How to capture video using v4l2 and streaming video using ffmpeg

Reference:
Method adapted from boneCV:
boneCV: https://github.com/derekmolloy/boneCV
http://derekmolloy.ie/beaglebone/beaglebone-video-capture-and-image-processing-on-embedded-linux-using-opencv/
http://derekmolloy.ie/udp-video-streaming-beaglebone-black/

Useful previous cmpt433 how-to guides:
1. http://www.cs.sfu.ca/CourseCentral/433/bfraser/other/2015-student-howtos/RecordingWebcamVideos.pdf
2. http://www.cs.sfu.ca/CourseCentral/433/bfraser/other/2014-student-howtos/WebCam.pdf
3. http://www.cs.sfu.ca/CourseCentral/433/bfraser/other/2016-student-howtos/WebCamVideoOpenCV.pdf

How to capture video

1. BBG comes with v4l2, to check
whereis v4l2-ctl
v4l2-ctl: /usr/bin/v4l2-ctl

Some v4l2 commands(after connect camera to BBG):
v4l2-ctl –list-formats
...

v4l2-ctl –list-device
UVC Camera (046d:0825) (usb-musb-hdrc.1.auto-1):
	/dev/video0

v4l2-ctl --list-formats
ioctl: VIDIOC_ENUM_FMT
	Index : 0
	Type : Video Capture
	Pixel Format: 'YUYV'
	Name : YUYV 4:2:2

	Index : 1
	Type : Video Capture
	Pixel Format: 'MJPG' (compressed)
	Name : Motion-JPEG

v4l2-ctl --get-priority
Priority: 2

v4l2-ctl -D
Driver Info (not using libv4l2):

```
Driver name   : uvcvideo
Card type     : UVC Camera (046d:0825)
Bus info      : usb-musb-hdrc.1.auto-1
Driver version: 4.4.9
Capabilities  : 0x84200001
        Video Capture
        Streaming
        Extended Pix Format
        Device Capabilities
Device Caps   : 0x04200001
        Video Capture
        Streaming
        Extended Pix Format
```

2. how to capture video
1. # apt-get install libv4l-dev

2. store revised capture.c to NFS server

3. enter the NFS directory
cd /mnt/remote/...

compile capture.c on BBG
make
or
gcc capture.c -lv4l2 -o capture

capture video and store it in output.raw
./captureVideo
or
./capture -F -c 300 -o > output.raw
-F force format to YUYV (after revision)
-c | --count   Number of frames to grab [100] - use 0 for infinite
-o | --output   Outputs stream to stdout
-h | --help

4. after capturing, a output.raw file will be produced. Convert raw file to mp4
#./raw2mpg4
or
ffmpeg -f rawvideo -vcodec rawvideo -s 320x240 -r 25 -pix_fmt yuv420p -i output.raw -c:v libx264 -preset ultrafast -qp 0 output.mp4

How to stream video using udp:

1. install ffmpeg on BBG
First, we need to add backports to our sources.list because we are running debian 8.4 on BBG
cd /etc/apt/sources.list.d/

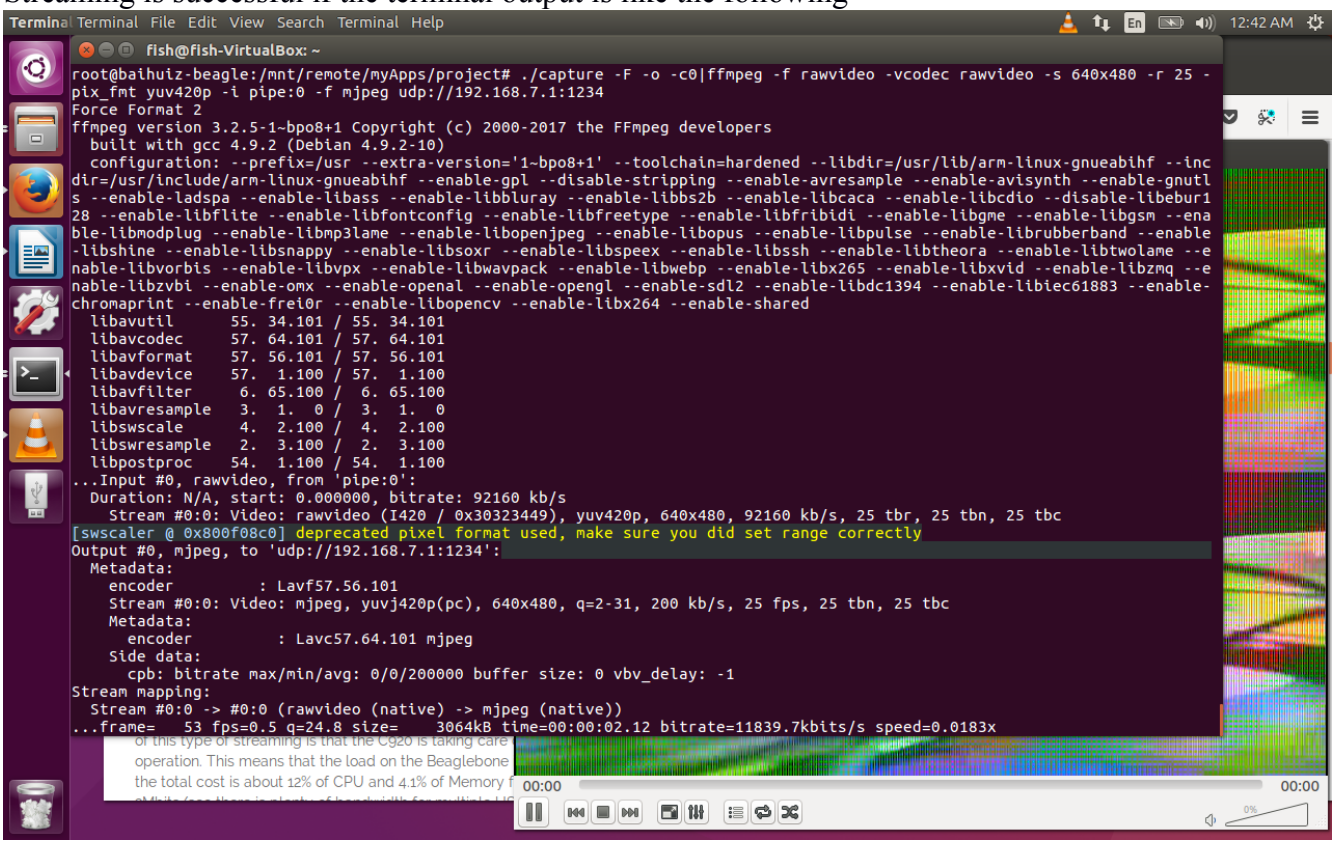
modify sources.list and add the following line to the end of the file
deb http://ftp.debian.org/debian jessie-backports main

