CH3 Basic Software and Tool

Software and Tool

- Open Source License
- Develop Tool
  - → Geany, gedit, vim
  - → Git
  - → diff, patch
- Build Code Tool
  - → ARM toolchain
  - → make
  - → automake, autoconfig

Software and Tool

- Network
  - → WiFi, Ethernet, Net tool
  - → Bluetooth
  - → SSH, SSHFS
  - → NFS
- Media Software
  - → gstreamer
  - → ALSA Tool - aplay, arecord

Software and Tool

- Bus
  - → I2C – I2cset, i2cget, i2cdump
  - → USB – lsusb

Open Source License

GNU General Public License

→ 只要在一個軟件中使用 (" 使用 " 指類庫引用，修改後的代碼或者衍生代碼)
GPL 協議的產 品，則該軟件產品必須也採用 GPL 協議，既必須也是開源和免費 .
這就是所謂的 " 傳染性 "

BSD License

→ 基本上使用者可以 " 為所欲為 ", 可以自由的使用，修改源代碼，
也可以將修改後的代碼作為開源或者專有軟件再發佈 .

LGPL

→ LGPL 是 GPL 的一個為主要為類庫使用設計的開源協議 . LGPL 允許商 業軟件
通過類 庫引用 (link) 方式使用 LGPL 類庫而不需要開源商業軟件的代碼．這使得採用
LGPL 協議的開源代碼可以被商業軟件作為類庫引用並發布和銷售 .

Develop Tool

Ubuntu Package Management

- apt-get : command-line tool for handling packages
- apt-get --help
  - → apt-get update
  - → apt-get install ${PACKAGE_NAME}
  - → apt-get remove ${PACKAGE_NAME}
  - → apt-get autoremove
  - → apt-get clean

Geany

- You can find a good edit for programing

→ Geany

https://www.geany.org/

```
$ sudo apt-get install geany
```

→ Vim

```
$ sudo apt-get install vim
```

→ gedit

Tracking code command

- Linux command
  - Filter :
    → grep -r -n “function name”
  - Fine special file include “String”
    → find -name “*.c” | xarge grep -n “String”

diff and patch

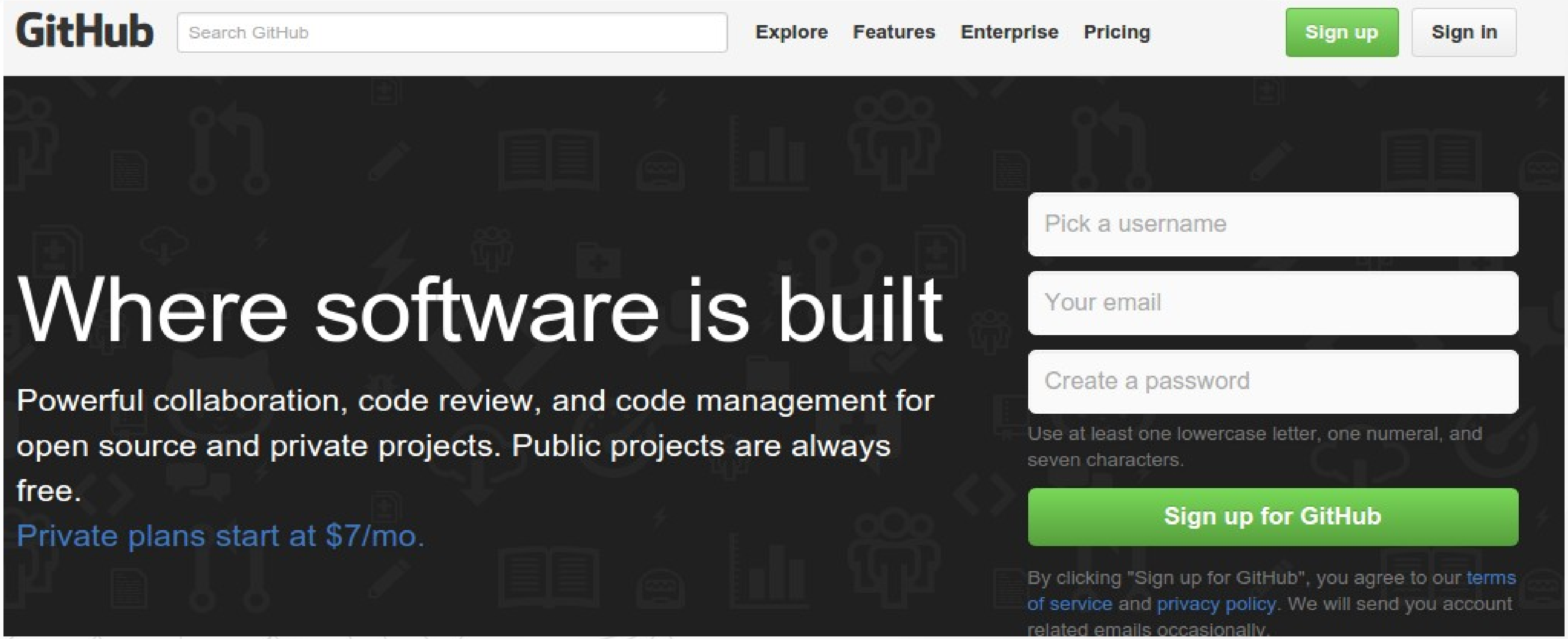
- diff - compare files line by line
  - Create a patch file
    - diff -Nuar file_a file_b > c.patch
      - -N, treat absent files as empty
      - -a, --text
      - -u, output NUM (default 3) lines of unified context
      - -r, recursively compare any subdirectories found
- patch - apply a diff file to an original
  - apply a patch file
    - patch ./hello_1.c < ./tmp.patch
  - Reverse a patch file
    - patch -R ./hello_1.c < tmp.patch

Git

- https://git-scm.com/book/zh-tw/v1/
- 版本控制
- 程式回溯
- 管理多人共同開發

GitHub

- https://github.com/



Where software is built

Powerful collaboration, code review, and code management for open source and private projects. Public projects are always free.

Private plans start at $7/mo.

Pick a username

Your email

Create a password

Use at least one lowercase letter, one numeral, and seven characters.

By clicking "Sign up for GitHub", you agree to our terms of service and privacy policy. We will send you account related emails occasionally.

Exercise

- 0. Create an empty Git repository (In local)

```
$ git init
```

- 1. Clone code to local

```
$ git clone https://github.com/xlloss/tiny4412-uboot.git
```

- 2. modify something

```
$ gedit README
```

- 3. check source status

```
$ git status
```

- 4. use "git add <file>..." to update what will be committed

```
$ git add ./README
```

- 5. check status again

```
$ git status
```

Exercise

- 6. commit code to local repository

```
      $ git commit -a “test”
Or  $ git commit
```

- 7. check log

```
      $ git log
```

- 8. check how many branch in local repository

```
      $ git branch
```

- 9. create new branch in local repository

```
      $ git branch  “new_branch_name”
       $ git branch cadtc_uboot
```

Exercise

- 10. check out to new branch

  ```
  $ git checkout “branch_name”
  $ git checkout slash_uboot
  ```

- 11. check branch again

  ```
  $ git branch
  ```

- 12 . push log branch to remote

  ```
  $ git push origin slash-uboot
  ```

- 13. check remote branch status

  ```
  $ git branch origin/ and push tab x2
  ```

Exercise

- reset your code, but modify code still live

```
$ git reset commit hash coed
```

- Hard reset your code, all modify code will discard

```
$ git reset - -hard hash coed
```

- Check log

```
$ git log
$ git show
```

- Download objects and refs from another repository

```
$ git fetch [--all]
```

BASIC Git Command

init	Create an empty Git repository
add	Add file contents to the index
branch	List, create, or delete branches
checkout	Checkout a branch or paths to the working tree
clone	Clone a repository into a new directory
commit	Record changes to the repository

BASIC Git Command

- diff Show changes between commits, commit and working tree, etc
- rm Remove files from the working tree and from the index
- pull Fetch from and merge with another repository or a local branch
- push Update remote refs along with associated objects
- reset Reset current HEAD to the specified state
- cherry-pick apply changes introduced by some existing commits

Build Code Tool

Makefile

Makefile

- Simplify compile command
- Automation compile, linker program source
- It can update source in accordance with the dependence

Compile a Hello_World

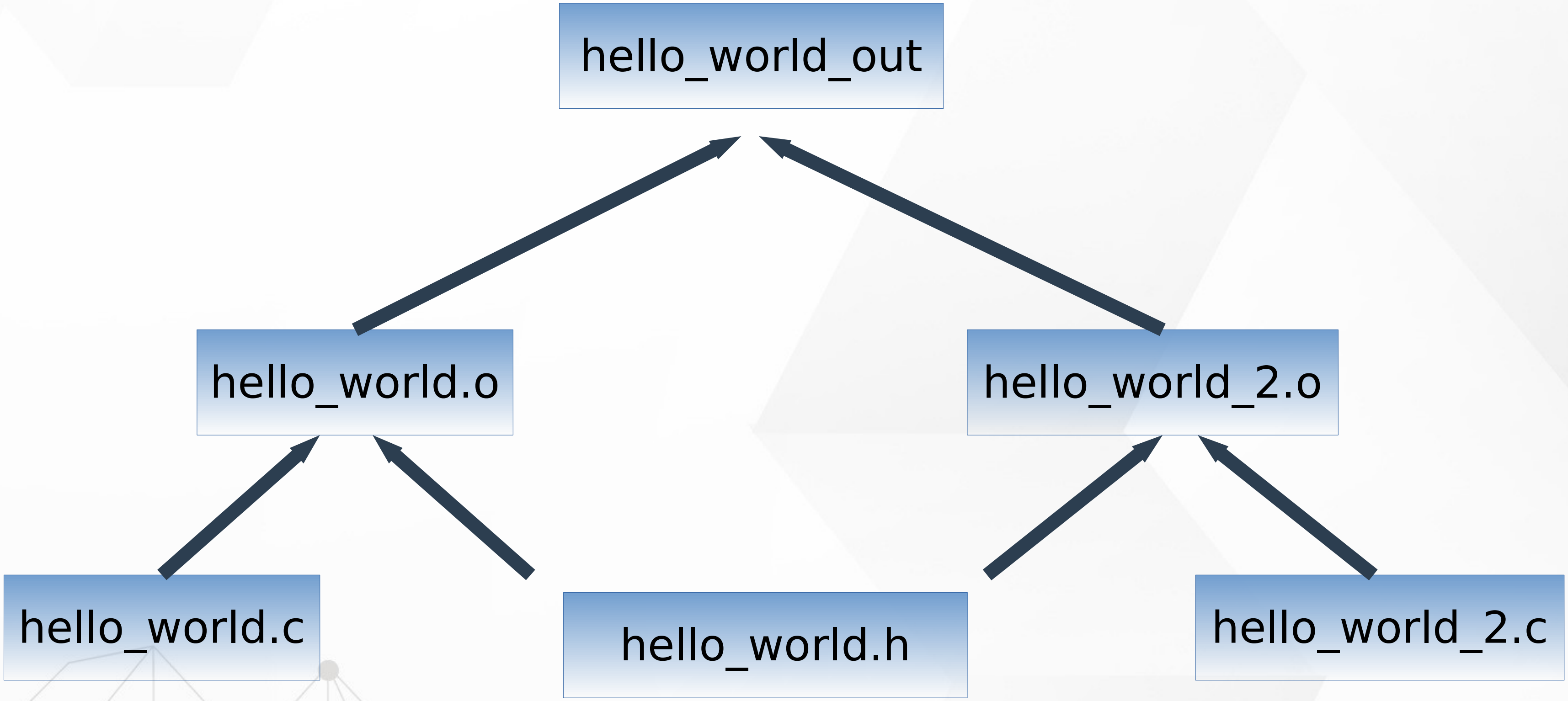
A	B	C
aarch64-linux-gnu-gcc	-o helloworld	./hello.c

