USER GUIDE

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1 INTRODUCTION

Raspberry Pi series are low cost credit card sized single board computers. The Raspberry Pi models feature a Broadcom SoC that includes an and an on chip (GPU). Raspberry Pi uses SD card that facilitates users to swap out different versions of the operating system or software updates, hence, speeding the development and testing process. This is a great way to develop new applications/software and show these to customers in remote locations or at trade shows.

The RDK media client software runs on the Raspberry Pi 2 and 3 devices and provides all the features and functionality of an emulator along with an enhanced WPE browser.

Please contact us at info@RDKcentral.com for more information.

2 PURPOSE

This document contains set-up and other information to run the RDK-V gateway stack on a Raspberry Pi 2 and Raspberry Pi 3 devices.

3 REQUIRED EQUIPMENT

The equipment listed below is required for complete functionality of the standalone environment. The only devices that are tested to work properly in this solution are the specific brands and models listed below. Support for other types of equipment is not available at this time.

1. **Two Raspberry Pi 2 or Raspberry Pi 3 device**

2. **Standard USB keyboard**

3. **Television set/monitor with HDMI input**

4. **Ethernet cable**

5. **SD Card**

6. **TSOP4838 GPIO IR receiver**

7. **Xfinity-XR2 Remote Control**

4 SYSTEM SET-UP
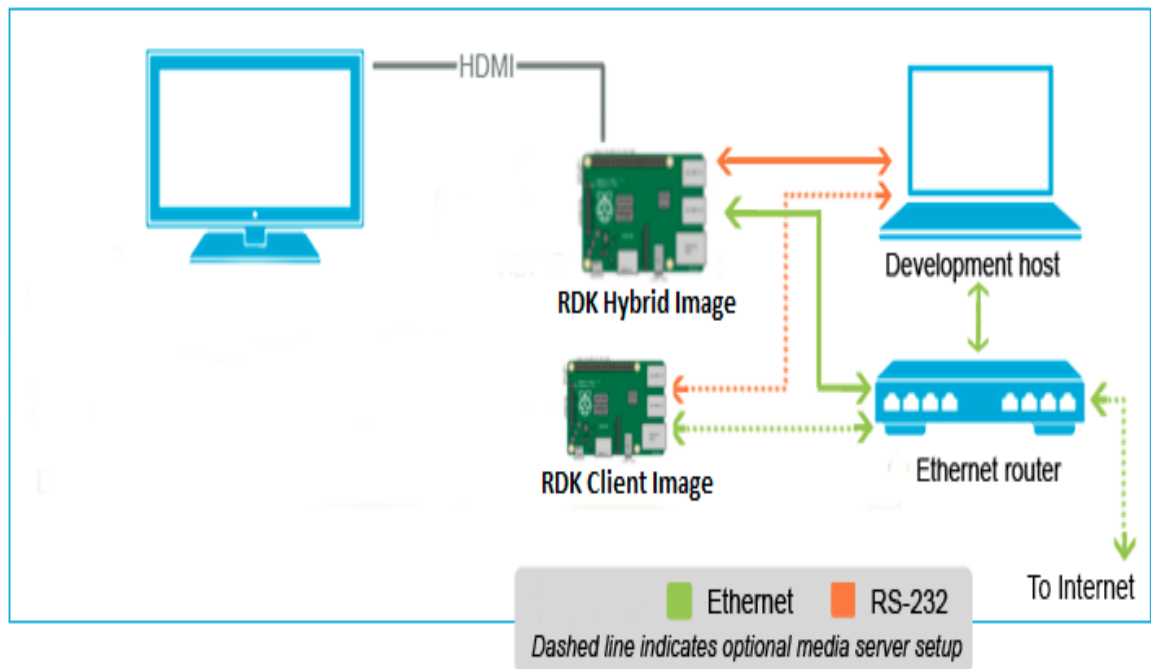
1. Connect TV/Monitor to HDMI Video Output

2. Connect Ethernet cable to LAN port.

    a. The other end of the Ethernet cable should be connected to the network where DHCP server is running so that the Raspberry Pi device gets assigned an IP address on boot-up.

    b. Ensure that Raspberry Pi having hybrid image flashed, is also in the same network.

    c. Connectivity to Internet is required only if you want to play OTT content such as videos from YouTube.

