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"Doing Good with a Slice of Pi: Ideas for Using the Raspberry Pi as a Low Cost Information Platform in Libraries"

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Doing Good with a Slice of Pi:

Ideas for Using the Raspberry Pi as a Low Cost Information Platform in Libraries.

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ABSTRACT
In the last decade, librarians have been under pressure to cut costs at every level. These cuts often occur in acquisitions, while other areas such as technology demand fiscal expansion just to meet user demand. In the last few years, University of Cambridge computer science researchers have developed a credit card-sized computer, affectionately known as the Raspberry Pi. Intended to serve as an educational platform for children learning Python programming, the project has far exceeded its original scope. At $35, this small computer can now serve as a creative solution in various areas of librarianship.

Introduction

Over the last eight years, computer science researchers at the University of Cambridge have developed a credit card-sized computer, affectionately known as the Raspberry Pi. Originally developed to serve as an educational platform to teach children the basics of Python programming, the Pi is now being used in thousands of innovative projects thanks to a robust open source community. From the beginning, the mission of the Raspberry Pi project has had many charitable elements. From its basic premise of teaching children to its low cost of purchase, the Raspberry Pi is definitely a computing platform with the potential for doing good.

One of the most interesting uses of the Raspberry Pi relating to libraries is the ability to configure and run a web application server from this small, $35 device. Based on ARM processor technology, similar to what is used in smartphones, the Pi can be configured to run full functioning server platforms such as WordPress (blogging content management platform), Jekyll (web site development platform), Ghost (blogging platform), and OpenCloud (cloud storage server) via the arkOS version of Linux. Another positive outcome in using the Raspberry Pi as a server, as opposed to hosting content online, is that it can ensure content ownership of digital materials. Unlike some questionable hosting agreements that an institution may enter into for the sake of convenience, using a Pi to host a web platform allows the organization to have complete control with little overhead and minimal technical expertise.

Aside from configuring a Raspberry Pi as a server, one could add peripherals such as a mouse, keyboard, and monitor to use as a PC for patron use. Though not robust enough to play streaming video content or online games, a Raspberry Pi can be used for basic word processing or as an OPAC terminal by library patrons. Another library-oriented possibility is to install a video player operating system called XBMC, which turns a Pi into a high definition video streaming platform that could be used as an information display in a library. The variety of Raspberry Pi projects go well beyond what can be discussed in this article; however, a search of YouTube or Google will return many creative ideas from the Raspberry Pi open source community.

The History and Development of the Raspberry Pi and arkOS

In 2006, Eben Upton and colleagues at the University of Cambridge came up with a general idea to create a small, cheap computing platform to serve as a learning environment for children. Their motives behind this idea were based on the steady decline of youth pursuing education in computer science and other areas of technical learning. Their goal was to change the way children were interacting with technology. As a result, by 2008, with advances in video processing and mobile computing platforms, they were able to begin an investigation into creating a low cost platform for learning which would eventually become the Raspberry Pi ("About us," n.d.).

In 2011, the Raspberry Pi Foundation based at the University of Cambridge released the first Pi platform. Once released, the target audience for the platform quickly expanded beyond educators and students to a broader group of hobbyists and open source technology professionals. Since 2011, many programmers have shared their work with porting over various Linux-based operating systems, while also using the Raspberry Pi to create hardware-oriented projects that were unimaginable when the units were released in 2011 ("Raspberry Pi," 2013).

In 2013, arkOS, a Linux-based operating system, was announced by the CitizenWeb Project using the Raspberry Pi as a hardware platform. The ambition of this project was rooted in the idea of giving users the ability to host and own their content by using applications like WordPress, Jekyll, Ghost, and OpenCloud on the low cost Raspberry Pi (Pearce, 2013). This operating system provides users with the ability to not only load and run these software platforms, but also to do so while utilizing minimal system requirements on an already low-powered device. This is all possible because of the high efficiency of the Pi's ARM-based processor, and the creative development of a robust open source software community.

How the Raspberry Pi Works

From a technical perspective, the Raspberry Pi Model B runs a processor (CPU) set at 700 MHz by default. However, it is possible to over-clock the CPU to run higher. In current test environments conducted by the author, the recommended performance level is 800 to 900 MHz. In the latest Raspbian Linux operating system (which can be used as a desktop PC operating system on the Pi) there are easy-to-use settings for changing the processor speed. It should be noted that over-clocking the processor can cause performance issues, so exceeding 900MHz is not recommended ("FAQs," n.d.).

