CUBIEBOARD
http://cubieboard.org

Using ARM Streamline base on Cubieboard

ARM-DS-5

Website:http://cubieboard.org/
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1. Abstract

The document which described how to debug the Android or Linux system with ARM-Streamline on cubieboard, the ways of debugging including network debugging and ADB debugging(Android only).

2. Introduction of ARM Streamline

2.1. What is ARM Streamline ?

ARM Streamline performance analyzer is a part of the ARM DS-5 tool chain, it has made the software developers make full use of the available resources to create a high performance and high energy efficiency products which based on the ARM-processor 's system. It has a visual graphical user interface that can display information from the CPU and the GPU performance counters to the source code hotspots and display the actual power consumption, in this way, the developers relieve the performance bottleneck easily, improve the code parallelism, extend the battery life and enhance the user experience. Streamline based on system tracking point, hardware and software performance counters, and sample analysis and user comments. It offers the powerful functional system analysis environment used for the software optimization. More details and introductions please visit the homepage: http://ds.arm.com/

2.2. Why use Streamline ?

Improve the rate of code

- Find the position of CPU which consumed the time is more
- Improve multi-core platform code parallelism
- Adjust the code for achieve the most optimal use of the cache and vector.

Reduce energy consumption

- Using the ARM energy detector to monitor actual power, current and voltage
- Find out the chance of improved power management solutions
- The optimization of calculation task is to achieve the best energy efficiency

Use the system resources effectively

- Analysis and optimization of Mali GPU utilization and CPU code
- Monitor the CPU and Mali GPU cache usage and system memory
- Check the distribution of the load across multiple cores.

Customize system accordingly

- Make your data connect to Streamline analysis view
- Expand open source drivers for watch variables and components
- Test the code like printf which sends message to streamline

3. Preparation before development

1）Ubuntu12.04 operating system of the computer
2）A piece of Cubietruck development board
3）USB-MiniUSB data cable, for PC and development board data interaction
（The Linux system does not have ADB tools, data interaction through network）
4）Download the source code of cubieboard android or linux
5）Download the DS-5 source code pack

4. Download the source code and tools

Linux source code：
$ mkdir linux-sdk-card

$ cd linux-sdk-card

1) kernel-source:

$ git clone https://github.com/cubieboard/linux-sdk-kernel-source.git

$ mv linux-sdk-kernel-source linux-sunxi

2) tools:

$ git clone https://github.com/cubieboard/linux-sdk-card-tools.git

$ mv linux-sdk-card-tools tools

3) products:

$ git clone https://github.com/cubieboard/linux-sdk-card-products.git

$ mv linux-sdk-card-products products

4) rootfs&u-boot:

$ git clone https://github.com/cubieboard/linux-sdk-binaries.git

$ mv linux-sdk-binaries binaries

Get file from:

http://dl.cubieboard.org/model/commom/linux-sdk-binaries

android4.2 source code：

git clone https://bitbucket.org/cubietech/a20-android4.2_lichee.git

git clone https://bitbucket.org/cubietech/a20-android4.2_android.git

DS-5 tool for source code package：

http://pan.baidu.com/s/1pJG66bL

How to compile and build the cubieboard firmware, please refer to the following tutorial:

android: http://pan.baidu.com/s/1dDF5cVR

linux: http://pan.baidu.com/s/1o6LYsDs

5. Add kernel options

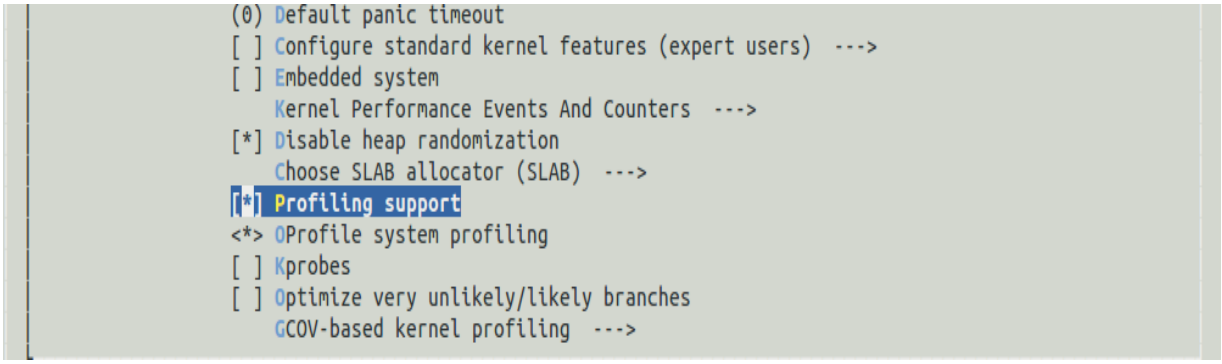
Support ARM Streamline need to recompile the kernel, the public version of SDK , Android kernel directory：

lichee/linux-3.4

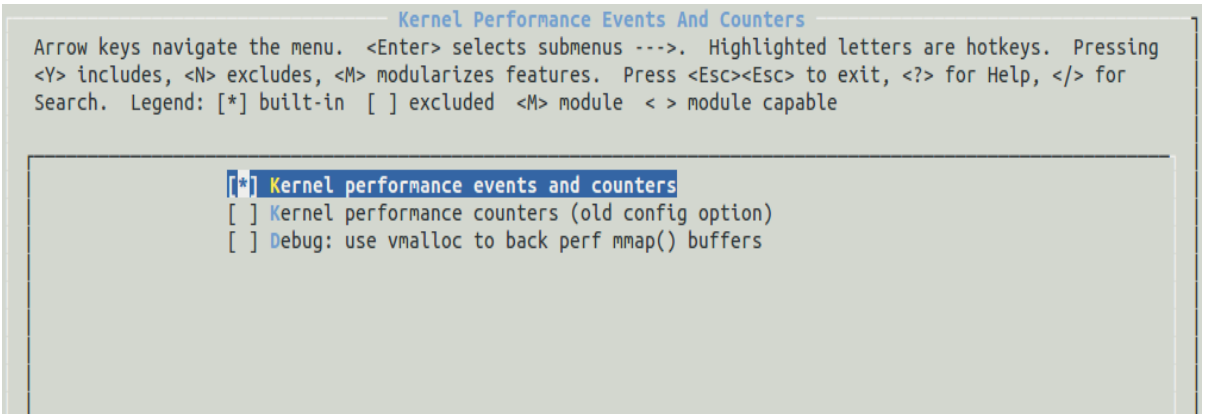
The kernel directory of linux is linux-sunxi .

5.1. General Setup

Into “General setup” and put on “Profiling support”， as below：

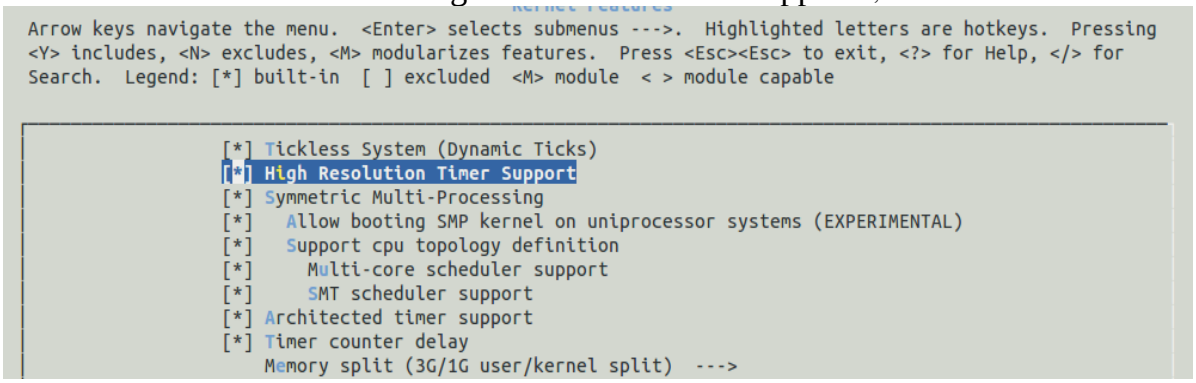


Enter “General setup”-> Kernel Performance Events And Counters Selecte “Kernel performance events and counters ”， as below：