3. Connect Standard Keyboard to one of USB ports

4. Connect your IR receiver to the board per the diagram displayed below.

    a. Pin 1 is DATA, connect it to GPIO 18 (Pin 12) on Raspberry-Pi

    b. Pin 2 is GND, connect it to GROUND (Pin 6) on Raspberry-Pi

    c. Pin 3 is POWER, connect it to 5V (Pin 1) on Raspberry-Pi
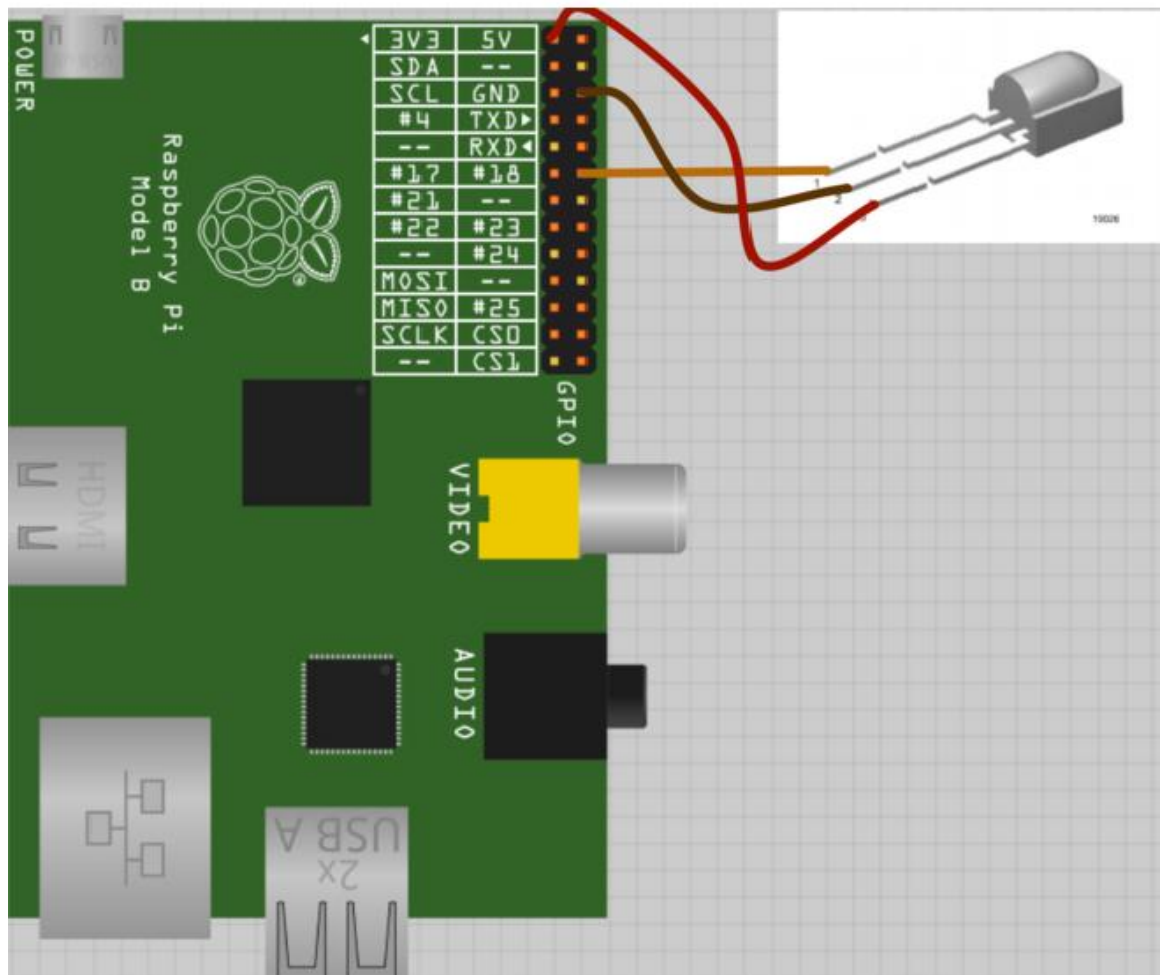
5. Insert the SD card into Micro SD Card Slot