A : ARM C Compile

B : ARM C Compile Parameter (Output name)

C : C source code

Another Sample



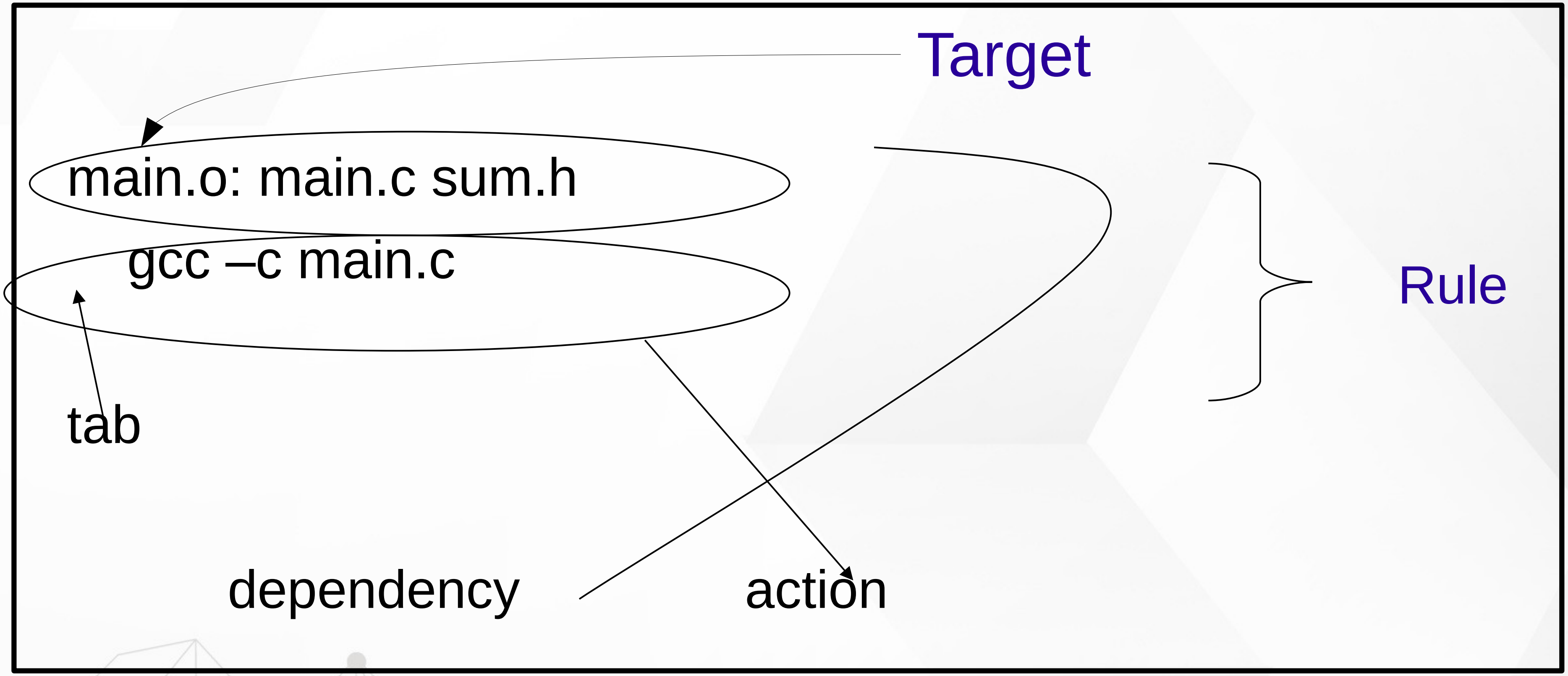
Compile Another Sample

- Step 1 : gcc -c hello_world_2.c
- Step 2 : gcc -c hello_world_2.c
- Step 3 : gcc -o hello_world hello_world.o hello_world_2.o

Another Sample - Makefile

```
CC=$(CROSS_COMPILE)gcc


all: hello_world

hello_world: hello_world.o hello_world_2.o
	$(CC) -o hello_world hello_world.o hello_world_2.o

hello_world.o: hello_world.c
	$(CC)  -c hello_world.c

hello_world_2.o: hello_world_2.c
	$(CC)  -c hello_world_2.c

clean:
	rm -r *.o
	rm hello_world
```

Rule Syntax



Target

```
main.o: main.c sum.h
	gcc –c main.c
```

Rule

tab

dependency

action

make 在編譯時，若發現 target 比較新，

也就是 dependencies 都比 target 舊，

那麼將不會重新建立 target，如此可以避免不必要的編譯動作

Rule Syntax

```
CC=$(CROSS_COMPILE)gcc

CFLAGS=-Wl,-Map,out.map -lpthread -lm

all: hello_world

hello_world: hello_world.o hello_world_2.o
	$(CC) -o hello_world hello_world.o hello_world_2.o

hello_world.o: hello_world.c
	$(CC) $(CFLAGS) -c hello_world.c

hello_world_2.o: hello_world_2.c
	$(CC) $(CFLAGS) -c hello_world_2.c

clean:
	rm -r *.o
	rm hello_world
```

Rule Syntax Sample 1

```
hello_world_2.o: hello_world_2.c
        $(CC) $(CFLAGS) -c hello_world_2.c
```

hello_world_2.o depend hello_world_2.c

If hello_world_2.c alive and **be update**,

it will do command ($(CC) $(CFLAGS) -c hello_world_2.c),

then output hello_world_2.o object file

Rule Syntax Sample 2

```
hello_world_2.o: hello_world_2.c
	$(CC) $(CFLAGS) -c hello_world_2.c
```

hello_world.o depend hello_world.c

If hello_world.c alive and **be update**,

it will do command ($(CC) $(CFLAGS) -c hello_world.c),

then output hello_world.o object file.

Rule Syntax Sample 2

```
hello_world_2.o: hello_world_2.c
        $(CC) $(CFLAGS) -c hello_world_2.c
```

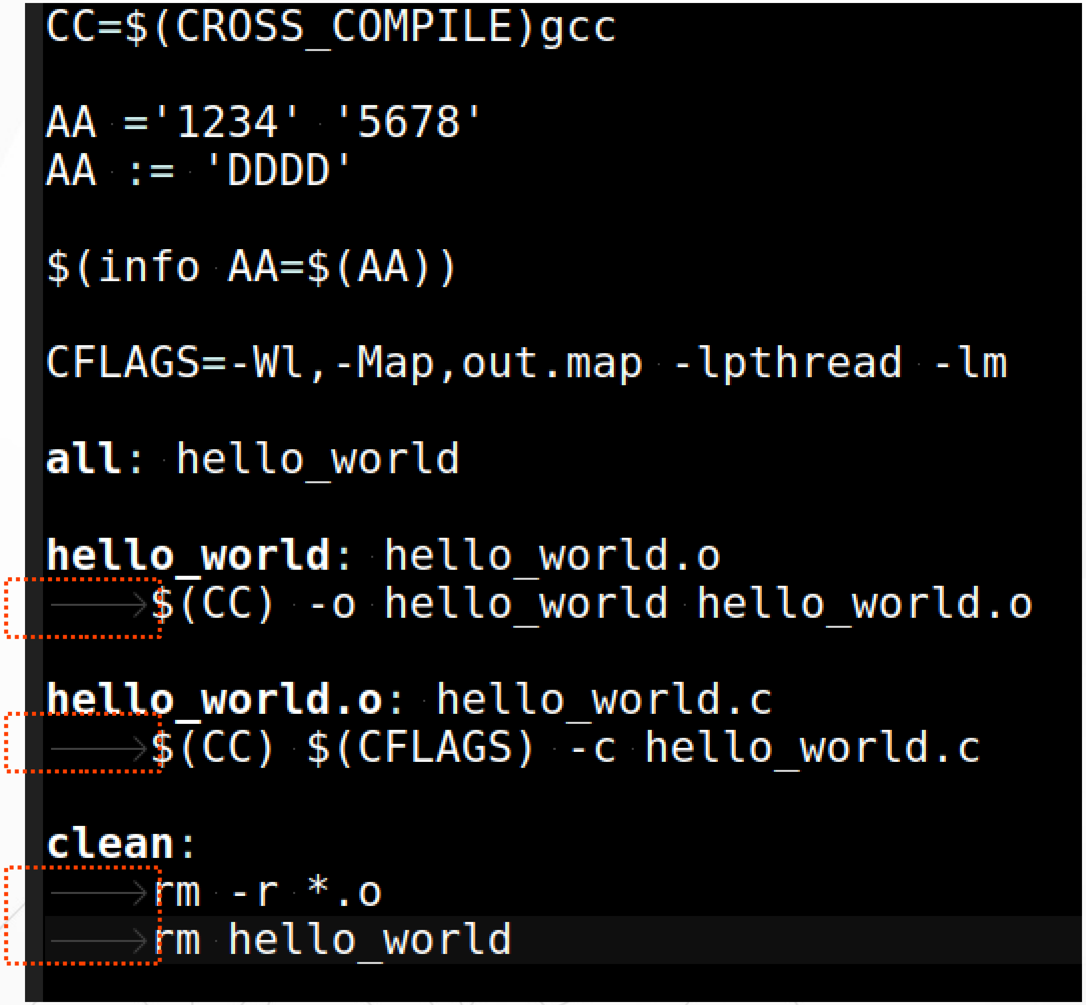
hello_world depend hello_world.o and hello_world_2.o

