

Introduction

My wife and I like to travel in our small *Rialta* RV. We usually dry camp without connecting up to any services like power, water or sewer but sometimes we need to take showers or do laundry so we opt for a commercial campground. When we are in a commercial campground we will connect up to at least power and this allows us the ability to watch movies or listen to music using the portable media center which I will describe in this article.

When we bought our RV it had a TV/monitor that we really didn't use. When I realized it had an HDMI input I immediately thought of the Raspberry Pi and my mind starting wondering what I could do that would enhance our RVing experience. Of course playing movies came first to mind but I didn't want to use a DVD player because that would take up precious space in our already compact RV. In researching how one might play digitized movies with a Raspberry Pi, I came across OpenELEC which is an embedded Linux operating system built around Kodi, the open source entertainment media hub.

Kodi describes itself as:

“Kodi® (formerly known as XBMC™) is an award-winning free and open source (GPL) software media center for playing videos, music, pictures, games, and more. Kodi runs on Linux, OS X, Windows, iOS, and Android ... It allows users to play and view most videos, music, podcasts, and other digital media files from local and network storage media and the Internet.”

OpenELEC upon which Kodi runs is different from other versions of Linux because:

“OpenELEC is built from the ground up specifically for one task, to run Kodi. Other operating systems are designed to be multi-purpose, so they include all kinds of software to run services and programs that won't be used. OpenELEC, however, only includes software *required* to run Kodi. Because of that it is tiny (roughly 150MB), it installs literally in minutes, and, it can boot extremely quickly in 5-20 seconds, depending on the hardware type used.”

OpenELEC can automatically update itself and can be managed entirely from within the graphical user interface it presents. Even though it runs on Linux, you will never need to see a management console, use a command line or have Linux knowledge to use it.

In the home environment Kodi is generally controlled with a mouse and keyboard but I didn't want to carry those items around in our RV either so I found a free remote control application for my Android tablet called “Kore” which provides wireless remote control of Kodi for our media center. There are equivalent apps for controlling Kodi in the iTunes app store as well for iOS devices.

Of course remote control requires WiFi for communication between the tablet and the media center but here also OpenELEC comes to the rescue. With the correct WiFi adapter connected to the Raspberry Pi (more on this in a moment), OpenELEC can run as an AP or Access Point (called Tethered Wireless Access Point in the OpenELEC user interface) thereby creating its own WiFi network when no other WiFi network is available. This way we can use our tablet to control our media center while in a campground that doesn't have WiFi. Pretty slick if you ask me.

Unlike most of my articles for Nuts & Volts this article doesn't have any code you have to configure or compile or hardware you have to wire up or solder. For this project you collect the required parts, assemble the hardware, load the openELEC software, gather up your media and you will be ready to go. I'll give you detailed instructions on how to do this in the text that follows. First though, let me describe my system to show you what is possible for a media center you can literally hold in the palm of your hand. See Figure One.

In my system I used a 128GB flash drive for holding all of my digital media files. On this drive I have 34 full length movies, approximately 30 TV shows and 500 CD's of music and I still have 53 GB available for other things. I could load a bunch of our photos onto the flash drive and use the slide show feature of Kodi but I haven't got around to that yet. As you can see with this kind of content you could be entertained for weeks on end. If you travel with a digital camera and a laptop you could download all the pictures you took during the day and then copy them to the flash drive of the media center to view them in the evenings and/or just to back them up.

On a final note, when we aren't traveling, I use our portable media center in our living room with our large screen TV. It works just as well there as in our RV.

Software

Two pieces of software are required for the media center. First and most important is OpenELEC itself and the second is Kore, the remote control application.

OpenELEC

The OpenELEC software can be downloaded from the link provided in the Resources section. The current version at the time of writing is 6.0.3 although a version 7 is in beta testing.

Before downloading the software make sure you identify the correct version for the Raspberry Pi 2 and 3. Also get the one marked *Diskimage* instead of the one marked *Update File*. Once you have identified the correct version, download it to your computer.