6. Connect Power cable to Micro USB power Input

5 HDP CONFIGURATION

5.1 Image Flashing

1. **Linux:**

    - Insert an SD card in either the SD card port of the laptop or the USB SD card reader.
    - Verify that the SD card has been detected by executing either of the commands listed below:
      - `# lsblk`

```
◦ # sudo fdisk –l
```

Notes: Remember to look at the size of the device to be sure that you have identified the device number associated with your SD card. We use "dd" command to write the generated image on the SD card, thus an incorrect identification may delete data from your hard drive or other device of importance. In most case, the hard disk drive will be at /dev/sda.

- Type the following command to ensure that the partitions, if present, on the SD card are not mounted

```
◦ # mount
```

- Repeat the below command to unmount all the mounted partition present on the SD card.

```
◦ # umount <partition-mountpoint>
```

- Execute the following command to flash the image on the SD card

```
◦ # sudo dd if=<r-pi sdimg> of=<SD card device> bs=1M

  for ex:
  # sudo dd if=rdk-mc-rpi.sdimg of=/dev/sdb bs=1M
```

- Repeat the below command to unmount all the mounted partition present on the SD card.

```
◦ # umount <partition-mountpoint>
```

- Remove the SD card and insert it to the Raspberry Pi SD card slot

- Similarly flash the hybrid image on another SD Card and insert it to another Raspberry Pi SD Card slot

- Bring up both the devices

2. Mac

- Follow the instructions provided in the link below to flash the image:

3. Windows

- Follow the instructions provided in the link below to flash the image:

5.2   Modify partition size

Increase size of "ext3" File system based partition of SDCard. The increased partition is required to copy media files for streaming. Any tools/utilities can be used to alter partition size. The explanations captured below are using "Gparted" a linux-based tool to alter partition size.

Follow instruction given below:-

- Install 'Gparted' using below instruction:-

```
$ sudo apt-get install gparted
```

- Once Gparted installed successfully. Open 'Gparted' with root privileges:-

```
rdk@rdk-Vostro-1014:~$
rdk@rdk-Vostro-1014:~$ sudo gparted
=====================
libparted : 2.3
=====================

(gpartedbin:5055): GLib-CRITICAL **: Source ID 7 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 6 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 26 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 25 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 85 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 84 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 92 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 91 was not found when attempting to remove it

(gpartedbin:5055): GLib-CRITICAL **: Source ID 95 was not found when attempting to remove it
```

"Gparted" graphical window shall appear.