If hello_world.o and hello_world_2.o alive and **be update**,

it will do command ($(CC) -o hello_world hello_world.o hello_world_2.o),

then create hello_world execute file

hello_world_ex1



```
CC=$(CROSS_COMPILE)gcc

AA ='1234' '5678'
AA := 'DDDD'

$(info AA=$(AA))

CFLAGS=-Wl,-Map,out.map -lpthread -lm

all: hello_world

hello_world: hello_world.o
	$(CC) -o hello_world hello_world.o

hello_world.o: hello_world.c
	$(CC) $(CFLAGS) -c hello_world.c

clean:
	rm -r *.o
	rm hello_world
```

: Tab

Assignment Operators

＝　定義一個 需做遞迴展開的 變數型態

:＝　定義一個 立即運作的 變數型態

+＝　將 指定值，續加在 原變數中

?=　如果之前 無任何設定該變數，即現在設定，
否則 跳過設定 (就是不做任何事)

Assignment Operators Sample 1

```
AA ='1234' '5678'
BB = ${AA}
AA = '789'
AA += 'ABCDE'
```

Output

```
AA='789' 'ABCDE'
BB='789' 'ABCDE'
```

Assignment Operators Sample 2

```
AA ='1234' '5678'
BB := ${AA}
AA = '789'
AA += 'ABCDE'
```

Output

```
AA='789' 'ABCDE'
BB='1234' '5678'
```

Assignment Operators Sample 3

```
AA ='1234' '5678'
BB := ${AA}
AA = '789'
AA ?= 'ABCDE'
```

Output

```
AA='789'
BB='1234' '5678'
```

The Automatic Variables

- $@ The target filename.
- $< The first prerequisite.
- $^ The list of prerequisites, excluding duplicate elements.

The Automatic Variables

```
CC = gcc
CFLAGS = -Wall -g -std=c99
LDFLAGS = -lm

circle : circle.o circulararea.o
        $(CC) $(LDFLAGS) -o circle circle.o
circulararea.o

circle.o : circle.c
        $(CC) $(CFLAGS) -o circle.o -c circle.c

circulararea.o: circulararea.c
        $(CC) $(CFLAGS) -o circulararea.o -c
circulararea.c
```

The Automatic Variables

```
CC = gcc
CFLAGS = -Wall -g -std=c99
LDFLAGS = -lm

circle : circle.o circulararea.o
        $(CC) $(LDFLAGS) -o $@ $^

circle.o : circle.c
        $(CC) $(CFLAGS) -o $@ -c $<

circulararea.o: circulararea.c
        $(CC) $(CFLAGS) -o $@ -c $<
```

Phony Targets

- .PHONY
  - Any targets that are prerequisites of .PHONY are always treated as out of date.

```
#Naming our phony targets
.PHONY: clean install

#Removing the executable and the object files
clean:
    rm sample main.o example.o
    echo clean: make complete

#Installing the final product
install:
    cp sample /usr/local
    echo install: make complete
```

Command-Line Options

- -C dir, --directory= dir
  - make changes the current working directory to dir before it does anything else. If the command line includes multiple -C options, each directory specified builds on the previous one

- -j [number] , --jobs[= number]
  - Run multiple commands in parallel

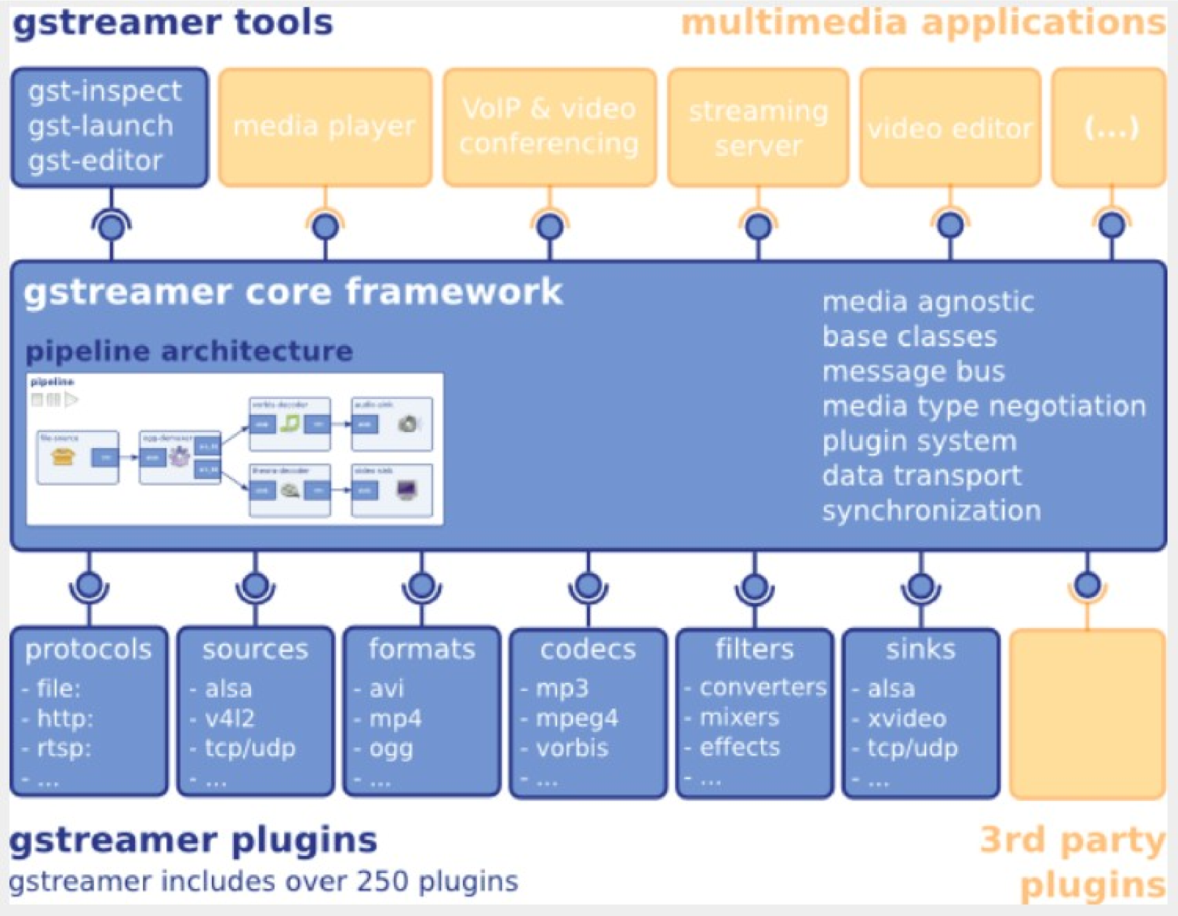
Media Tool

Gstreamer

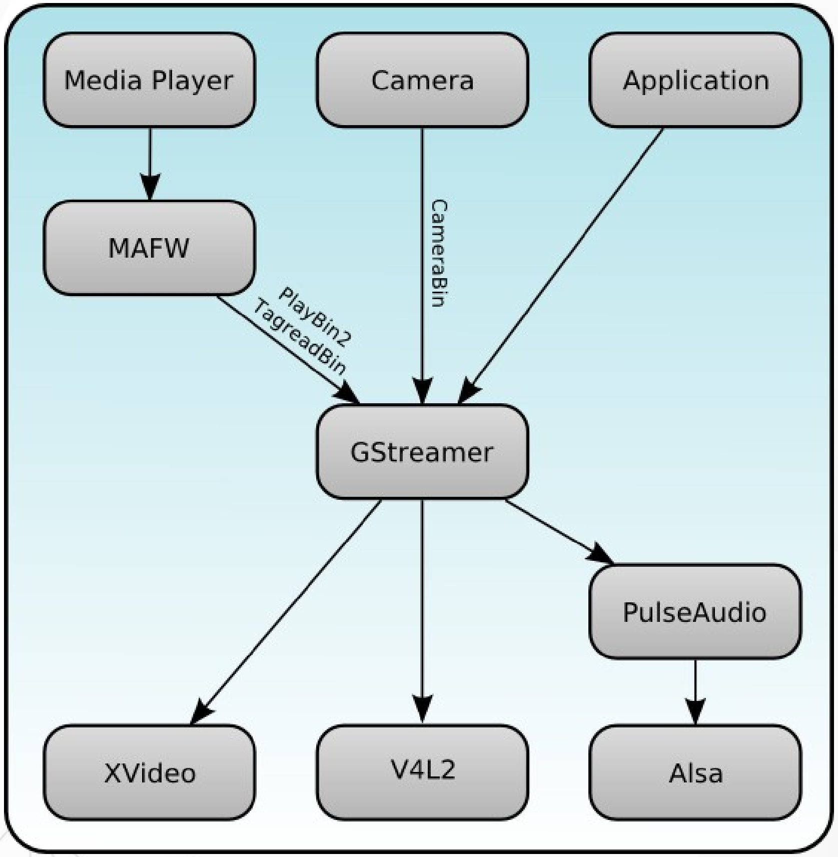
Open Source Multimedia Framework

- https://gstreamer.freedesktop.org/
- Documentation
  - Tutorials

Block Diagram



Block Diagram



http://maemo.org/development/sdks/maemo_5_beta_docs/using_multimedia_components/

Overview

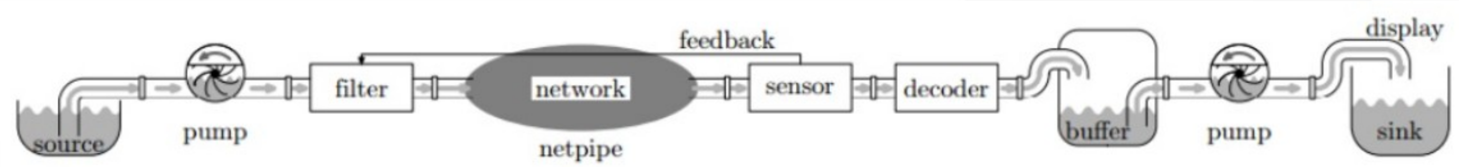
- GStreamer is a **framework** for creating streaming media applications
- The framework is based on **plugins** that will provide the various codec and other functionality