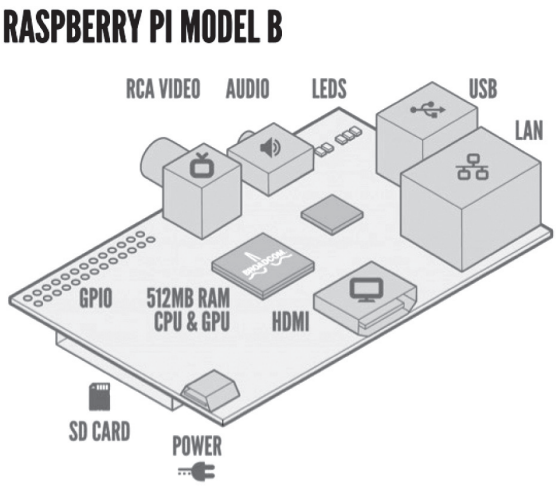

Figure 1. Raspberry Pi Layout. From "FAQs," n.d., http://www.raspberrypi.org/faqs#performanceSpeed

From a graphics perspective, the Raspberry Pi has a 1080p HDMI video output, with a level of quality equal to the first generation Xbox ("FAQs," n.d.). However, because the Raspberry Pi only has HDMI video out, an additional purchase of an HDMI/VGA converter is required to use the device with an older VGA monitor. Additionally, when purchasing a Pi by itself, it should be noted it does not include a power adapter. Typically, online retailers make it easy to purchase a low-cost power adapter, or one is available in a Pi starter kit. These kits typically contain additional items for the Raspberry Pi, such as the power adapter, case, and SD card for around $70 ("Raspberry Pi Model B Starter Kit," n.d.).

The Raspberry Pi's architecture does not include a traditional hard drive. Operating system installations are done on SD cards, which plug directly into the Raspberry Pi itself. This is a feature that makes the Pi platform a versatile technical option for a library. If an operating system such as Raspian Linux (Desktop PC OS) is loaded on one SD card, and another operating system such as arkOS Linux (server OS) is loaded on another card, there are conceivably two swappable images that will run on one Raspberry Pi. This is a great option for learning and testing with a Raspberry Pi, because investment in only one Pi and several SD cards is necessary for installing different operating systems.

Hypothetically, if a library were to deploy Raspberry Pis for patron use in place of existing PCs, fixing a down system would be as easy as changing out SD cards with new ones that contain a clean operating system, instead of re-installing an entire operating system when a computer fails due to hardware issues or malicious behavior. However, due to the small size of the Raspberry Pi itself, special consideration should be given to securing the devices from theft if deployed in a public setting.

Using the Raspberry Pi as a Platform for Teaching

Many technology educators over the past ten years have opined over the fact that though students of all ages use technology and are exposed to it almost on a 24/7 basis, there is a growing and profound disconnect to understanding how computers really work. In general, society is so connected to Facebook, Google, and Twitter that little thought is given to the infrastructure, the programming, the licensing, or even the ownership of what has become so engrained in life. The Raspberry Pi was invented in an attempt to address this issue by teaching kids how to program and understand how computers work. The intent was to provide an educational entry point for kids who do not have the luxury of learning technology from the ground up as kids did years ago with systems like the Commodore 64 or TRS-80.

Another potential use for the Raspberry Pi in libraries is to bring in local computer professionals to teach Python in a community workshop setting. Raspian Linux is a variant of the Debian Linux operating system, with customizations made by the Raspberry Pi Foundation that provides programming tools for users of all ages to learn the Python programming language. Due to the ease of configuring and reconfiguring Raspian on an SD card, it would require little time for library personnel to maintain the systems needed for such workshops. In many areas, workshops of this nature could provide young people with initial exposure to programming and give them an interactive reason to return to the library on a regular basis.