- Select "ext3" File System based partition of SDCard to alter partition size:-
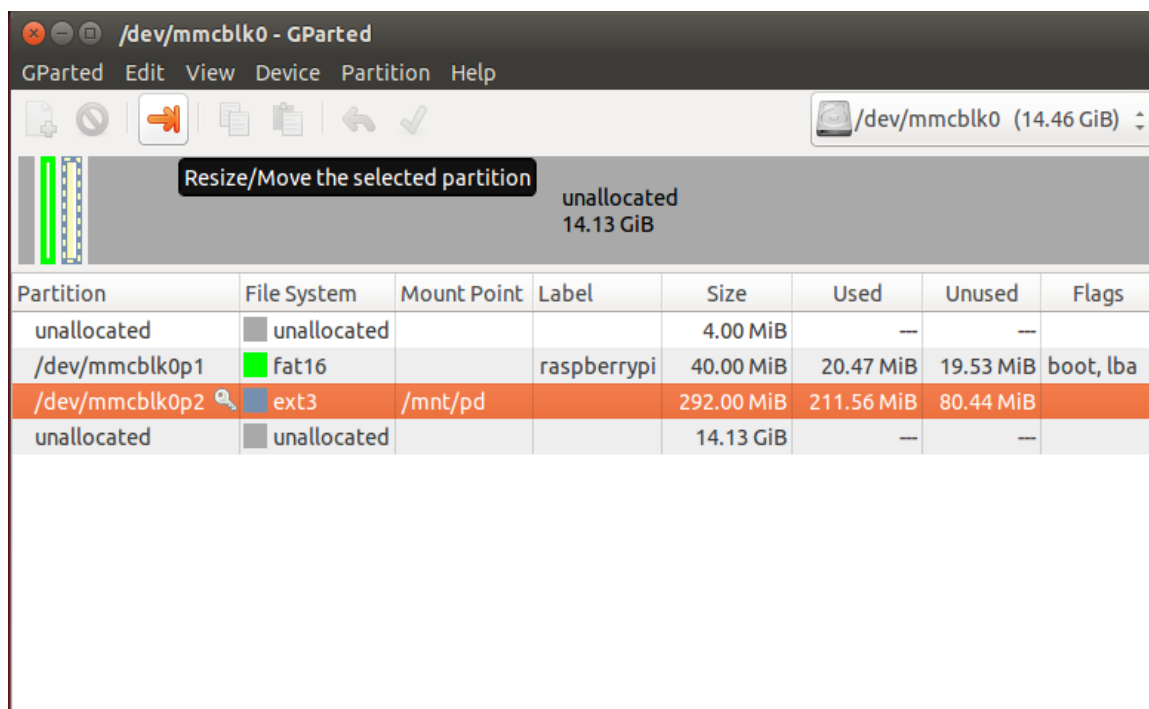
In the above snapshot, the SDCard partition "/dev/mmcblk0p2" is of "ext3" File system based partition, selected to modify the size. Click on "Resize/Move the selected partition" option.

- Enter new partition size in MBs. It is recommended to enter 2048MB at least.
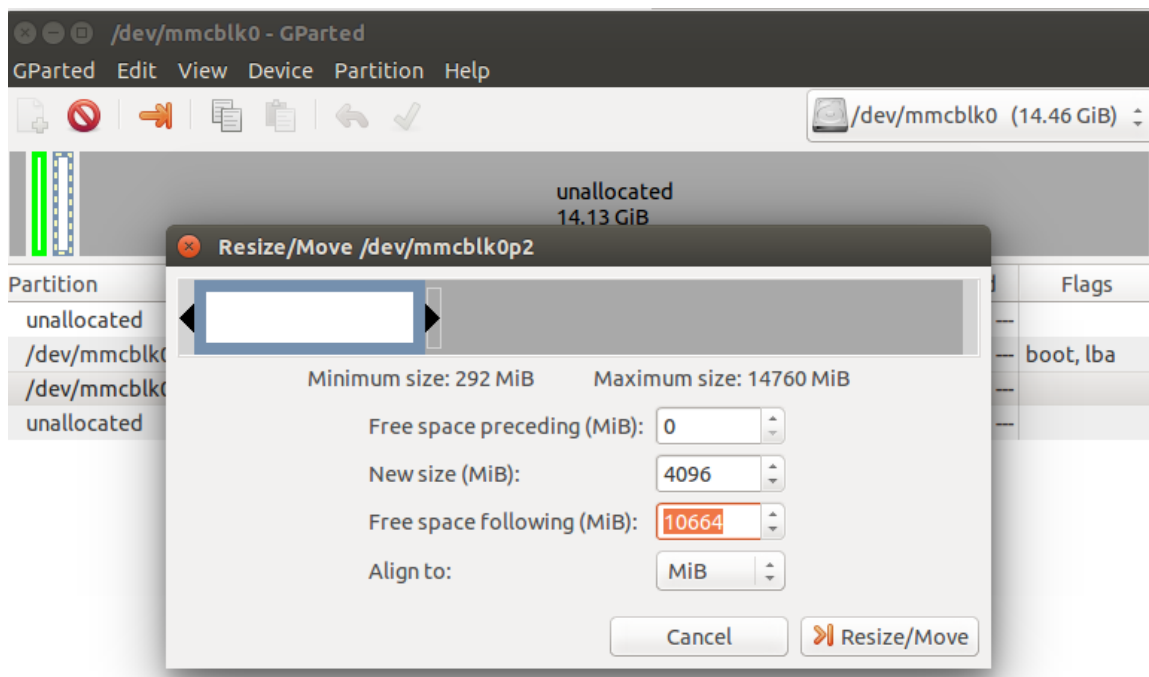
In the above snapshot, the "New Size" of selected partition is 4096 MB.