Overview

- **Gst-plugins-base:**
  an essential exemplary set of elements
- **Gst-plugins-good:**
  a set of good-quality plug-ins under LGPL
- **Gst-plugins-ugly:**
  a set of good-quality plug-ins that might pose distribution problems
- **Gst-plugins-bad:**
  a set of plug-ins that need more quality

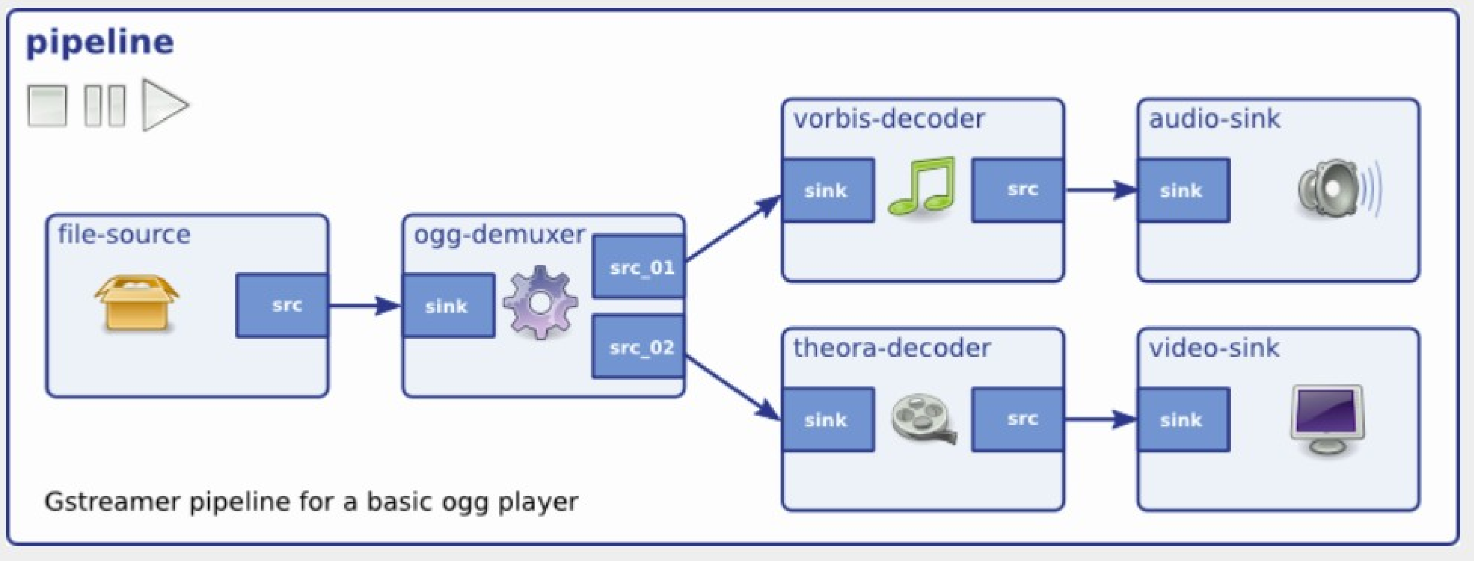
Gstreamer Pipe

A streamer pipe



https://www.slideshare.net/rodrigo_costa/gstreamer-an-overview

Gstreamer Pipe

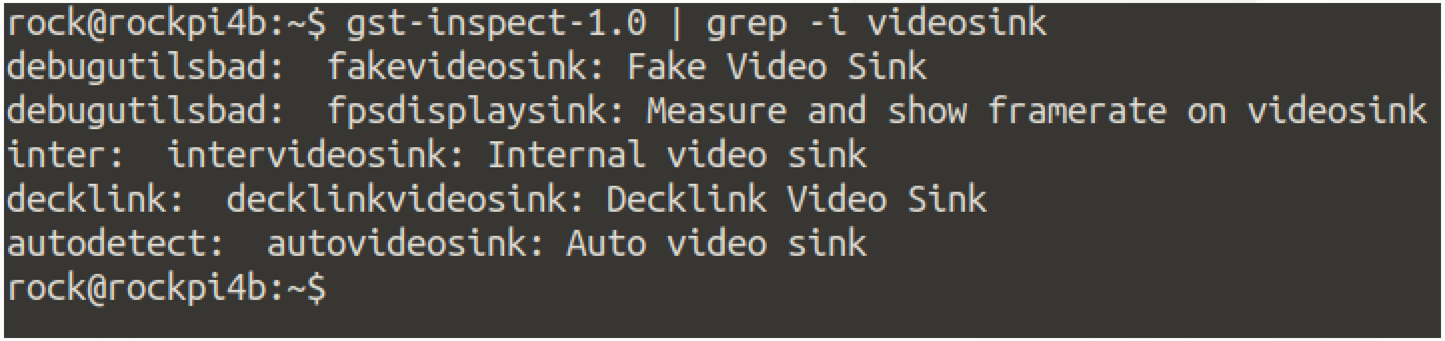


Gstreamer - Tool

- Gst-inspect-1.0
  - Print supported plug-in
- Gst-launch-1.0
  - Gstreamer tester
- Gst-typefind-1.0
  - Check file for gstreamer plug-in type

Gstreamer - Tool

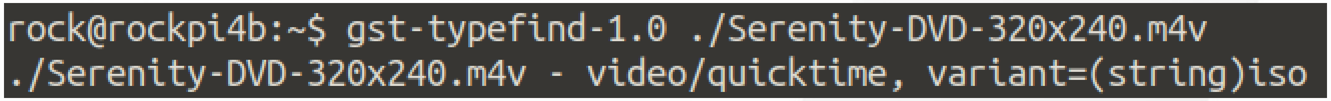
- Gst-inspect-1.0
  - Check what kind of videosink in Rockpi4b
  - gst-inspect-1.0 | grep -i videosink



```
rock@rockpi4b:~$ gst-inspect-1.0 | grep -i videosink
debugutilsbad:  fakevideosink: Fake Video Sink
debugutilsbad:  fpsdisplaysink: Measure and show framerate on videosink
inter:  intervideosink: Internal video sink
decklink:  decklinkvideosink: Decklink Video Sink
autodetect:  autovideosink: Auto video sink
rock@rockpi4b:~$
```

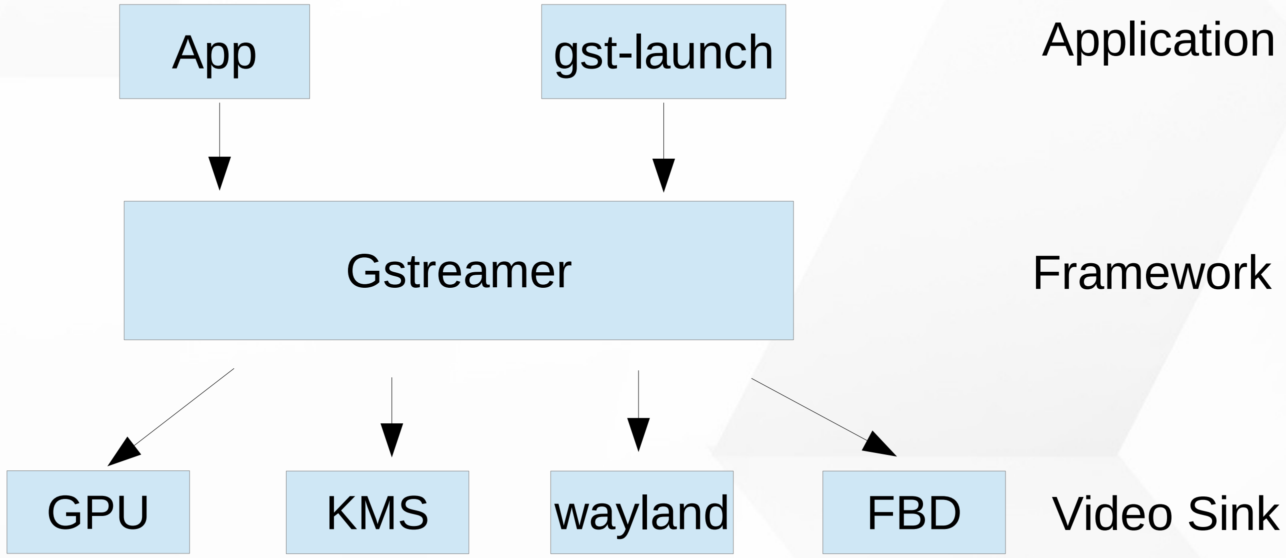
Gstreamer - Tool

- Gst-typefind-1.0
  - Check Serenity-DVD-320x240.m4v what kind of file type in gstreamer
  - gst-typefind-1.0 ./Serenity-DVD-320x240.m4v



```
rock@rockpi4b:~$ gst-typefind-1.0 ./Serenity-DVD-320x240.m4v
./Serenity-DVD-320x240.m4v - video/quicktime, variant=(string)iso
```