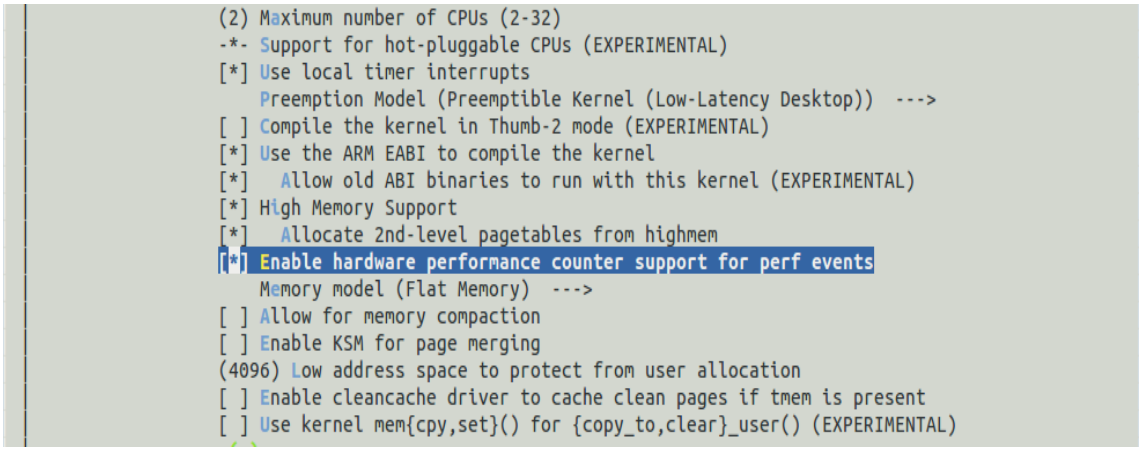


5.2. Kernel Features

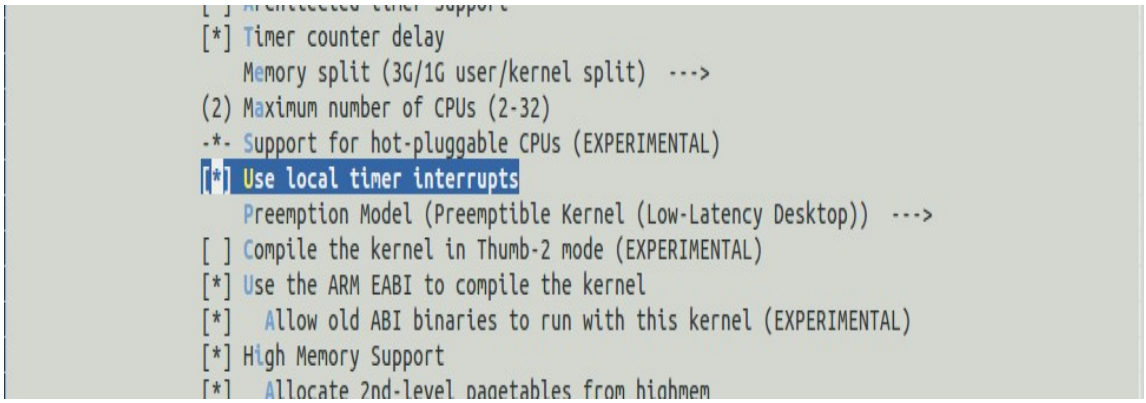
Enter “Kernel Features” Selecte “High Resolution Timer Support”， as below：



Enter “Kernel Features” Selecte “Enable hardware performance counter support for perf events ”， as below：

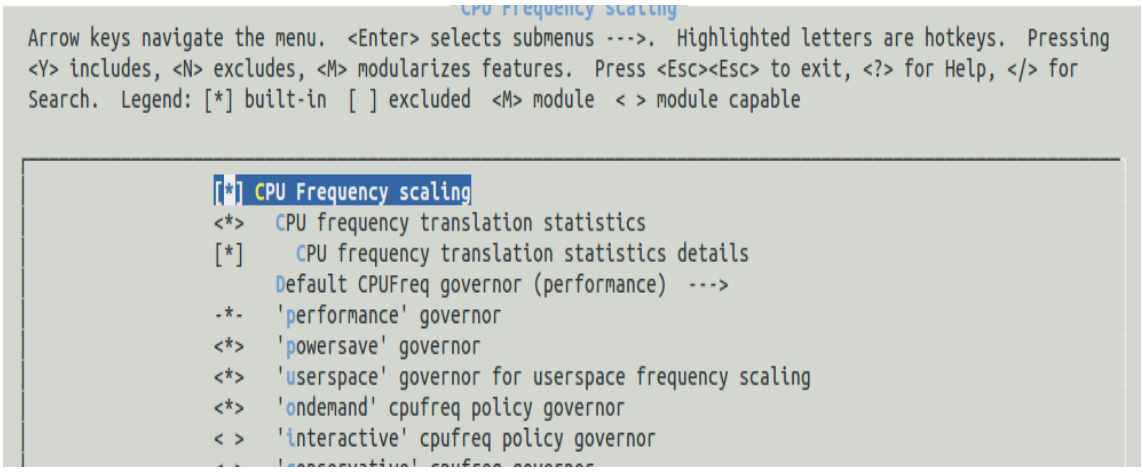


Enter “Kernel Features” Selecte Use local timer interrupts， as below：



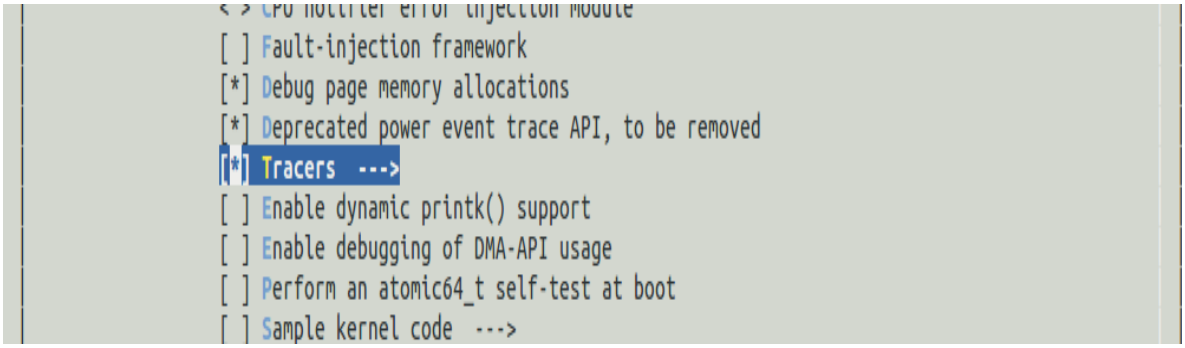
5.3. CPU Power Management

Enter CPU Power Management -> CPU Frequency scaling
Select “CPU Frequency scaling”， as below：



5.4. Kernel hacking

Enter “Kernel Features” select Tracers as below：



The final confirm ”CONFIG_GENERIC_TRACER” and ”CONFIG_TRACING” were selected, as below：

```
Symbol: TRACING [=y]
Type  : boolean
  Selects: DEBUG_FS [=y] && RING_BUFFER [=y] && STACKTRACE [=y] && TRACEPOINTS [=y] && NOP_TRACER [=y] && BI
  Selected by: GENERIC_TRACER [=y] || ENABLE_DEFAULT_TRACERS [=n] && TRACING_SUPPORT [=y] && FTRACE [=y] &&
```

When the above options were selected, compile the kernel, making firmware, we will use the firmware later.

6. Compile Gator driver

Unzip the source code package from the first step and get the gator-driver driver source code. Then starting to compile the gator.ko drive.

Enter gator-driver directory

$ cd gator-driver

Executive compiler directive, please replace the path corresponding to the kernel, ensure that the PC development environment has been installed on the cross compiler tool.