The next step in the process is to decompress the downloaded file. How this is done depends upon the computer platform you are using. On my Mac, in the OSX environment, this is as simple as double clicking the downloaded file and it decompresses automatically. In the Windows 10 environment I had to first install 9Zip from the Microsoft app store and then use it to decompress the file. In either case you end up with a file called, *OpenELEC-RPi2.arm-6.0.3.img* which is the Linux disk image we need to put on a microSD card for the Raspberry Pi in the media center.

Both my Mac and my Windows 10 computer have a slot for reading and writing normal SD memory cards. The microSD card specified in the parts list of Figure Two comes with an adapter allowing the microSD card to be used in a normal SD card slot. It doesn't matter how you get the image file onto the microSD card its only important that you do.

How one copies a Linux image file to an SD card also depends upon the computer platform being used.

Instructions for OSX (Section 3.3), Windows (Section 3.2) and Linux (Section 4.4) can be found at: http://elinux.org/RPi_Easy_SD_Card_Setup. Because the OpenELEC image is so small, writing it to the microSD card happens quickly. Much quicker than when writing a full on Raspberry Pi operating system image.

Remote Control

As mentioned, *Kore* is a remote control application for the media center that can be downloaded for free from the Google Play Store for Android devices. On my Nexus 7 tablet, I first click the icon for the Play Store from the home screen and then in the search bar type in *Kore*. You will see numerous versions of *Kore* but the one I use is called, “*Kore, Official Remote for XBMC Foundation*” as it seems to have some kind of official sanction.

Once you have *Kore* installed you execute it by tapping its icon. *Kore* will immediately try to identify all OpenELEC installations on the WiFi network to which it is connected. If it finds your media center, click on it to indicate it is the one you wish to control. This process should only need to be done once unless connection parameters change.

After playing with *Kore* for a while its operation should become second nature as using *Kore* is a lot like using a normal TV remote.

I should mention there are many different ways to control your media center but *Kore* for Android is the method I have chosen. Google “Kodi remote control” if you would like to see what other options there are.

Hardware

Before assembly of the media center collect all of the parts shown in the parts list of Figure Two and shown in Figure Three. NOTE: most of the parts specified in the parts list are non critical and other brands can usually be substituted successfully. My media center worked right out of the box with the parts specified. Your mileage may vary if you substitute other parts.

Almost any USB 2.0 WiFi adapter can be used with OpenELEC. However if you want to use the AP or tethered mode you must have a WiFi adapter that supports AP operation; many don't. The adapter shown in the parts list was chosen because it does. From my research it seems any WiFi adapter using the Ralink 5370 Chipset can support AP mode. You can use whatever WiFi adapter you have on hand if AP mode is not important to you.

In the parts list I specified that either a Raspberry Pi 2 model B or a Raspberry Pi 3 model B can be used in the media center. I initially had a Pi 2 in mine and it worked for the most part but every now and then I would experience pauses in the video that lasted up to about 20 seconds making for difficult movie viewing. I have since replaced the Pi 2 with a Pi 3 and the video playback is now flawless. In researching this issue I came across many people that don't seem to have any troubles with the Pi 2 so it may have just been something amiss in my original installation. For now I'll leave the Pi 3 in my media center and use the Pi 2 for some other project.

Assembling the media center could not be easier and consists of the following steps:

1. Following the instructions in the Software section above, copy the OpenELEC software image onto a 2GB or larger microSD card.
2. Insert the microSD card into the Raspberry Pi.
3. If heat sinks are available, pull off the adhesive backing and press them firmly onto the black chips on the Raspberry Pi board.
4. Place the Raspberry Pi into the bottom of the protective case.
5. Snap on the top of the case.
6. Secure the two halves of the case together with the 4 screws.
7. Plug on the WiFi adapter.
8. Plug on the Flash drive containing your digital media files.
9. Connect an HDMI cable from the Raspberry Pi to your TV/monitor.
10. Connect the USB cable from the Raspberry Pi to the USB power adapter.
11. Turn on your TV/monitor and plug the power adapter in.

If all is well in mere moments you should see the OpenELEC user interface appear on the display as shown in Figure Seven.

After I verified the media center was working correctly, I put some velcro tape on the back of the case so I could attach it to the back of whatever TV/monitor I was using for display. That way I can use it in the house when I want to and then easily move it to the RV for traveling.