Gstereamer - Video



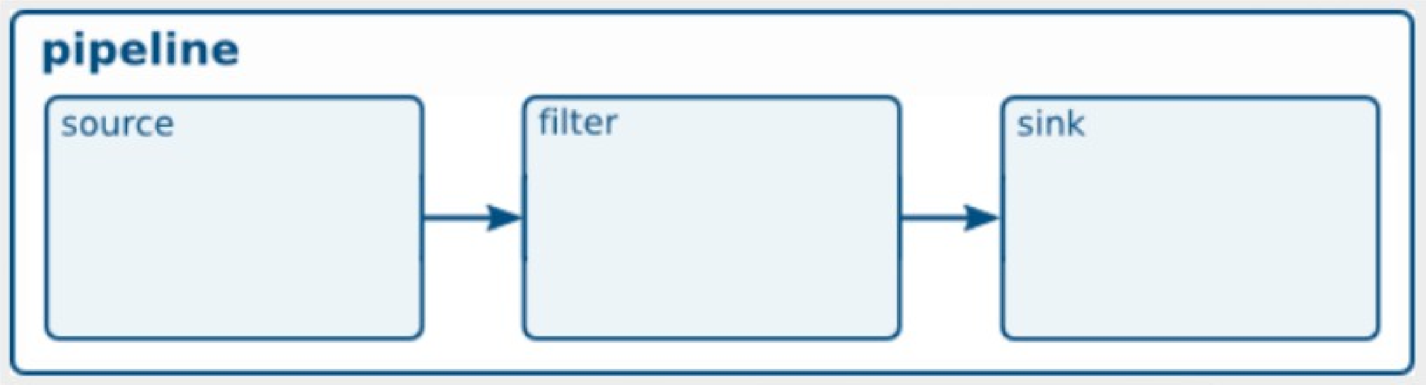
GPU : Use OpenGL to Display

KMS : Use Kernel Mode Setting to Display

Wayland : Use Wayland protocol to Display

FBD : Use Frame Buffer device to Display

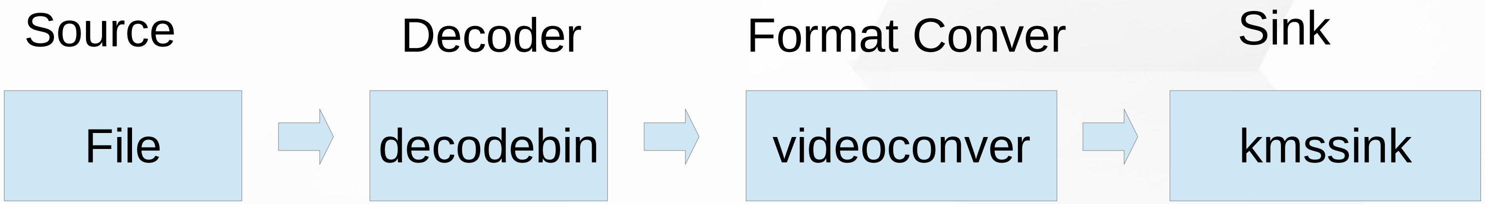
Play Video Test Stream



```
gst-launch-1.0 videotestsrc ! video/x-raw, width=1280, height=720 ! kmssink
```

Play a H.264 video

```
gst-launch-1.0 filesrc
location=/oem/200frames_count.h264 ! \
decodebin name=dec ! \
videoconvert ! \
kmssink
```



Source

Decoder

Format Conver

Sink

File

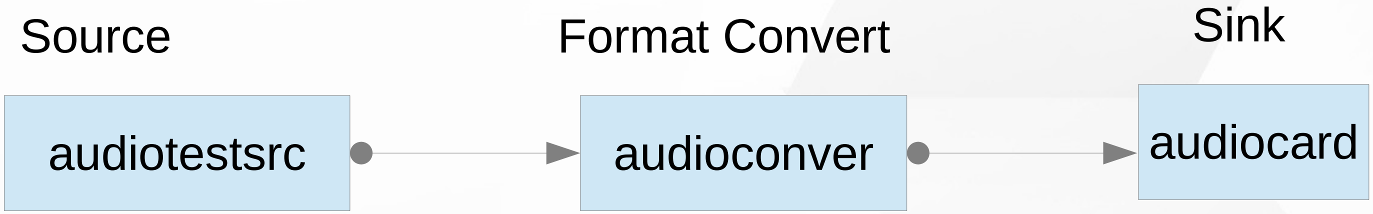
decodebin

videoconver

kmssink

Play a Audio Test

```
gst-launch-1.0 audiotestsrc ! audioconvert ! alsasink device-
name=rockchipes8316c
```



Source

audiotestsrc

Format Convert

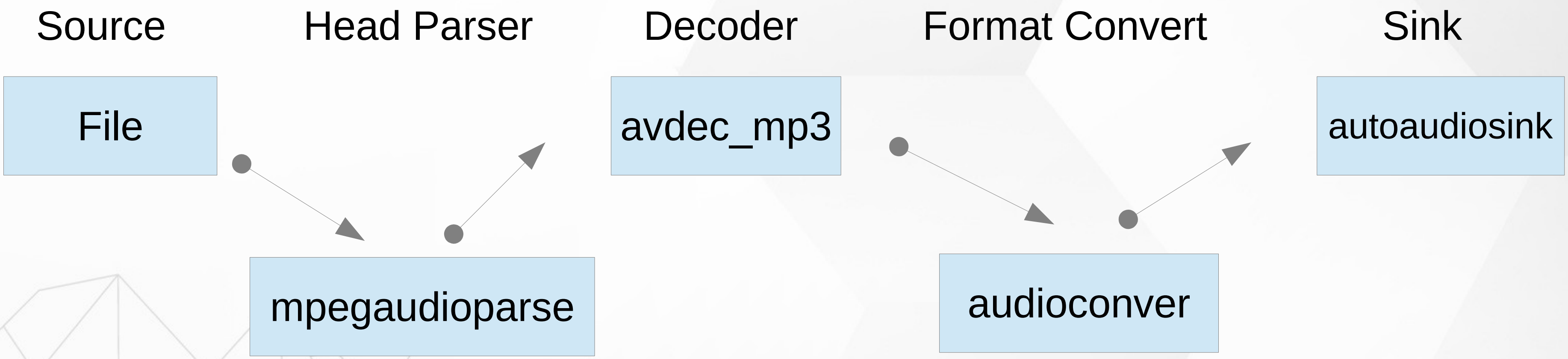
audioconver

Sink

audiocard

Play a MP3

```
gst-launch-1.0 filesrc location="/home/cadtc/audio/piano2-CoolEdit.mp3" ! \
mpegaudioparse ! \
mpg123audiodec ! \
audioconvert ! autoaudiosink
```



Source

Head Parser

Decoder

Format Convert

Sink

File

mpegaudioparse

avdec_mp3

audioconver

autoaudiosink

ALSA Tool

- ALSA Utile
  - **aplay**
    - Play a WAV file
  - **arecord**
    - Record a sound
  - **alsamixer**
    - A graph tool for adjusting audio gain
  - **amixer**
    - A console tool for adjusting audio gain

ALSA Tool

ALSA Utile

- **aplay**
  - aplay -Dsysdefault:CARD=rockchipes8316c /usr/share/sounds/alsa/Front_Center.wav
  - aplay -Dsysdefault:CARD=HDMICODEC /usr/share/sounds/alsa/Front_Center.wav
- **arecord**
  - arecord -Dhw:0,0 -r 44100 -t wav -f CD -d 5 /tmp/test.wav
- **alsamixer**
  - alasmixer
- **amixer**
  - amixer scontrols | less
  - amixer sget 'HP' 0%
  - amixer sset 'HP' 0%

WiFi and Network

Basic Network Tool

- ifconfig → Network setting check
- ping → Network package check
- iperf3 → perform network throughput tests
- dhcpc → used for automatic retrieving of

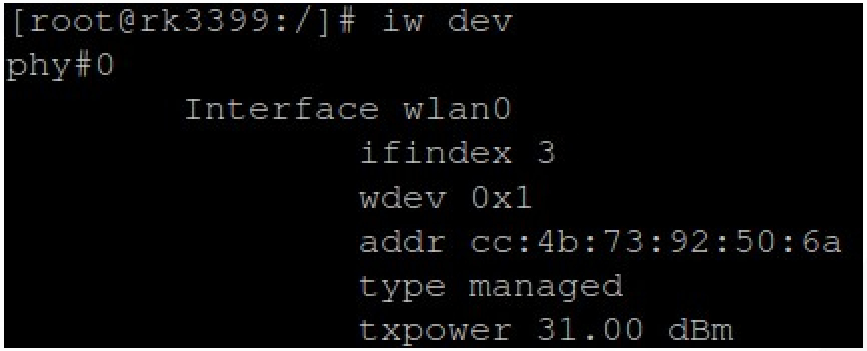
WPA/WPA2

- iw → Finding the WiFi device name
  - Scan SSID

- wpa_supplicant
  - For connecting to a WPA/WPA2 network

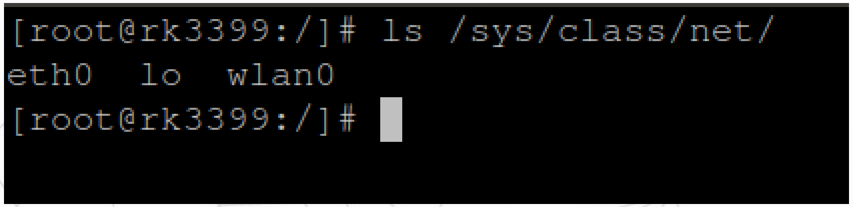
WPA/WPA2 - Device

$ iw dev



```
[root@rk3399:/]# iw dev
phy#0
        Interface wlan0
                ifindex 3
                wdev 0x1
                addr cc:4b:73:92:50:6a
                type managed
                txpower 31.00 dBm
```