- Click on "apply all operations" to modify the size:-
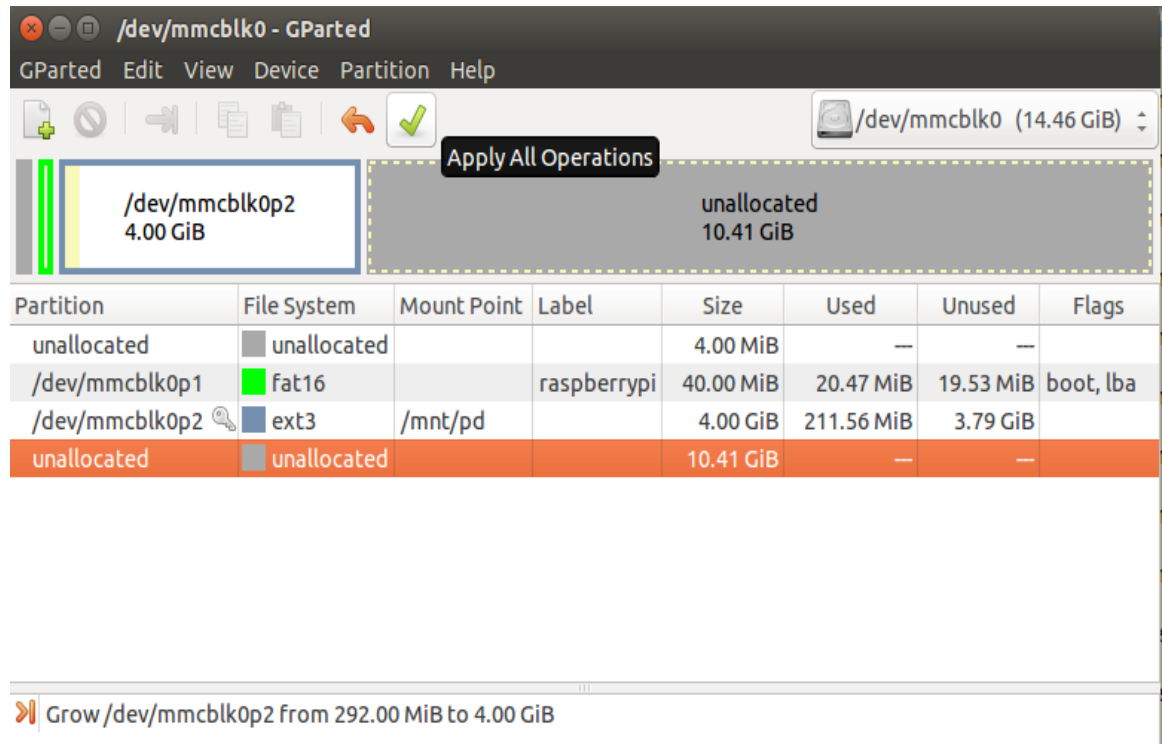
Once the operation is completed. The SDCard can be inserted into Raspberry Pi for image bring up.

5.3   Launching WPE browser

- Insert the micro SD card with the flashed RDK hybrid image in the SD card slot of Raspberry Pi.
- Plug in the power cable to boot up the Raspberry Pi device
- Type "root" when the login prompt is displayed
- Check network connectivity.