Creating Media

Before discussing media creation one first has to prepare the flash drive for storage of the digital media. I did the following:

1. Formatted the 128GB flash drive with **Win32** format. This may not have actually been necessary but it made sure no other files would be on the flash drive other than the ones I put there.
2. I then created a directory called MUSIC and a directory called MOVIES in the root directory of the flash drive.

I did this on my Mac but it is easily done on a PC as well.

Creating the digital media (movies and music) for your media center takes much more time than building the media center itself. Luckily, in my case I already had a large music library of about 500 CDs that I had ripped over time. I use iTunes to manage my music so all I had to do was copy the entire iTunes library of aac (m4a) files to the MUSIC directory of the flash drive. Now that was easy. Kodi can play many music formats so if you have a collection of mp3 files, for example, you can copy them to the MUSIC directory. Also, Kodi doesn't require all of the digital music files to be of the same format so you can load essentially any music you have onto the flash drive.

Video media, on the other hand, took some time to create. I have a rather large collection of DVDs so I

had to rip the movies I wanted to have on the media center into a format that Kodi can play. Being the frugal individual that I am I searched the web for free DVD ripping software and came up with a program called *HandBrake* which does the job nicely. See the Resources section for a link for downloading HandBrake. Handbrake is available for OSX, Windows and certain varieties of Linux.

HandBrake refers to itself as “*The Open Source Video Transcoder*”. This means it can convert from DVD format to many different output video formats with one important exception. It cannot transcode videos that are protected with the Content Scramble System (CSS) which is a form of Digital Rights Management (DRM) meant to prevent illegal copying. To get around this impediment, you can install a library called *libdvdcss* on the computer system you are planning on using to rip the DVDs and it will remove the DRM information during the transcoding process. See the Resources section for where you can acquire this library and how you go about installing it. As I understand it, I have the right to make a backup copy of any DRM protected media I personally own so I have no problem doing this.

Once you have HandBrake downloaded and installed it is easy, though time consuming, to rip a DVD for the media center. A normal length movie takes about 25 minutes to rip on my Mac so it is best to start the process and go do something else.

I used all of the HandBrake defaults (except I named the output files with the name of the movie) to rip my movies and they playback great. HandBrake produces m4v video files which I initially stored on the Mac and then I would copy the ripped movies in mass to the 128GB flash drive. This seemed to be faster than ripping the movies directly to the flash drive though that can be done as well.

Conclusions

It is easy to create a very powerful media center that fits in the palm of your hand but that can keep you entertained for hours on end. This is a great and useful project for someone getting into the Raspberry Pi for the first time. It is almost impossible to mess up because there isn't any programming involved or Linux configuration necessary.

One advantage of going digital is that the media center is much smaller physically than the audio CDs and the video DVDs it replaces. All of those CD and DVD cases take up a lot of space.

Why don't you build yourself a personal media center today. It only takes an hour or so! That way you can carry around a collection of your best loved music and videos in the palm of your hand or in your back pocket.

Resources

OpenELEC media center software is available for free at: <http://openelec.tv/get-openelec>. Make sure you pick the Raspberry Pi 2 and Pi 3 [Model B+ 512MB] diskimage.

Information on how to copy a Linux image file to a SD memory card can be found at:
http://elinux.org/RPi_Easy_SD_Card_Setup

In this article I only briefly touched upon what Kodi is capable of. With Kodi you can play games, get current weather conditions, have slide shows, re skin the app to change its appearance and much more. Look up Kodi addons to see what is available for customizing your media center. For more information about Kodi see: <https://kodi.tv/>

HandBrake software for Windows, OSX and UBUNTU Linux is available for free at:
<https://handbrake.fr/>

Instructions for downloading and installing libdvdcss are available at:
<http://www.winxdvd.com/resource/install-handbrake-libdvdcss-to-rip-dvd.htm>

Figure One
A Raspberry Pi Media Center
that fits in the palm of your hand or in your back pocket