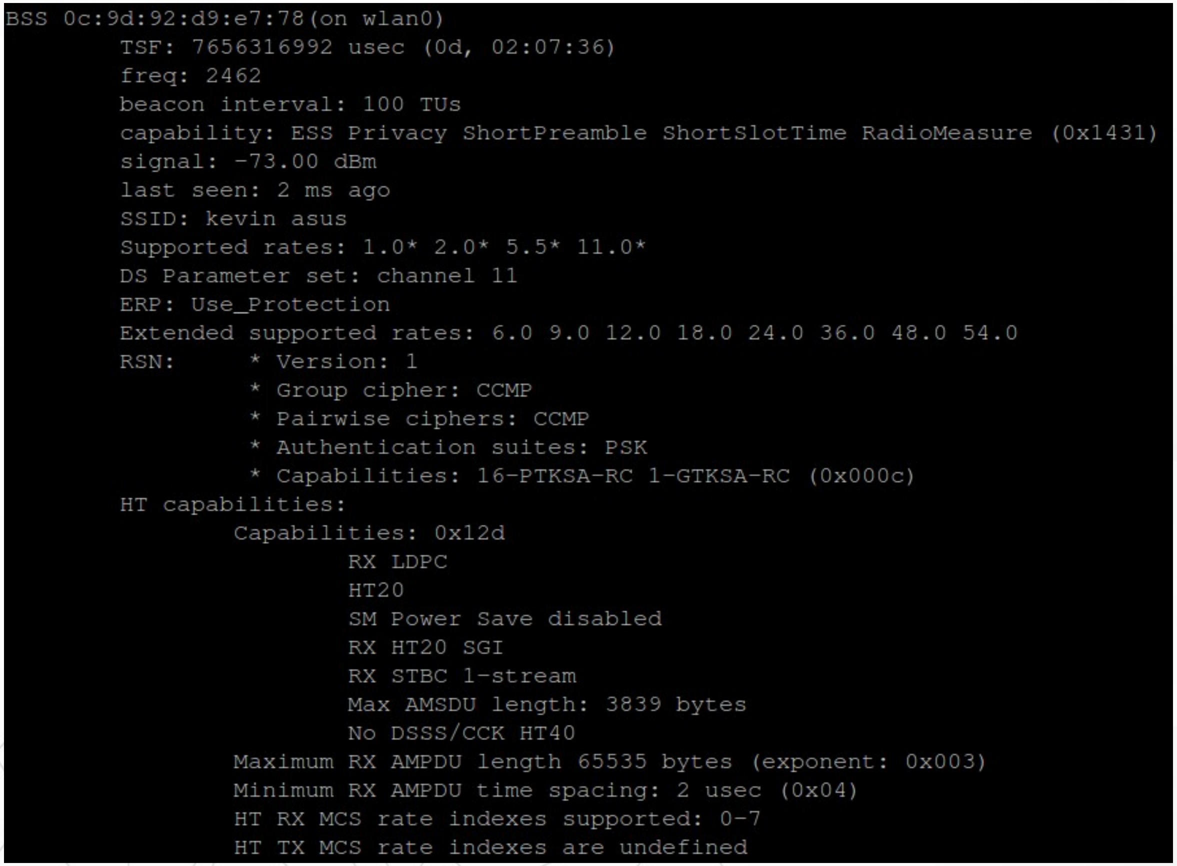
$ ls /sys/class/net



```
[root@rk3399:/]# ls /sys/class/net/
eth0  lo  wlan0
[root@rk3399:/]#
```

WPA/WPA2 - iw

$ iw wlan0 scan



```
BSS 0c:9d:92:d9:e7:78(on wlan0)
        TSF: 7656316992 usec (0d, 02:07:36)
        freq: 2462
        beacon interval: 100 TUs
        capability: ESS Privacy ShortPreamble ShortSlotTime RadioMeasure (0x1431)
        signal: -73.00 dBm
        last seen: 2 ms ago
        SSID: kevin asus
        Supported rates: 1.0* 2.0* 5.5* 11.0*
        DS Parameter set: channel 11
        ERP: Use_Protection
        Extended supported rates: 6.0 9.0 12.0 18.0 24.0 36.0 48.0 54.0
        RSN:     * Version: 1
                 * Group cipher: CCMP
                 * Pairwise ciphers: CCMP
                 * Authentication suites: PSK
                 * Capabilities: 16-PTKSA-RC 1-GTKSA-RC (0x000c)
        HT capabilities:
                Capabilities: 0x12d
                        RX LDPC
                        HT20
                        SM Power Save disabled
                        RX HT20 SGI
                        RX STBC 1-stream
                        Max AMSDU length: 3839 bytes
                        No DSSS/CCK HT40
                Maximum RX AMPDU length 65535 bytes (exponent: 0x003)
                Minimum RX AMPDU time spacing: 2 usec (0x04)
                HT RX MCS rate indexes supported: 0-7
                HT TX MCS rate indexes are undefined
```

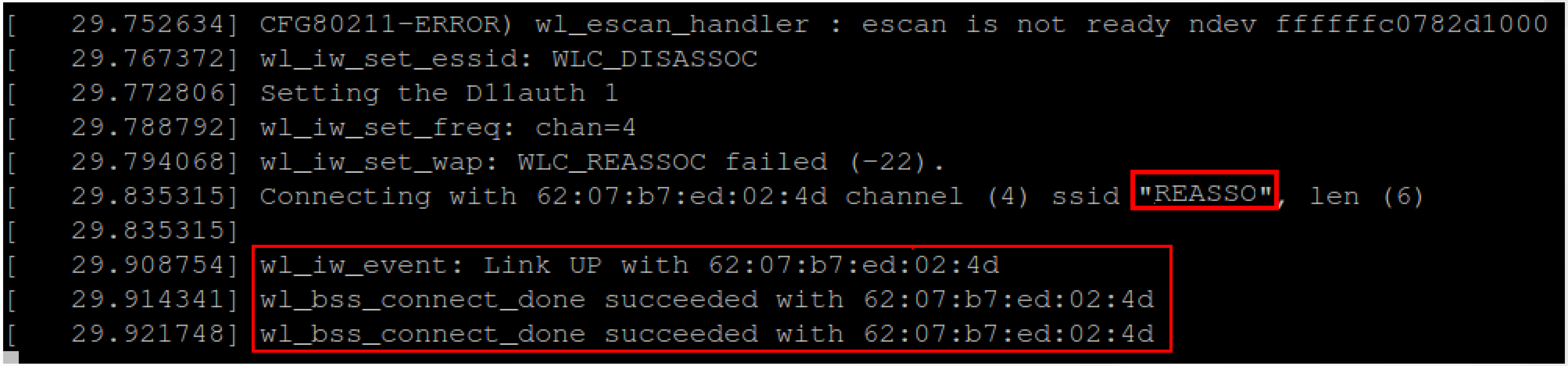
WPA/WPA2 – SSID and PASSWD

```
$ wpa_passphrase “SSID” > /etc/wpa_supplicant.conf
```

```
ctrl_interface=/var/run/wpa_supplicant
update_config=1
ap_scan=1

network={
	ssid="ssid"
	#psk="testtest"
	psk="password"
}
```

WPA/WPA2 - Connect

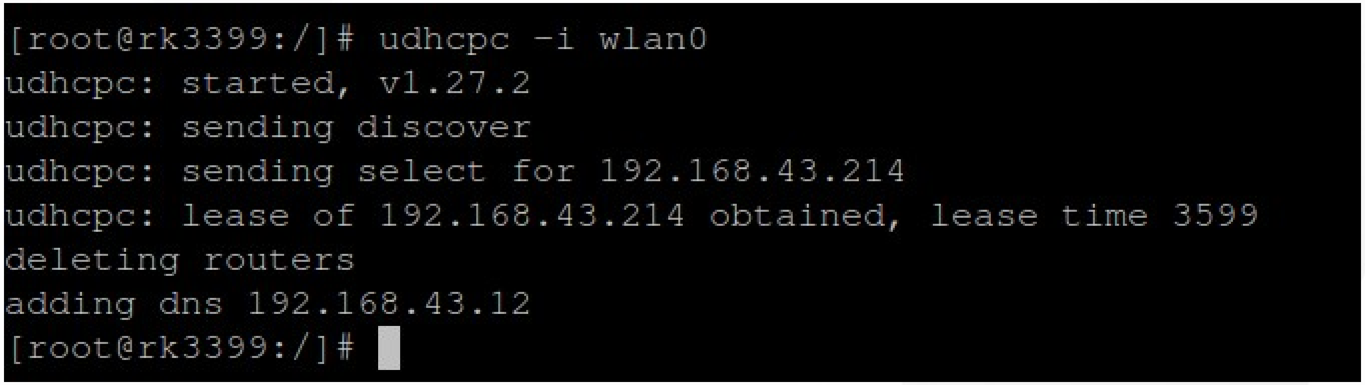
$ wpa_supplicant -B -D wext -i wlan0 -c /etc/wpa_supplicant.conf



```
[   29.752634] CFG80211-ERROR) wl_escan_handler : escan is not ready ndev ffffffc0782d1000
[   29.767372] wl_iw_set_essid: WLC_DISASSOC
[   29.772806] Setting the D11auth 1
[   29.788792] wl_iw_set_freq: chan=4
[   29.794068] wl_iw_set_wap: WLC_REASSOC failed (-22).
[   29.835315] Connecting with 62:07:b7:ed:02:4d channel (4) ssid "REASSO", len (6)
[   29.835315]
[   29.908754] wl_iw_event: Link UP with 62:07:b7:ed:02:4d
[   29.914341] wl_bss_connect_done succeeded with 62:07:b7:ed:02:4d
[   29.921748] wl_bss_connect_done succeeded with 62:07:b7:ed:02:4d
```

WPA/WPA2 - DHCP

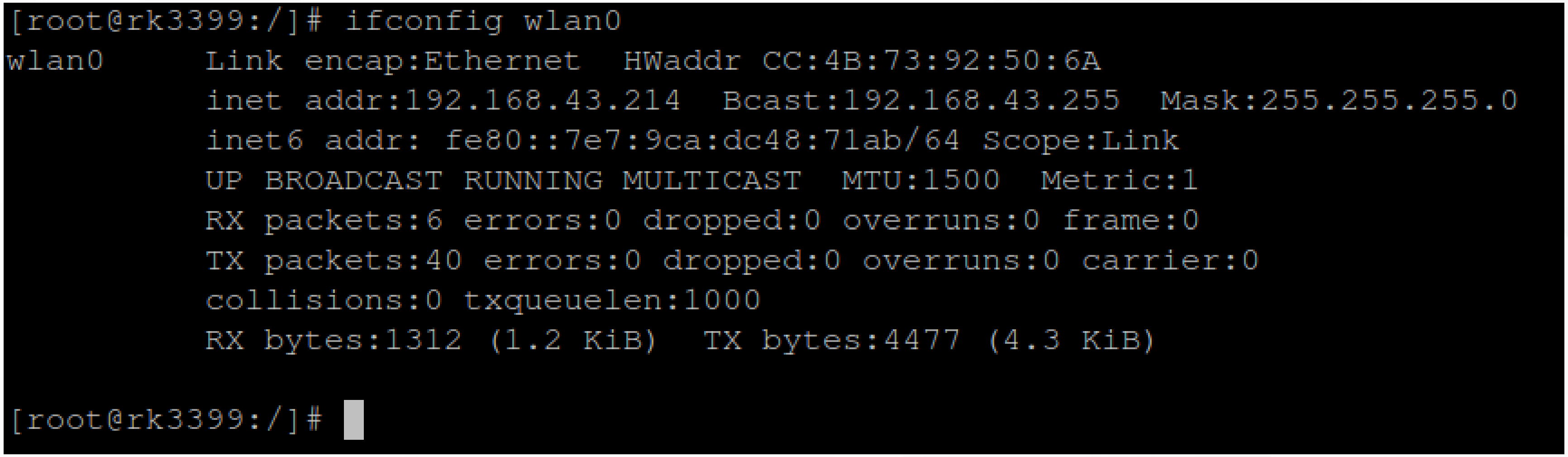
$ udhcpc -i wlan0



```
[root@rk3399:/]# udhcpc -i wlan0
udhcpc: started, v1.27.2
udhcpc: sending discover
udhcpc: sending select for 192.168.43.214
udhcpc: lease of 192.168.43.214 obtained, lease time 3599
deleting routers
adding dns 192.168.43.12
[root@rk3399:/]#
```