$ make -C /work/android4.2_tablet_A20/lichee/linux-3.4 M=`pwd` ARCH=arm

CROSS_COMPILE=arm-linux-gnueabi- modules

It will generate gator.ko in the current directory after compiled successfully,as below：

```
parker@parker:/work/jtag/gator-driver$ make -C android4.2_tablet_A20/lichee/linux-3.4 M=`pwd` ARCH=arm CROSS_COMPILE=
arm-linux-gnueabi- modules
make: *** android4.2_tablet_A20/lichee/linux-3.4: No such file or directory.  Stop.
parker@parker:/work/jtag/gator-driver$ make -C /work/android4.2_tablet_A20/lichee/linux-3.4 M=`pwd` ARCH=arm CROSS_CO
MPILE=arm-linux-gnueabi- modules
make: Entering directory `/work/android4.2_tablet_A20/lichee/linux-3.4'
  CC [M]  /work/jtag/gator-driver/gator_main.o
  CC [M]  /work/jtag/gator-driver/gator_events_block.o
  CC [M]  /work/jtag/gator-driver/gator_events_irq.o
  CC [M]  /work/jtag/gator-driver/gator_events_meminfo.o
  CC [M]  /work/jtag/gator-driver/gator_events_mmapped.o
  CC [M]  /work/jtag/gator-driver/gator_events_net.o
  CC [M]  /work/jtag/gator-driver/gator_events_perf_pmu.o
  CC [M]  /work/jtag/gator-driver/gator_events_sched.o
  CC [M]  /work/jtag/gator-driver/gator_events_armv6.o
  CC [M]  /work/jtag/gator-driver/gator_events_armv7.o
  CC [M]  /work/jtag/gator-driver/gator_events_l2c-310.o
  CC [M]  /work/jtag/gator-driver/gator_events_scorpion.o
  LD [M]  /work/jtag/gator-driver/gator.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /work/jtag/gator-driver/gator.mod.o
  LD [M]  /work/jtag/gator-driver/gator.ko
make: Leaving directory `/work/android4.2_tablet_A20/lichee/linux-3.4'
```

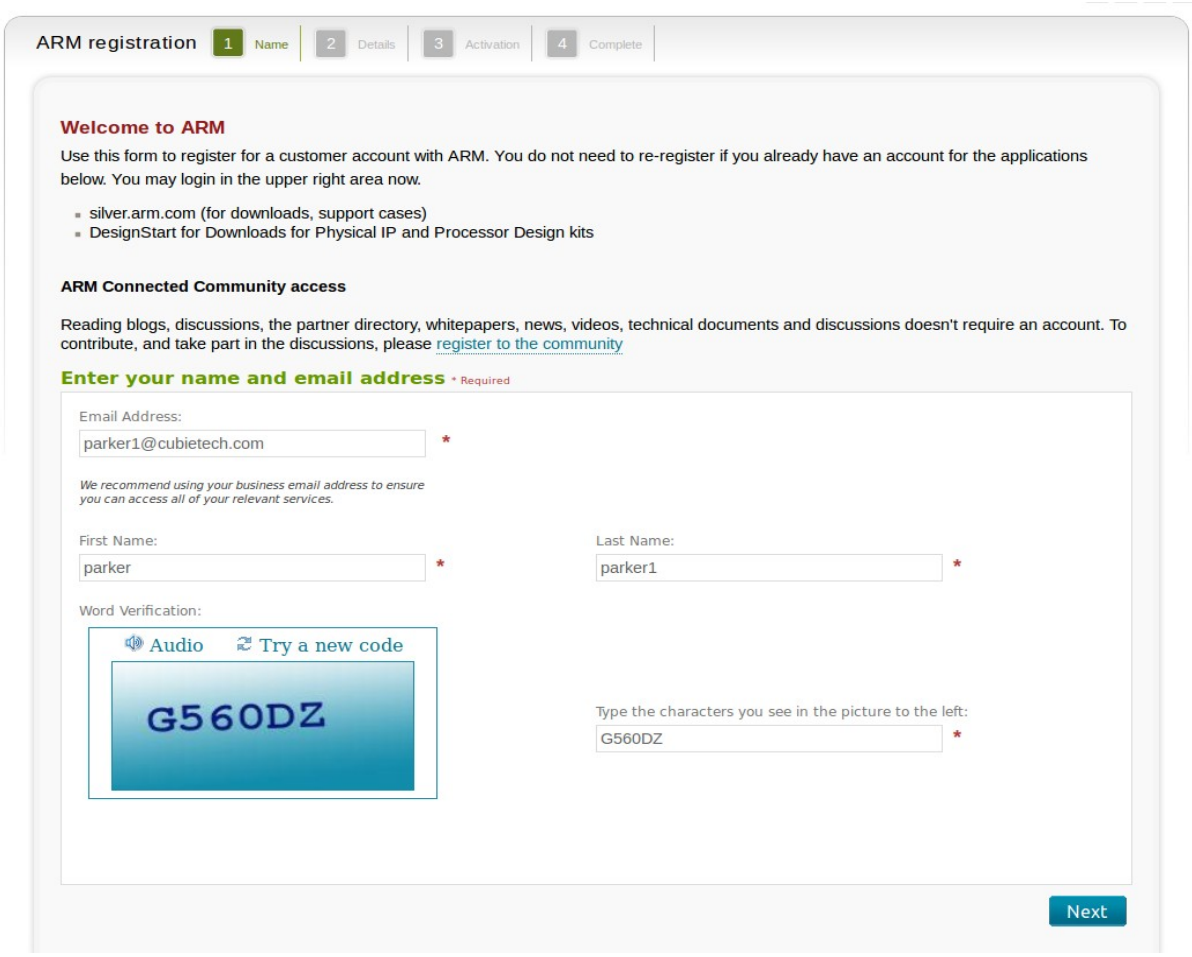
Note:The part of yellow need to fill according to their actual situation, the kernel path to choose what you used the kernel in the second step. The cross compiler tool as same as kernel.

7. Register arm account

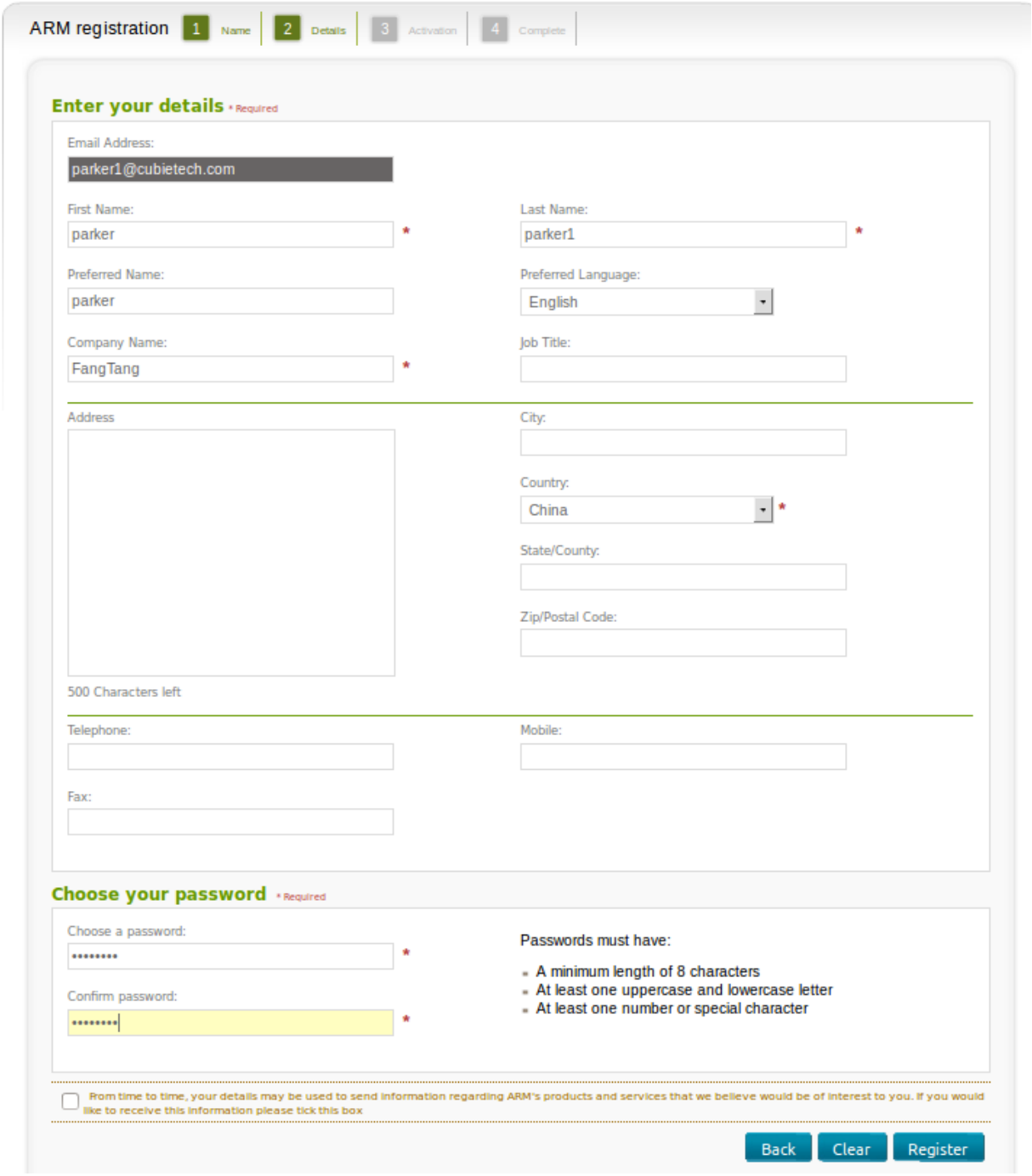
Teaching you sign up for an arm account here, you can obtain the right of DS-5 30 day trial and skip this step if already have a arm account .