Figure Two
Parts List for the Media Center

Description	Item	Source
Raspberry Pi Single Board Computer	Pi 3 Model B or Pi 2 Model B	adafruit.com, mcmelectronics.com, sparkfun.com
Protective Case	Enokay Black Case for Raspberry Pi 2 Pi 3 Model B B Plus	amazon.com
USB 2.0 WiFi Adapter	CanaKit Raspberry Pi WiFi Wireless Adapter or any adapter with a Ralink 5370 Chipset	amazon.com
microSD Memory Card	Sandisk 2GB microSD Memory Card with SD Adapter	amazon.com
USB Power Module	Any capable of 2 Amps @ 5 volts	amazon.com
USB 2.0 Flash Drive	PNY Attache 64 GB or 128GB	amazon.com
HDMI cable	High Speed HDMI Cable	anywhere
USB 2.0 Cable for power	Type A to micro B	anywhere

Figure Three
All of the Required Parts

the microSD card cannot be seen because it is inserted in the socket underneath the Raspberry Pi



Figure Four
Raspberry Pi with heat sinks installed

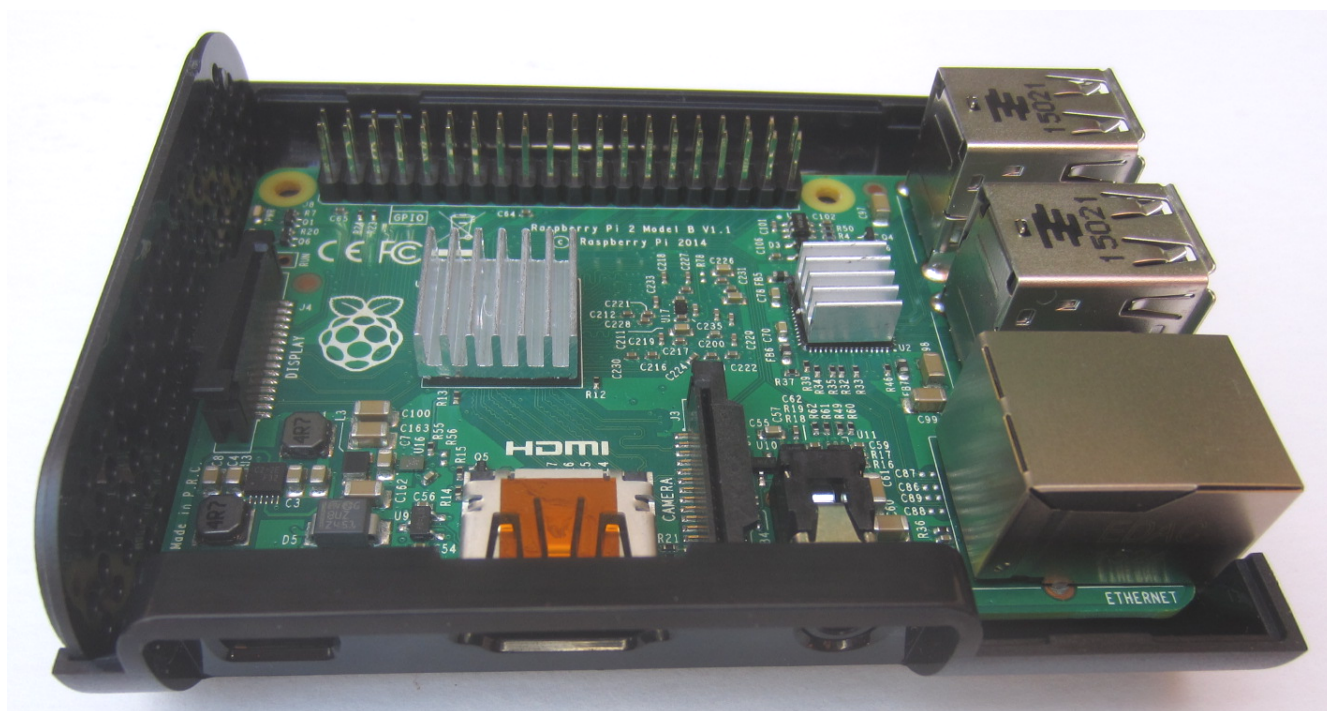


Figure Five
Raspberry Pi safe in its protective case



Figure Six

Bottom of the Media Center Case

Note the velcro strips which hold it to the back of the display in both our RV and home TV
Securing it to back of the display means it takes up zero additional space



Figure Seven

The OpenELEC User Interface you will see on successful installation
(stock skin but many others available)