WPA/WPA2 - IP

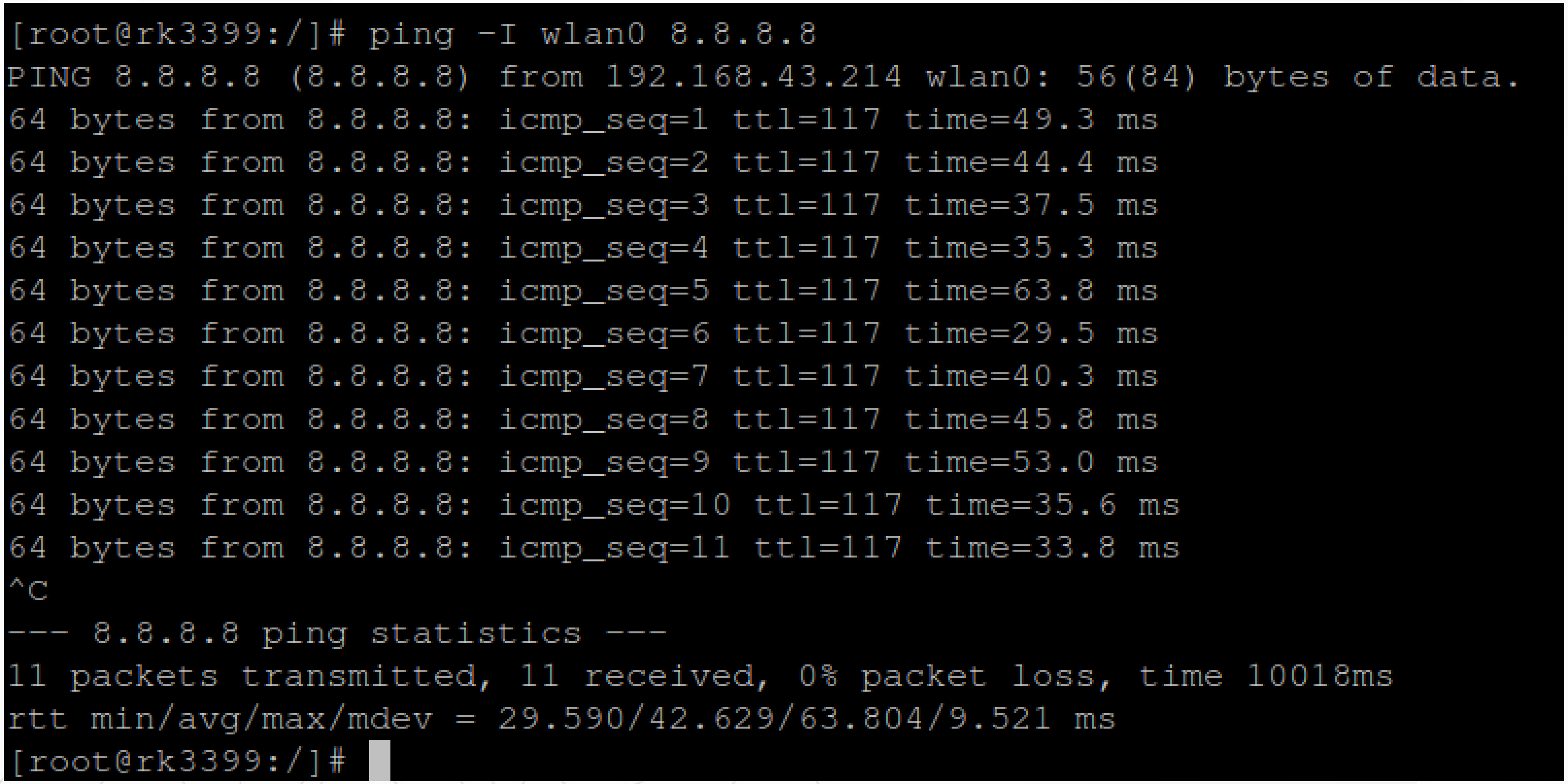
$ ifconfig wlan0



```
[root@rk3399:/]# ifconfig wlan0
wlan0     Link encap:Ethernet  HWaddr CC:4B:73:92:50:6A
          inet addr:192.168.43.214  Bcast:192.168.43.255  Mask:255.255.255.0
          inet6 addr: fe80::7e7:9ca:dc48:71ab/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:6 errors:0 dropped:0 overruns:0 frame:0
          TX packets:40 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1312 (1.2 KiB)  TX bytes:4477 (4.3 KiB)

[root@rk3399:/]# 
```

WPA/WPA2 - Ping

$ Ping 8.8.8.8 (Google)

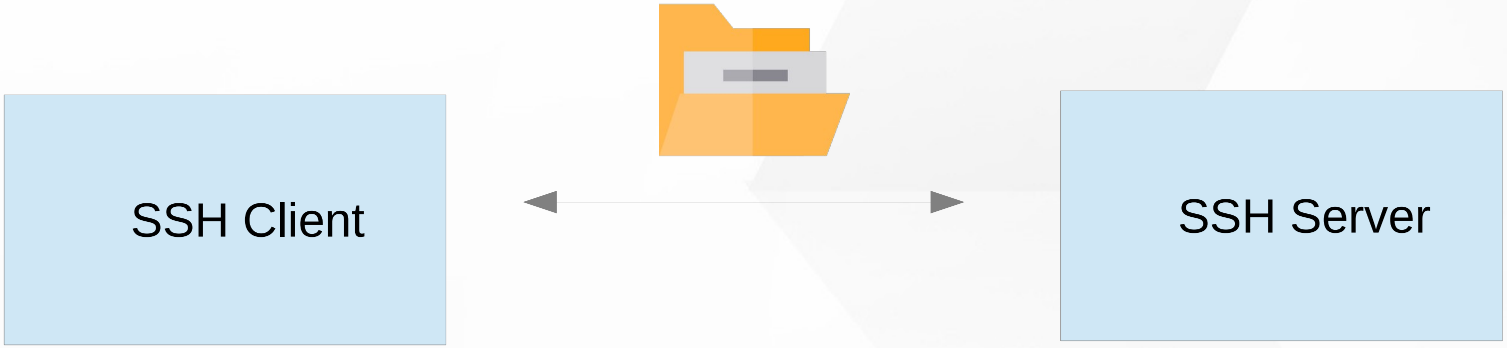


```
[root@rk3399:/]# ping -I wlan0 8.8.8.8
PING 8.8.8.8 (8.8.8.8) from 192.168.43.214 wlan0: 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=117 time=49.3 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=117 time=44.4 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=117 time=37.5 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=117 time=35.3 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=117 time=63.8 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=117 time=29.5 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=117 time=40.3 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=117 time=45.8 ms
64 bytes from 8.8.8.8: icmp_seq=9 ttl=117 time=53.0 ms
64 bytes from 8.8.8.8: icmp_seq=10 ttl=117 time=35.6 ms
64 bytes from 8.8.8.8: icmp_seq=11 ttl=117 time=33.8 ms
^C
--- 8.8.8.8 ping statistics ---
11 packets transmitted, 11 received, 0% packet loss, time 10018ms
rtt min/avg/max/mdev = 29.590/42.629/63.804/9.521 ms
[root@rk3399:/]#
```

SSH

SSH

- Secure SHell protocol
- SSH Client
- SSH Server



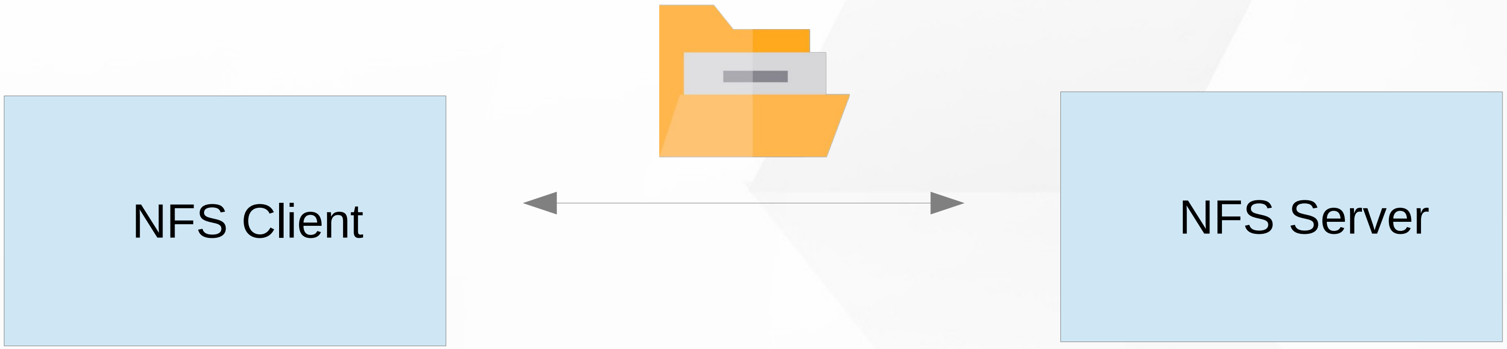
SSH

- SSH Client
  - # sudo apt-get install ssh
  - https://slashembeddedlinux.blogspot.com/p/tmp.html

