @ address 0x48000008

    Writing 0x00000700 @ address 0x4800000C
Writing 0x00000700 @ address 0x48000010

Writing 0x00000700 @ address 0x48000014

Writing 0x00000700 @ address 0x48000018

Writing 0x00018005 @ address 0x4800001C

Writing 0x00018005 @ address 0x48000020

Writing 0x008E04F4 @ address 0x48000024

Writing 0x000000B1 @ address 0x48000028

Writing 0x00000030 @ address 0x4800002C

Writing 0x00000030 @ address 0x48000030

Select auto JTAG speed (8000 kHz)

The target may not be able to correctly handle a memory-write-packet-size

of 1024 bytes. Change the packet size? (y or n) [answered Y; input not from terminal]

/root/.gdbinit:60: Error in sourced command file:

No executable file specified.

Use the "file" or "exec-file" command.

(gdb) n

start_code () at start.S:121

121 mrs r0, cpsr
```

```
Current language: auto; currently asm

(gdb) n

start_code () at start.S:122

122 bic r0, r0, #0x1f

(gdb)

start_code () at start.S:123

123 orr r0, r0, #0xd3

(gdb)
```

四、調試U-Boot(RAM中運行)

U-Boot最開始是在Flash中運行，初始化之後，會將自身代碼搬移到RAM中運行，由於鏈接的時候指定了運行地址是從0x0開始的，所以U-Boot轉移到RAM中運行之後，其真正的運行地址就和編譯出的elf文件中的地址就不對應了，通過反編譯elf文件就可以看出來，相差一個偏移。gdb應該是根據elf文件中記錄的符號表（函數名，變量名）和其對應的運行地址來進行調試的，現在實際的運行地址變了，gdb也就找不到地址所對應的符號了，那怎麼辦呢？

U-Boot在鏈接的時候運行地址是由CONFIG_SYS_TEXT_BASE這個宏指定的，這個宏最初是被定義為0的，也就是運行地址是從0地址開始，現在把它修改為實際的運行地址，重新編譯一個elf文件，現在這個elf文件中的地址就是和實際的運行地址一樣了，再使用這個elf文件來調試的話，就可以繼續調試RAM中運行的代碼了。

```
root@linsen-desktop:/home/linsen/u-boot/relocate# arm-linux-gdb u-boot

GNU gdb (Sourcery G++ Lite 2008q3-72) 6.8.50.20080821-cvs

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and "show warranty" for details.

This GDB was configured as "--host=i686-pc-linux-gnu
--target=arm-none-linux-gnueabi".

For bug reporting instructions, please see:

<https://support.codesourcery.com/GNUToolchain/>...

0x00000000 in ?? ()

JTAG speed set to 30 kHz

Target endianess set to "little endian"

Resetting target

Writing register (CPSR = 0x000000D3)

Writing 0x00000000 @ address 0x53000000

Writing 0xFFFFFFFF @ address 0x4A000008
Writing 0x00007FFF @ address 0x4A00000C

Writing 0x00FFFFFF @ address 0x4C000000

Writing 0x00000005 @ address 0x4C000014

Writing 0x0005C011 @ address 0x4C000004

Writing 0x22011110 @ address 0x48000000

Writing 0x00000700 @ address 0x48000004

Writing 0x00000700 @ address 0x48000008

Writing 0x00000700 @ address 0x4800000C

Writing 0x00000700 @ address 0x48000010

Writing 0x00000700 @ address 0x48000014

Writing 0x00000700 @ address 0x48000018

Writing 0x00018005 @ address 0x4800001C

Writing 0x00018005 @ address 0x48000020

Writing 0x008E04F4 @ address 0x48000024

Writing 0x000000B1 @ address 0x48000028

Writing 0x00000030 @ address 0x4800002C

Writing 0x00000030 @ address 0x48000030

Select auto JTAG speed (8000 kHz)
```

```
The target may not be able to correctly handle a memory-write-packet-size

of 1024 bytes. Change the packet size? (y or n) [answered Y; input not from term

/root/.gdbinit:60: Error in sourced command file:

No executable file specified.

Use the "file" or "exec-file" command.

(gdb) b board_init_r <-------uboot運行到這個函數的時候已經是在RAM中運行了

Breakpoint 1 at 0x33f44060: file board.c, line 455.

(gdb) c

Continuing.



Breakpoint 1, board_init_r (id=0x33b21f70, dest_addr=871636992) at board.c:455

455 gd = id;

(gdb) n

457 gd->flags |= GD_FLG_RELOC; /* tell others: relocation done */

(gdb) n

459 monitor_flash_len = _end_ofs;

(gdb) b do_ping <-------同樣可以調試命令處理函數

Breakpoint 2 at 0x33f4c6d0: file cmd_net.c, line 269.
```

```
        (gdb) c

        Continuing.



        Breakpoint 2, do_ping (cmdtp=0x33fac72c, flag=0, argc=2, argv=0x33b23430) at
cmd_net.c:269

        269 if (argc < 2)

        (gdb) p argv[1]

        $3 = 0x33b23440 "192.168.0.1"
```