- Run following to launch XG1 guide

```
# WPELauncher http://<Hybrid image RPI ip
address>:8082/ui/guide.html
```

For ex:

WPELauncher http://10.213.51.109:8082/ui/guide.html

5.4   Media Population on the image for streaming

The hybrid implementation on Raspberry Pi emulates QAM source to provide linear channel playback by (i) reading media file present on the file system (ii) reading UDP socket on configured port number. To read media contents from media files, media files should placed in proper location at Raspberrypi. To read media contents from UDP socket, provide media contents at specified UDP socket. Use 'cvlc', 'tsplay' or any other utility for UDP data. Make necessary configuration related changes before tuning a channel from headed gateway or a client.

Rerun the 'rmfStreamer' just after making all the changes as suggested:-

- Copy your SPTS media files to /opt/www directory on Raspberry Pi:-

```
root@raspberrypi-rdk-hybrid:/opt/www# ls *.ts
TheSpiritTrailer2HD60FPS.ts              The_Hobbit_An_Unexpected_Journey_Trailer.ts
root@raspberrypi-rdk-hybrid:/opt/www#
```

  As per the snapshot, two media files present at recommended location at Raspberry pi.

- Modify config file */usr/bin/tune.config* to reflect the media file along with actual path and respective port number to readh UDP data:-

```
$ vi /usr/bin/tuner.config
modulation:8 frequency:179 /opt/www/mux1-cp.ts 2005
modulation:8 frequency:251 /opt/www/ts/channel_1.ts 2006
modulation:8 frequency:252 /opt/www/received_spts1.ts 2007
modulation:8 frequency:253 /opt/www/ts/channel 3.ts 2008
```

- Map 'sourceid' (ocap locator) present in */usr/bin/sidb.xml* with corresponding media file entry present in */usr/bin/tune.config* by mapping similar value of 'modulation_mode' and 'frequency' as shown below:-

```
<?xml version="1.0" ?>
<SIDB>
 <program sourceid="162" carrier_frequency="179" modulation_mode="8" program_number="-1" virtual_channel_number="4"></program>
 <program sourceid="163" carrier_frequency="180" modulation_mode="8" program_number="-1" virtual_channel_number="5"></program>
 <program sourceid="164" carrier_frequency="181" modulation_mode="8" program_number="-1" virtual_channel_number="5"></program>
 <program sourceid="165" carrier_frequency="179" modulation_mode="8" program_number="4671" virtual_channel_number="3"></program>
 <program sourceid="11164" carrier_frequency="251" modulation_mode="8" program_number="-1" virtual_channel_number="3"></program>
 <program sourceid="4701" carrier_frequency="252" modulation_mode="8" program_number="-1" virtual_channel_number="3"></program>
```

  Here, value of attribute 'program_number' indicates source of media contents. Eg. Value of Program_number '-1' indicates read the data from media file whereas '+ve' value of program_number indicates read media contents from UDP socket.

- Rerun the rmfStreamer with modified configuration:-
  ```
  $ kill -9 <rmfStreamer Pid>
  $ /usr/bin/rmfStreamer –config /opt/rmfconfig.ini –
  debugconfig /etc/debug.ini
  ```

- Use 'vlc', 'tsplay' or any other suitable tool/utility to generate udp packet on specific port for Raspberry Pi hybrid device. Eg. Below 'cvlc' (command line utility) used to through UDP packets.
  ```
  $ cvlc <Media File> --loop
  :sout='#transcode{vcodec=h264,acodec=mpga,ab=128,channels=2
  ,samplerate=44100}:udp{dst=<RPI IP Address>:<port number>}'
  :sout-all :sout-keep
  ```
  Where port number is the same, which is configured in '/usr/bin/tune.config'file above. Keep program_number as +ve in '/usr/bin/sidb.xml' to read live media contents from UDP socket.

6 LIVE CHANNEL PLAYBACK

Linear Channel playback is main functionality support by RaspberryPi Gateway device. RaspberryPi as Gateway device shall receive Linear Channel playback request from either MediaClient RaspberryPi device or any other client application such as VLC Player, RDK inbuilt application rmfApp etc.