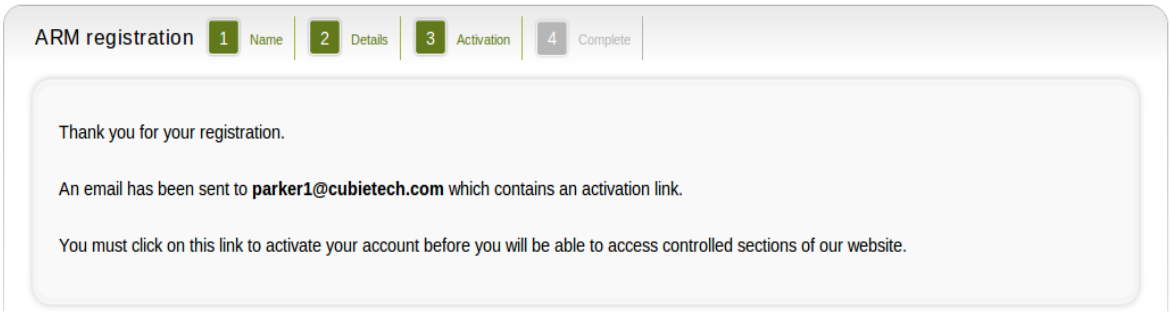
Access to the arm registration page directly
https://login.arm.com/register.php

Registered in 4 steps, just to fill in with * :



Continue to fill in the information:





Registration information has sent to your mailbox, you can complete the registration with click on the link in the mailbox.

8. Installing DS-5 on your computer

Enter the source code directory of DS500-BN-00019-r5p0-20rel1

Add executable permissions of script

$ chmod +x install.sh

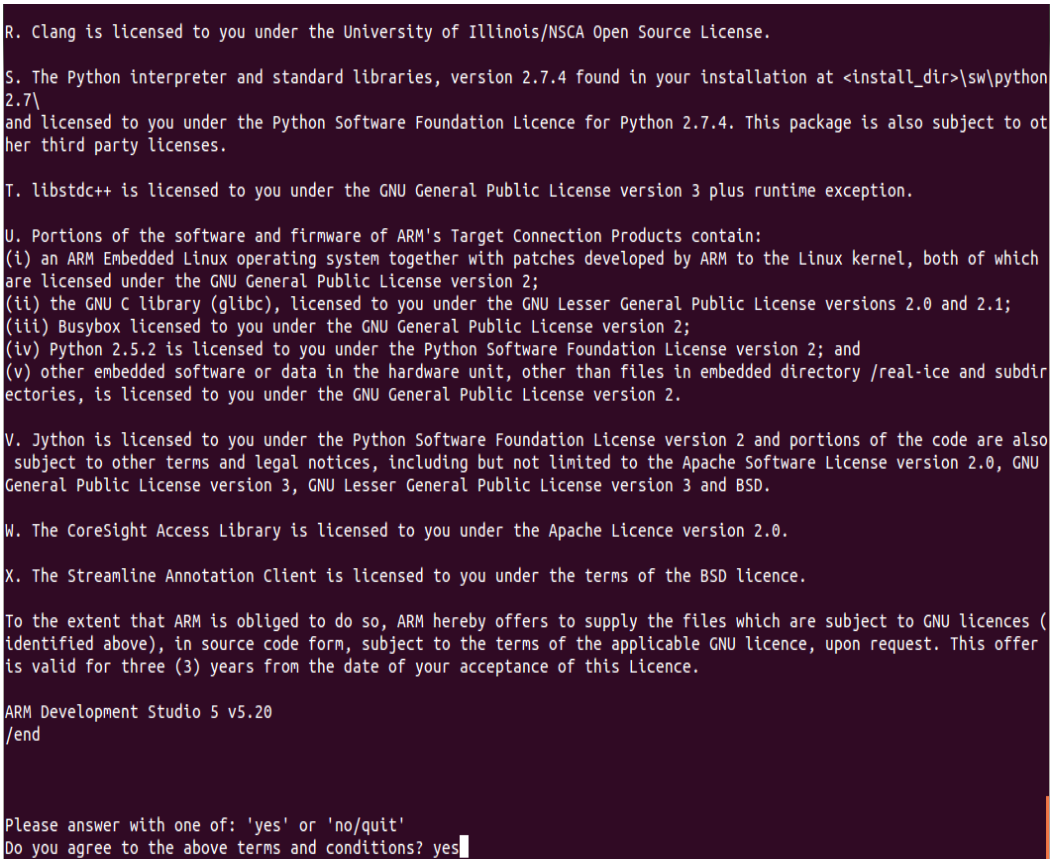
Execute the script

$ ./install.sh

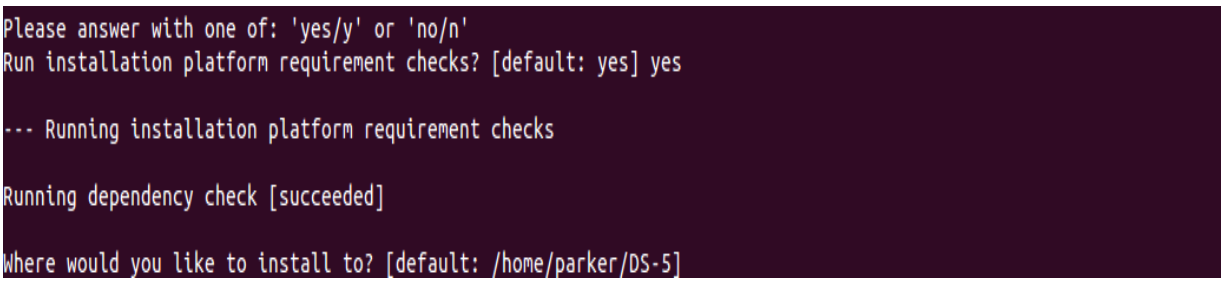
Select B to enter the next step, as shown below:

```
====================================
Welcome to the Installer for ARM DS-5
====================================
--- Host target check...[x86_64]
This installation has a post install step that requires root privileges
The post install stage performs the following functions:
- Set default toolkit selection
- Installation of USB drivers for RealView ICE and DSTREAM hardware units

 (A) Abort the installation and try again as a user with root privileges (Recommended)
 (B) Continue with the installation and skip stages that require root privileges
     (execute "run_post_install_for_ARM_DS-5.sh" afterwards as root to gain full functionality)

Please answer with one of: 'A/a' or 'B/b'
Enter option: [default: A] B
```