then ffmpeg can be installed using apt-get
apt-get update
apt-get install ffmpeg

2. install VLC media player on host
```
$ sudo apt update
$ sudo apt install vlc
```

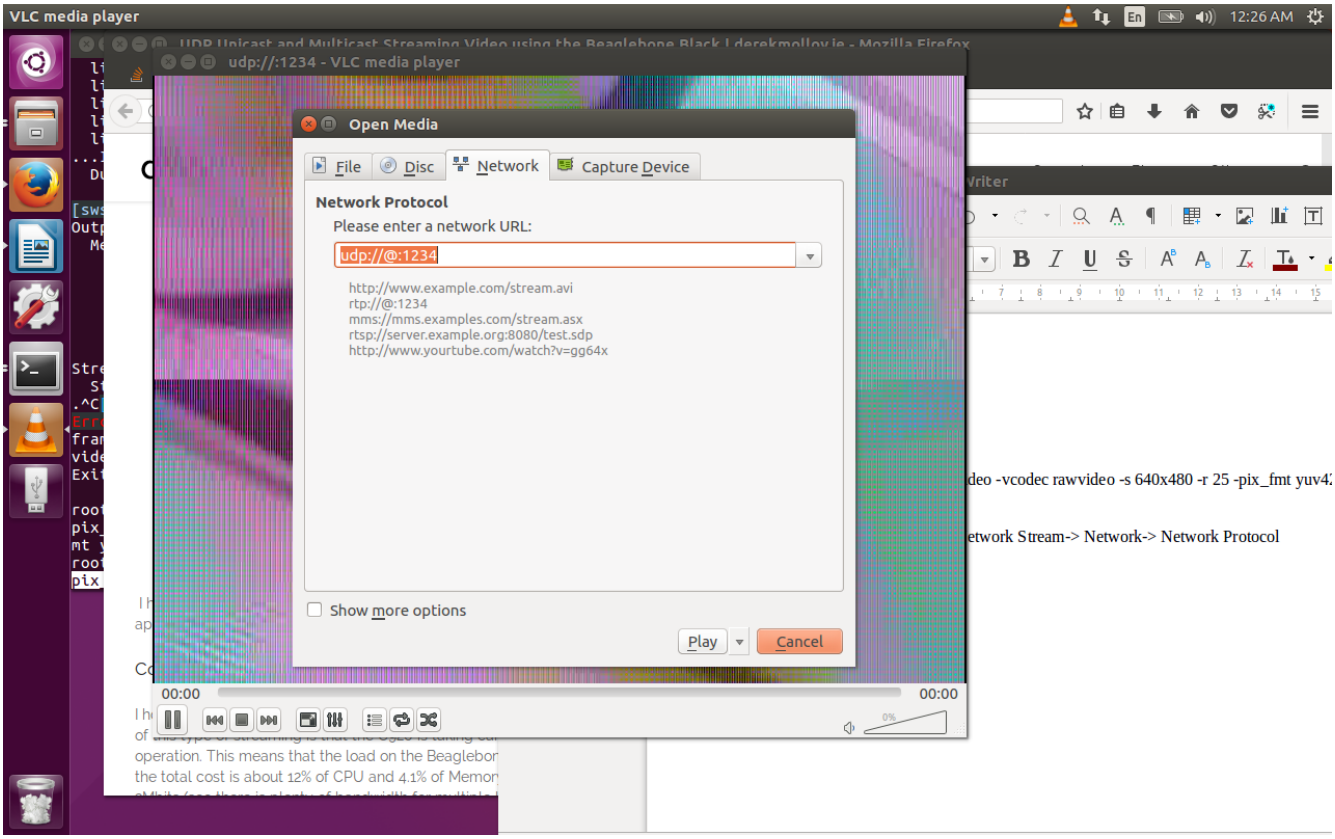
3. on BBG
./streamVideoUDP
or
./capture -F -o -c0|ffmpeg -f rawvideo -vcodec rawvideo -s 640x480 -r 25 -pix_fmt yuv420p -i pipe:0 -f mjpeg udp://192.168.7.1:1234

Streaming is successful if the terminal output is like the following



on host, open VLC, Media->open Network Stream-> Network-> Network Protocol->Please enter a network URL:
udp://@:1234

then click play



deo -vcodec rawvideo -s 640x480 -r 25 -pix_fmt yuv4

etwork Stream-> Network-> Network Protocol