6.1 Raspberry Pi Media Client

Note: This Section will be updated once Wizardkit application shall be merged into CMF repository.

6.2 VLC Client Request

Linear Channel playback is main functionality support by RaspberryPi Gateway device. RaspberryPi as Gateway device shall receive channel tuning request from other either RaspberryPi acting as Media Client or any media client application such as VLC Player, RDK inbuilt application rmfApp etc. VLC player can act as Media Client to send linear channel playback request to RaspberryPi (Gateway).

Open VLC from same network where Raspberry Pi (Gateway) connected and generate channel playback request. Use following format as below:-

http://<IP Address of Gateway Raspberry Pi>:8080/vldms/tuner?ocap_locator=ocap://<Source ID in Hexa>

Eg.

http://10.213.51.116:8080/vldms/tuner?ocap_locator=ocap://0xa2   *//0xa2 is Hexa convertion of ocap locator 162*

VLC should get IP Streaming over the network and should start the playback.

6.3 RMFApp request

RMFApp, an RDK inbuilt application, can also be used to send Linear Channel playback request to Gateway Device.

Find below steps to use rmfApp to send linear channel playback request:-

```
$ cd /usr/bin

$ export USE_GENERIC_GSTREAMER_TEE=TRUE

$ ./rmfApp

$ rmfApp-> play  http://<Ip Address of Gateway
Device>:8080/vldms/tuner?ocap_locator=ocap://<Hexa ocap locator>
```

Eg.

```
$rmfApp-> play
http://10.213.51.116:8080/vldms/tuner?ocap_locator=ocap://0xa2
```

The requested channel shall be tunned to Display device connected to the Raspberry Pi HDMI port.

7 CLOUD BASED EPG PLAYBACK SUPPORT

7.1 Youtube

To play audio/video over the internet, type the following command

```
# WPELauncher <YouTube URL>
```

Press ESC key on keyboard or EXIT key on Xfinity remote control to exit the YouTube video.