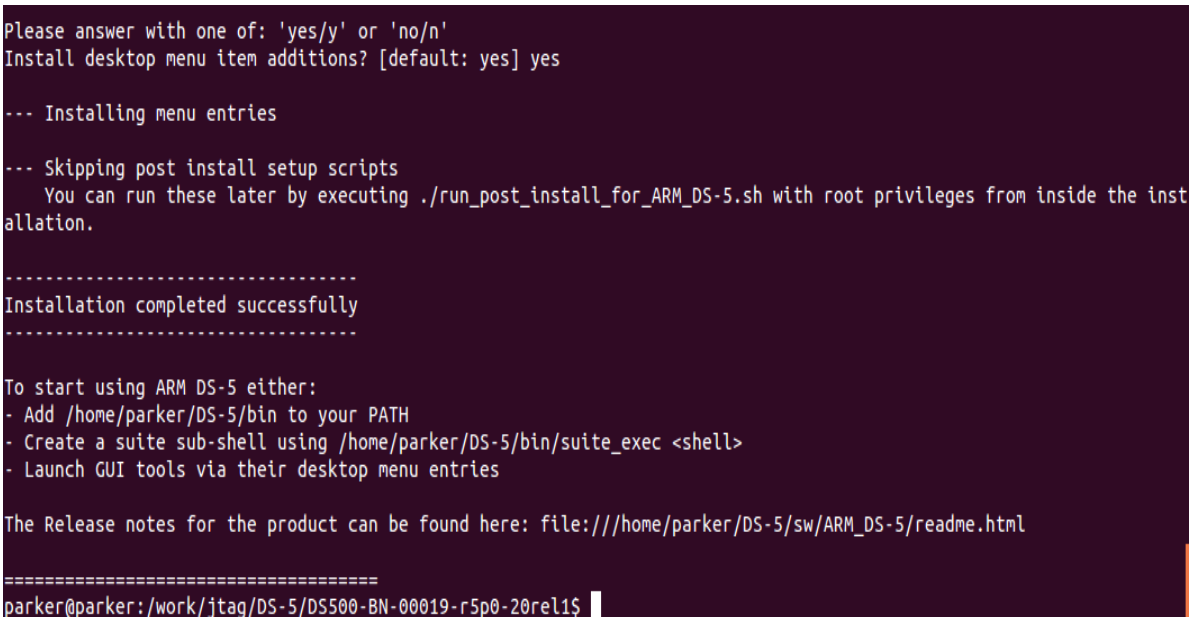
Always press the Enter key to reading information , enter "yes", as shown below:



Always enter "yes", select the DS-5 installation directory, as shown below:



Waiting for the installation, enter the last "yes" after the installation is complete, as shown in the following figure:



Add the DS-5 environment variable, the bin folde under the DS-5 installation directory r, we need to get him to the environment variable, as shown below:

$ vim ~/.bashrc

$ source ~/.bashrc

9. Open Streamline debugging tools in the CT

9.1. Load drive and shell

The compiled firmware of android4.2 cubietrck in the first step, burning to the board, computer and board connected with the USB line.

The gator.ko of compiled previously and source code in the gatord /data directory, pushed to the board.

$ adb push gator.ko /data

$ adb push gatord /data

Enter the board file system

$ adb shell

Load gator.ko driver

$ insmod gator.ko

Running gatord

$ chmod 777 gatord

$ ./gatord &

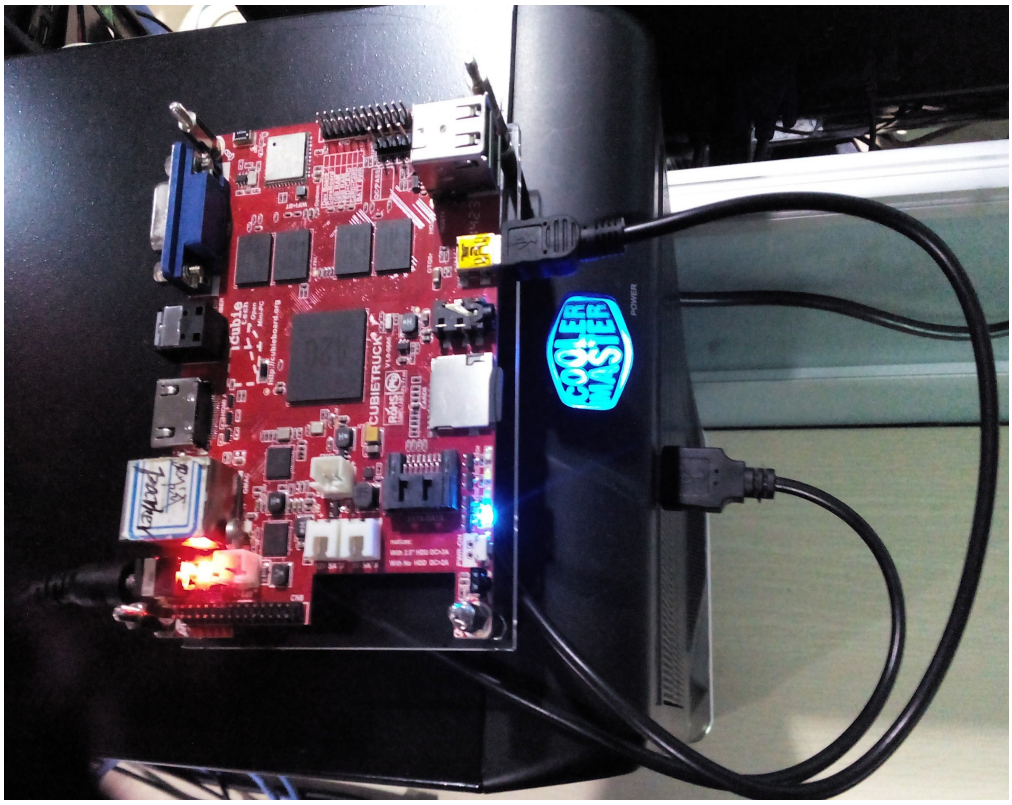
The board internal environment are good, as shown below:

```
root@android:/data # insmod gator.ko
root@android:/data # lsmod
gator 57201 0 - Live 0x00000000 (O)
cdc_ether 3163 0 - Live 0x00000000
rtl8150 9023 0 - Live 0x00000000
mcs7830 5644 0 - Live 0x00000000
qf9700 5884 0 - Live 0x00000000
asix 13586 0 - Live 0x00000000
usbnet 13741 4 cdc_ether,mcs7830,qf9700,asix, Live 0x00000000
sunxi_csi0 30818 0 - Live 0x00000000
gc2035 13734 0 - Live 0x00000000
gc0308 11800 0 - Live 0x00000000
camera 36086 1 sunxi_csi0, Live 0x00000000
videobuf_dma_contig 4157 1 sunxi_csi0, Live 0x00000000
videobuf_core 16284 2 sunxi_csi0,videobuf_dma_contig, Live 0x00000000
sun7i_ir 5797 0 - Live 0x00000000
security_system 1067129 0 - Live 0x00000000
sw_device 11512 0 - Live 0x00000000
mali 151201 31 - Live 0x00000000 (O)
hdmi 25437 0 - Live 0x00000000 (O)
lcd 5155 0 - Live 0x00000000
disp 288683 13 mali,hdmi,lcd, Live 0x00000000
nand 142727 8 - Live 0x00000000 (O)
root@android:/data # chmod +x gatord
Bad mode
10|root@android:/data # chmod 777 gatord
root@android:/data # ./gatord &
[1] 3646
```

9.2. Uses the ADB to interactive data

Android uses mini-USB as the CT and PC data transmission media, ADB development and debugging options have been turned on by default, we just need connecte the hardware, ensure that the PC can identify to CT.