NFS

NFS

- Network File System
- NFS Client
- NFS Server

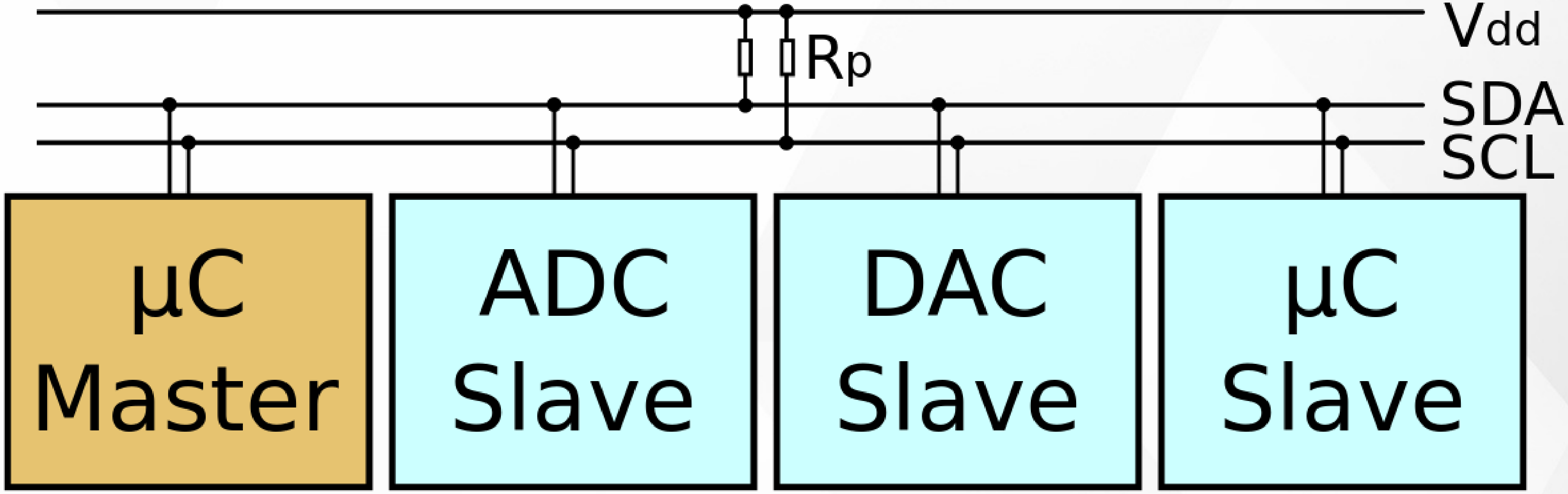


NFS

- https://slashembeddedlinux.blogspot.com/p/tmp.html

I2C Tool

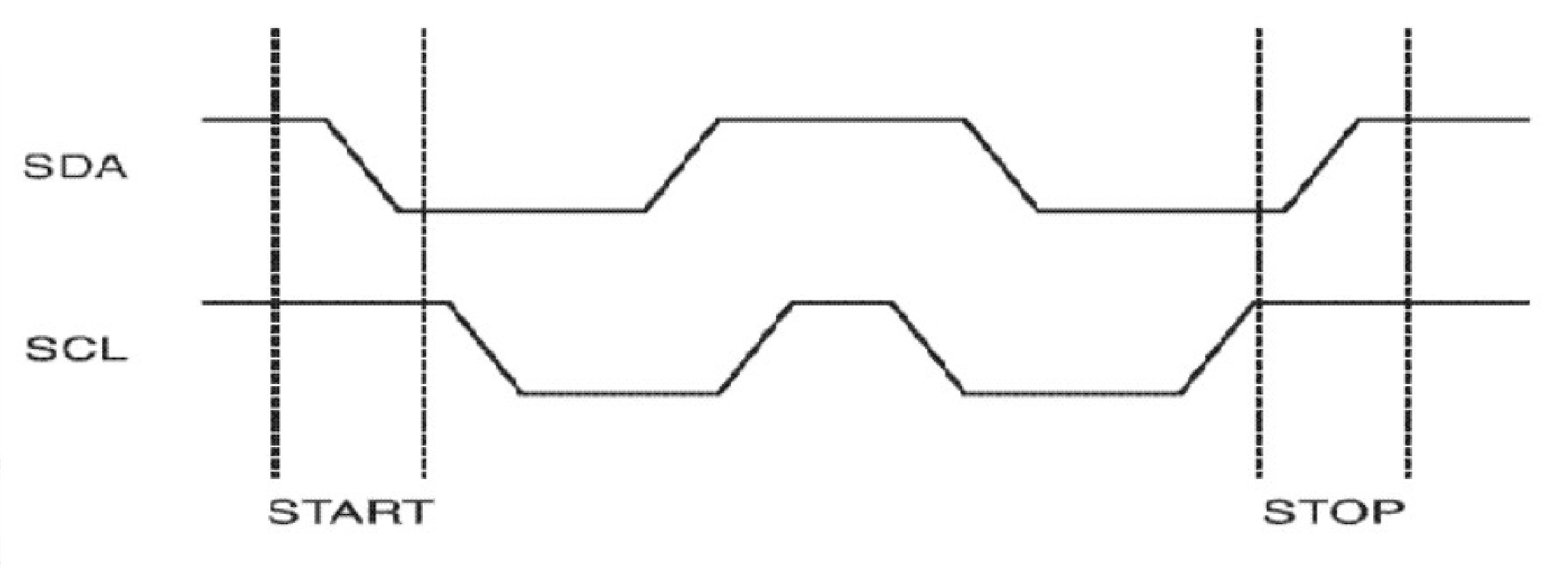
I2C Driver



https://zh.wikipedia.org/wiki/I%C2%B2C

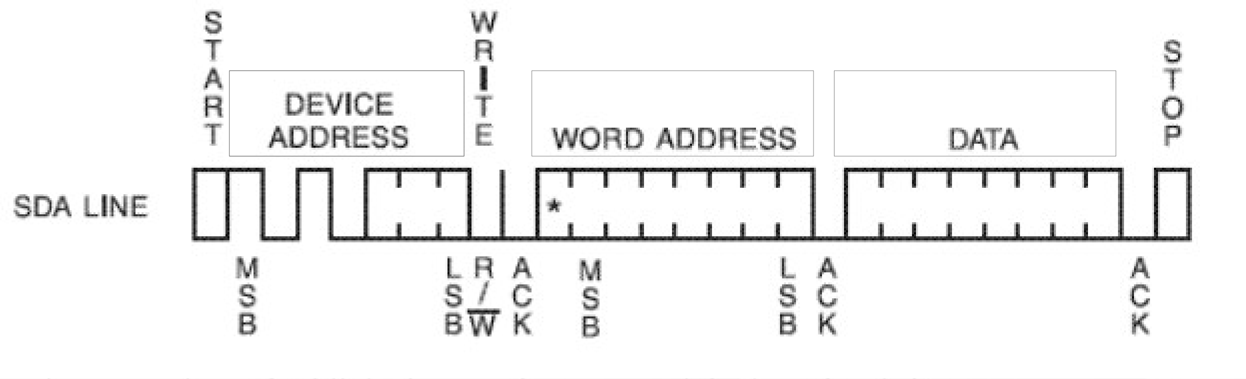
I2C protocol

- Serial bus
  - SDA data line
  - SCL clock line



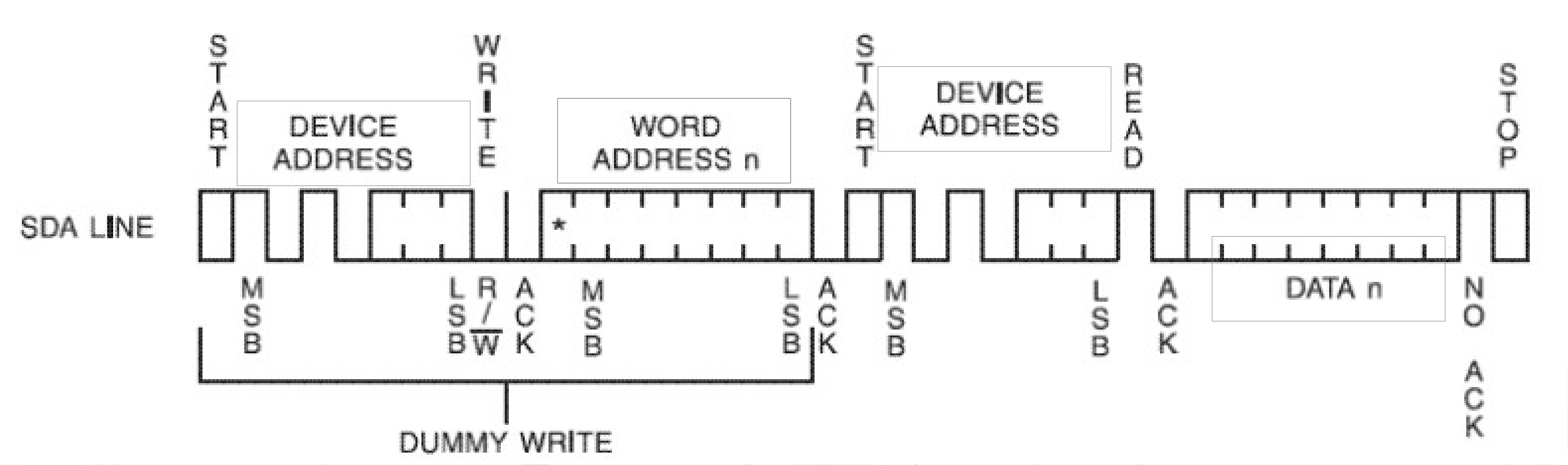
I2C protocol

- Write
  - byte write
  - page write
- Device address
- Read/write bit : 0
- ACK



I2C protocol

- Read
  - byte read
  - page read
- Device address
- **Read/write bit : 1**
- ACK



I2C Dev Interface

- i2c tool
  - i2cset, i2cget, i2cdump
  - i2cdetect -l
- /dev/i2c-x
  - /dev/i2c-0, /dev/i2c-1, /dev/i2c-2 ...
- /sys/class/i2c-dev/
  - i2c-0 i2c-1 i2c-2 i2c-3 i2c-7 i2c-8 ...

I2C Dev Interface

- Documentation/i2c/dev-interface
- i2c-tools
  - i2cdump
  - i2cdetect
  - i2cget
  - i2cset