7.2 HTML5 based URLs

Integrated WPEBrowser can be used to access cloud based URLs. The WPEBrowser having media player plugins enabled by default to playback media contents.
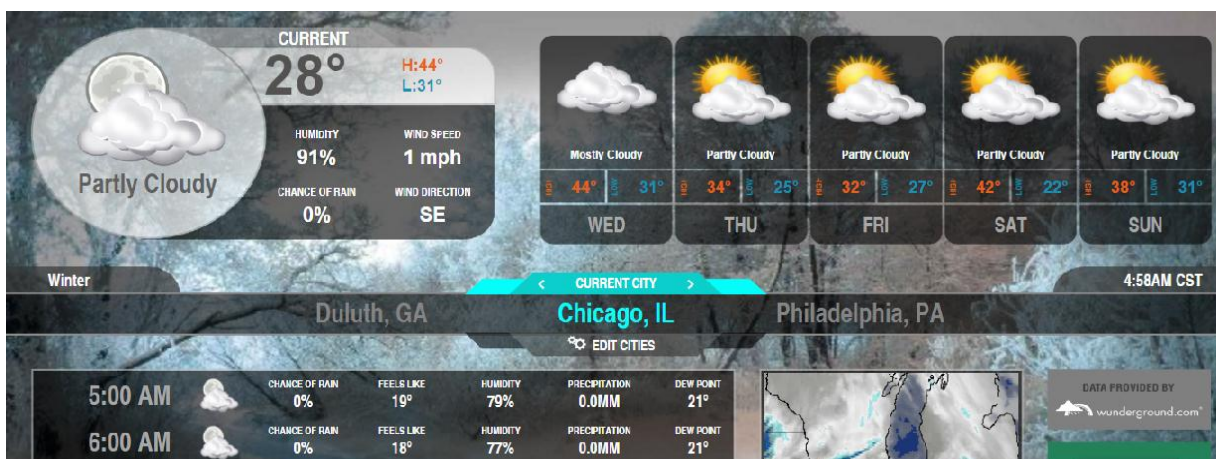
Following RDK-OTT (cloud based URL) can be used to access using WPE Browser:-

```
$ WPEBrowser http://107.21.252.26/scte/rdkott/
```
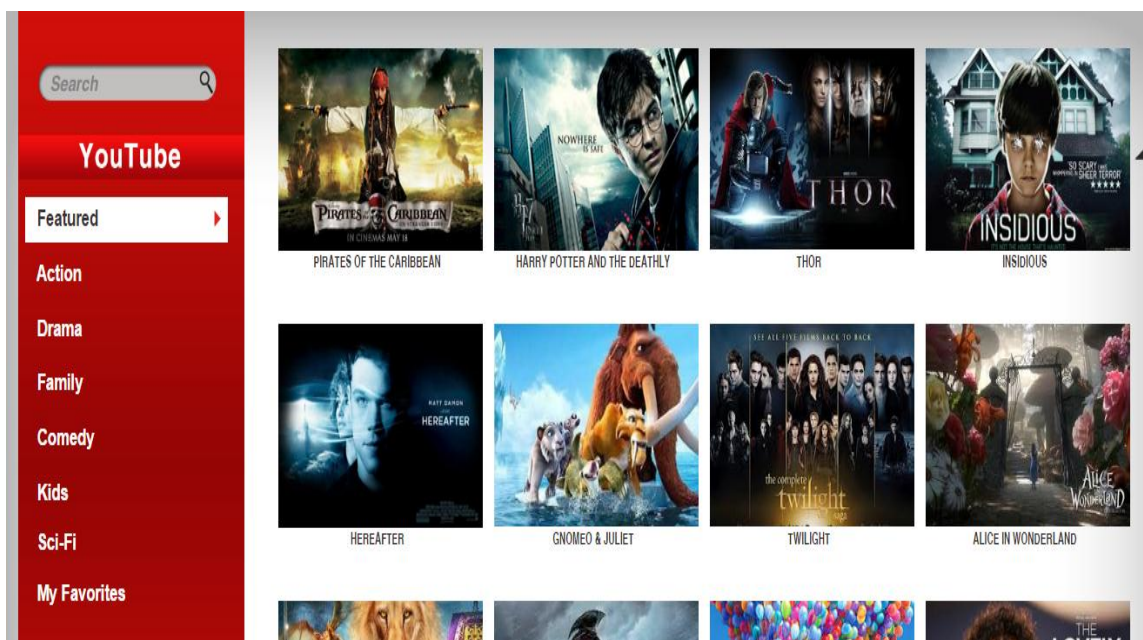
The above HTML page shall be displayed on the connected display device. You can navigate using keyboard and play the media contents.

```
$ WPEBrowser http://107.21.252.26/scte/WeatherLow/
```


The HTML page shall display the Weather information for listed cities.

APPENDIX A: MPEG-2 LICENSE FOR RASPBERRY PI

You will be required to purchase license to play MPEG-2 TS streams on a Raspberry-Pi device. You can purchase the license key from the Raspberry Pi portal.

URL: http://www.raspberrypi.com/mpeg-2-license-key/

Read the "Product Description" section carefully on the above link and order the MPEG-2 license key for your Raspberry-Pi device. You should receive the license key on your registered email address.

Follow these steps to enable codecs on your device(s):

1. **Linux:**

- Insert an SD card in either the SD card port of the laptop or the USB SD card reader.
- Verify that the PC detects the SD card by executing either of the commands listed below:

```
# lsblk
# sudo fdisk –l
```

- Type the following command to check that the partitions on the SD card are mounted

```
# mount
```

- If not mounted, mount the FAT partition on the SD card with the following command

```
# mount /dev/mmcblk <partition-mountpoint>
```

- Open and edit the config.txt file. Add the following line at the end of the file.

```
# decode_MPG2=<Your_mpeg-2_licenseKey>
```

```
For ex:
# decode_MPG2=0xf628130b
```

- Save and close the file
- Remove the SD card and insert it to the Raspberry Pi SD card slot
- Following command will report codecs status:

```
# vcgencmd codec_enabled MPG2
```