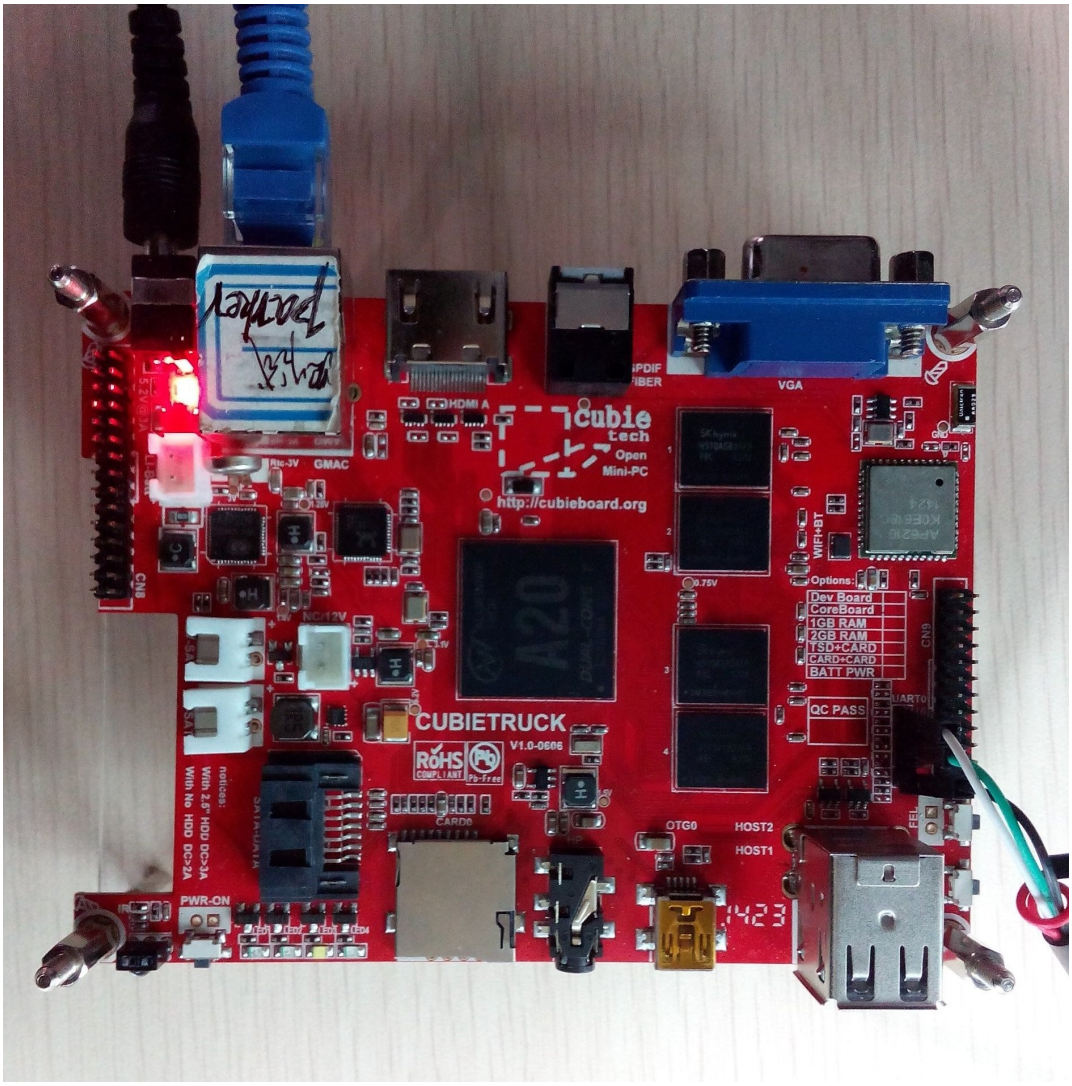
The method of connection is very simple, only needs the power on and connected to the mini-usb:



9.3. The use of interactive network data

Using mini-USB is only one way, you can be connected to the PC and CT by the network and serial debugging tools if there is no mini-USB and ADB tools, but gator.ko and gatord will use the USB stick or TF card copy to the board of internal.

If you are using WiFi, you do not need to take the network cable, just make sure to get the IP address:



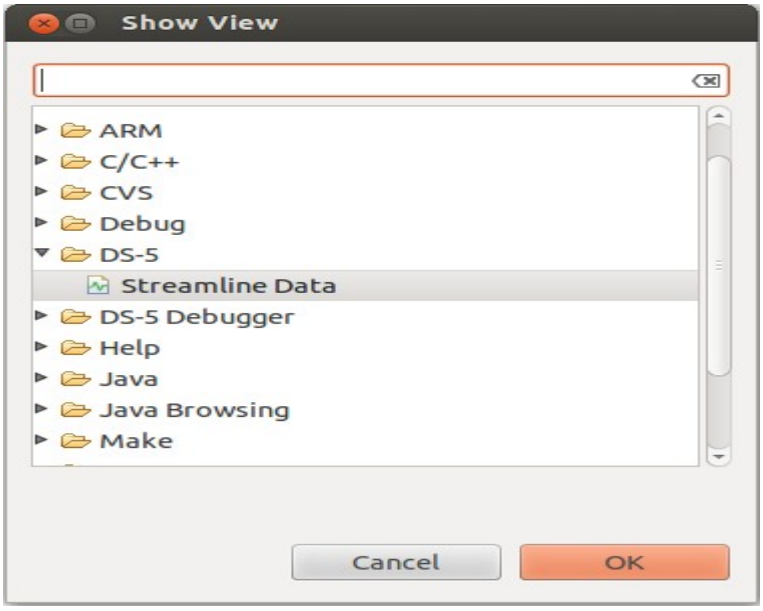
10. Use DS-5

Terminal input

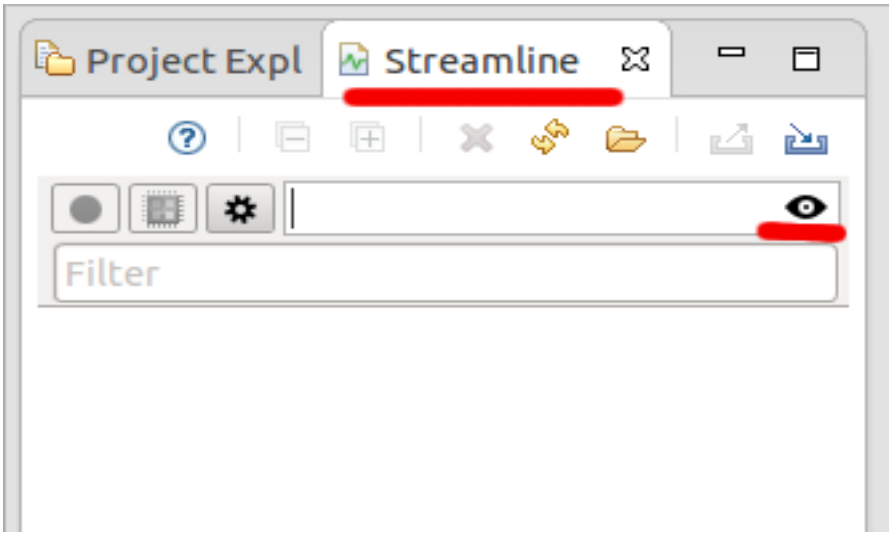
$ eclipse

10.1. Create project of Streamline Data

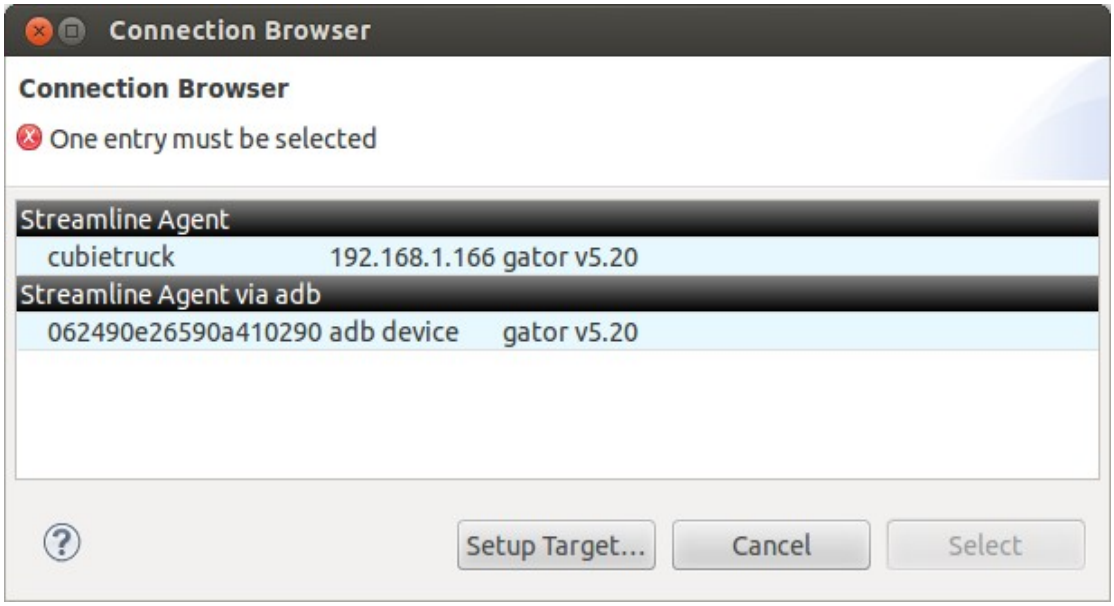
Click on the menu bar of Window > Show View > Other..., select Streamline Data, click "OK", as shown below:



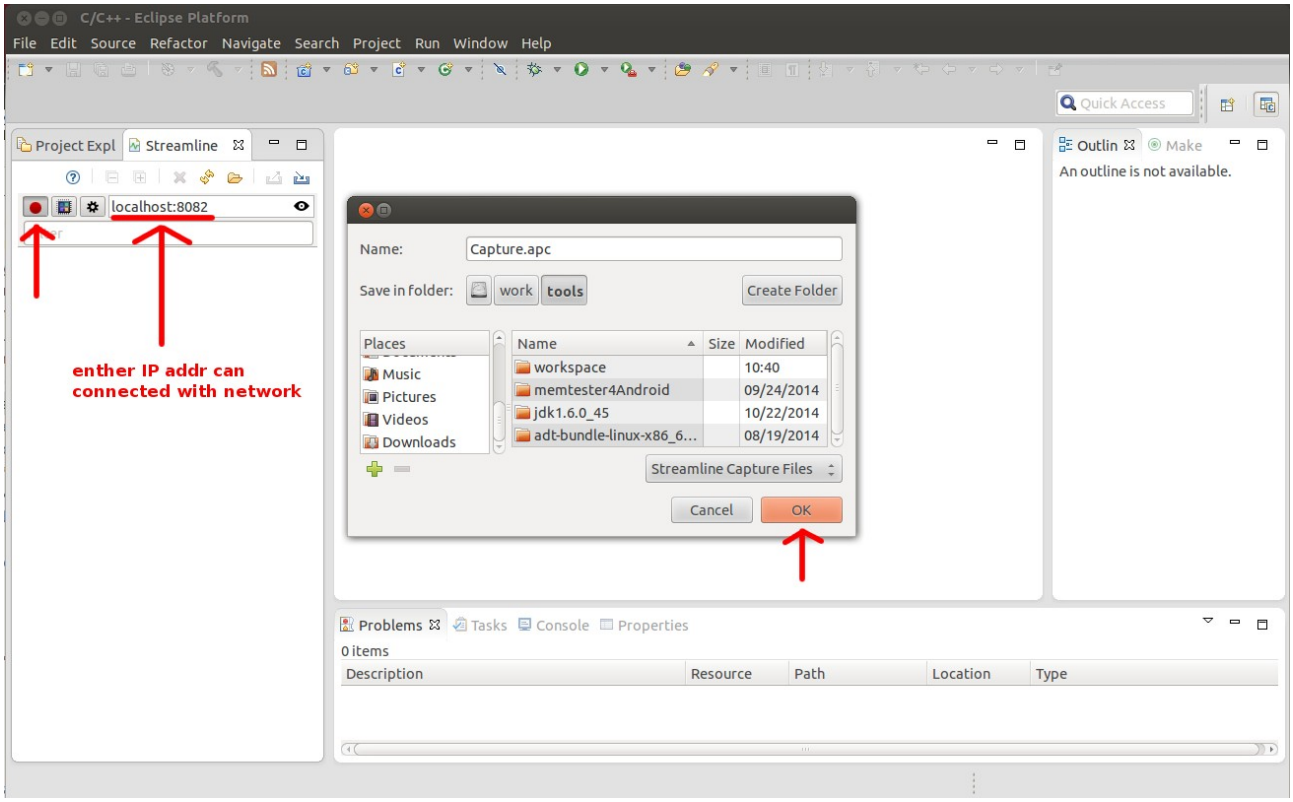
We have been set up the board environment in the sixth step, ensure that the USB line has been connected to the computer and board, select the Streamline project, and click on the eye like icons, as shown below:



Then, select the "Streamline Agent via ADB", as shown below:



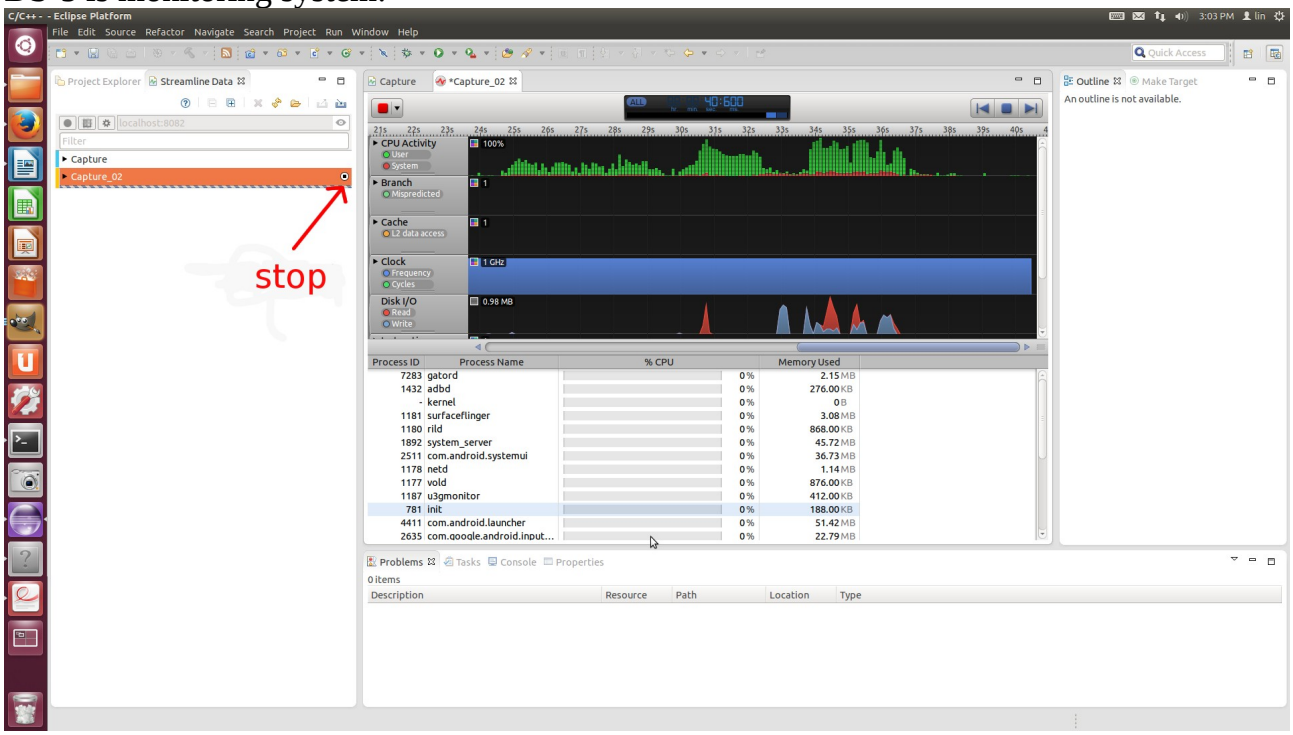
Finally, click on the red icon, select the save path, you can start debugging, as shown below:

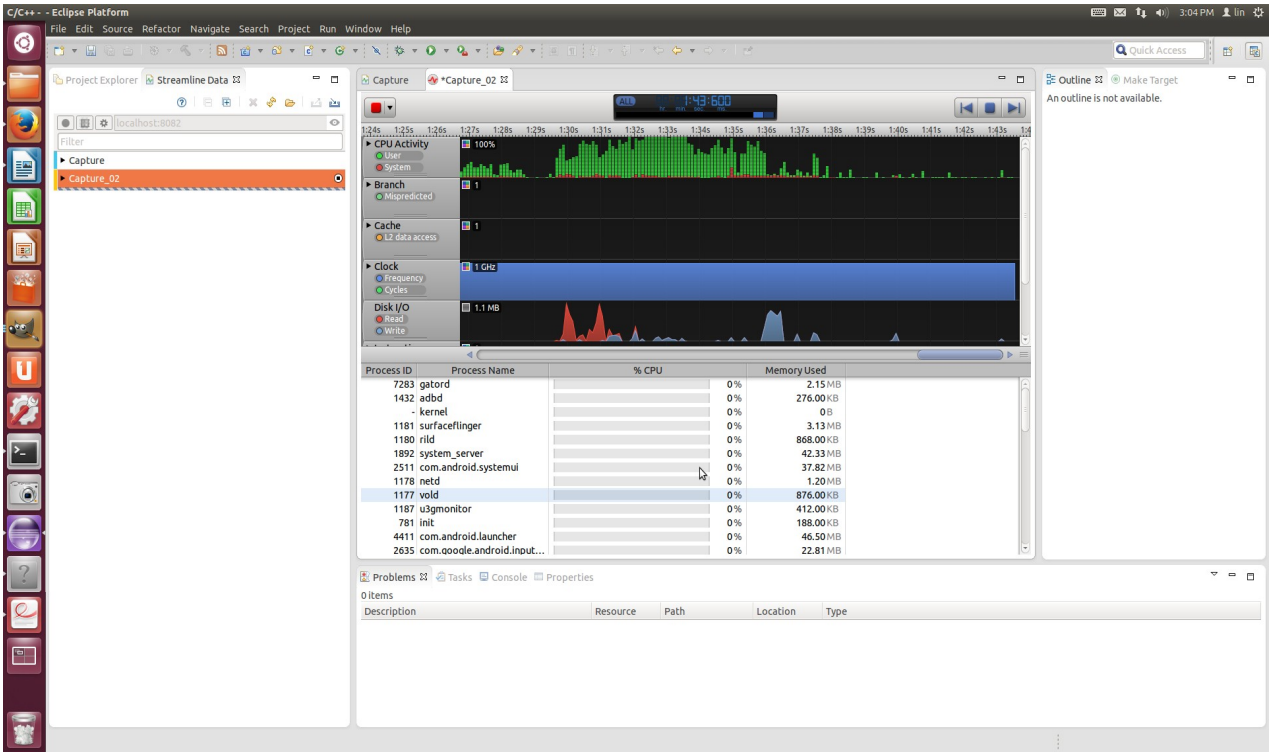


Note: the board with Linux system can not be connected ADB, as long as we replace "localhost:8082" with the board of IP address (e.g. input: 192.168.1.174) can be connected by the way of network.

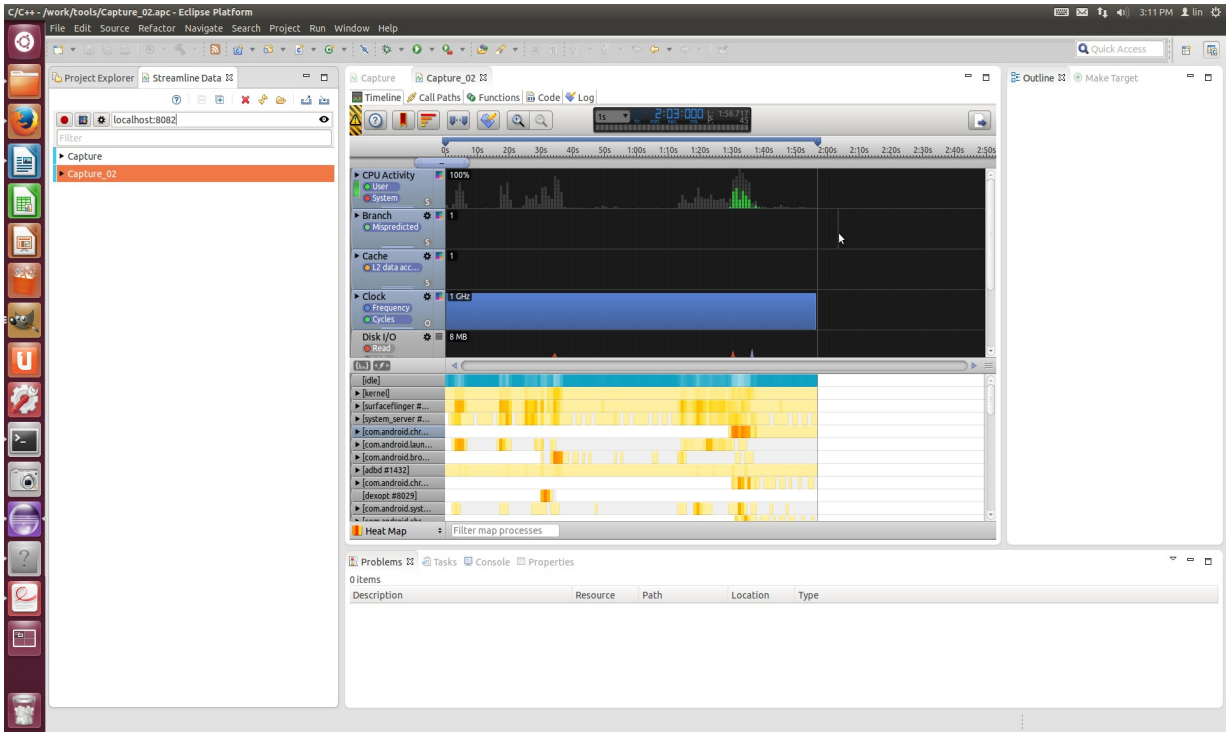
10.2. The working effect of DS-5 graph

DS-5 is monitoring system:



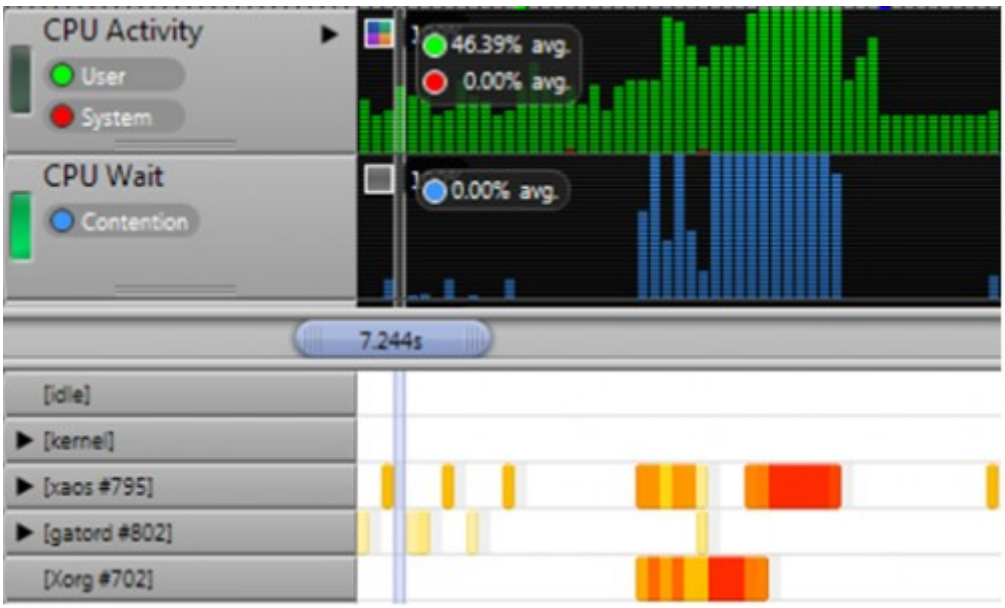


The DS-5 stops working, the derived analytical results:



10.3. Streamline simple analysis

The Streamline process can be configured to display the different information, click on activity diagram in rectangular beside GPU and CPU, we can know time that each thread in GPU and CPU latency. For example, you can see the Xorg who spent a lot of time waiting for the release of xaos processor in the example below, xaos also waiting to the end of other threads activity.



Please refer to the official ARM documentation you need detailed instructions:

http://ds.arm.com/developer-resources/ds-5-documentation/