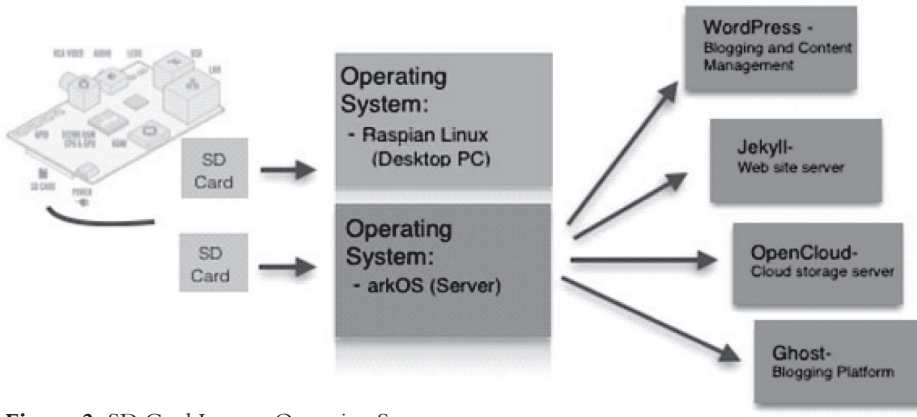

Figure 2. SD Card Images, Operating Systems, and installed server applications.

Setting up and Hosting a Website Using the Raspberry Pi

In January 2014, Advanced Micro Devices (AMD) announced the first true ARM-based processor server for the IT market (Shimpi, 2014). This announcement confirmed that server platforms are now poised to become lower in cost and have a much greener energy footprint than even the most efficient rack servers in use today. The Raspberry Pi can already serve as an entry level to this new single board server market and provide fiscal saving for libraries of all sizes. Remote libraries with questionable sources of electricity also can benefit from this evolution in server technology, due to the fact that these new server platforms require far less energy to operate (Shimpi, 2014).

No matter the type of library, having the ability to inexpensively configure and run technology infrastructure in-house can be a huge benefit. With the arkOS version of Linux on a Raspberry Pi, a library has the capability to run applications such as WordPress or other server software with total freedom and little risk. Whether testing website ideas or replacing an existing website, a Raspberry Pi running arkOS can provide a valuable library service.

The arkOS project website provides detailed information on the installation and configuration of the arkOS server ("Getting Started," n.d.). Thanks to a robust programming community and a mission focused on content ownership, the arkOS platform aligns perfectly with the need for fiscal restraint and technical control in today's library. The author's current arkOS self-hosted website (www.rpiforlibs.info) has been up and running for over six months on a single Raspberry Pi from a residential internet connection. The installation and configuration took less than one day to complete including the configuration of WordPress and network firewalls for securing the site from attackers.

Computer security is always a consideration in today's world, even for libraries. Though questionable at its inception due to security issues, running WordPress today is quite safe even from a home-based network. There are several WordPress security plugin apps that can help manage access to a site. By allowing only certain ports to be open through a basic firewall, network attacks, such as Distributed Denial of Service (flooding a website with inbound traffic), can be blocked or diverted in several ways. In March 2014, the rpiforlibs.info site sustained a minor DDoS attack that originated from China and Russia via a botnet (virus infected computers from around the world sending data) which was directed at WordPress servers globally. This attack was detected and nullified in less than two hours thanks to WordPress security add-on applications, and the ability to block inbound traffic from both arkOS and the network firewall. Though security issues sound daunting, they

require little technical knowledge to address due to the ease of the arkOS interface, WordPress security apps, and documentation available online.

By using arkOS to host a web application server like WordPress, library personnel can look at setting up subdomains to grow their web services. Specific network setup issues are beyond the scope of this article, and are unique to each library. However, linking from existing websites to new arkOS hosted sites can easily expand web services without impacting current hosting contractual agreements, if desired. If library personnel have no desire to change their main website, they can still use a WordPress server to add additional content in-house without impacting their current site. This may provide library personnel with more content control, or give them features that the current site does not provide for little extra expense.

Another web service possibility that the arkOS platform affords would be to allow a library to have their own in-house version of Dropbox or Google Drive for library patrons. The arkOS platform comes with the capability to serve up cloud storage by the installation of an application called OpenCloud. After installing and configuring OpenCloud, a library can attach an external hard drive to the Raspberry Pi via a USB connection, and depending on the capacity, the device can become cloud storage for library employees or patrons. If used by patrons, this could be a location where they could store and access library related research projects from home or in the library itself. However, prudent policy and management guidelines would need to be considered before deploying any cloud storage service for patron use.

The Potential for Good

When discussing issues of finance with public, academic, or special librarians over the past decade, one rarely gets the feeling that there is an excess of money available at any level. However, the situations faced by libraries in the western world seem like a luxury when compared to libraries in Africa or South and Central America. There is little doubt that librarians work in a profession where need far outpaces the capacity to meet that need. Whether the topic is physical books or technical learning, libraries need as many resources as possible to help patrons.

The Raspberry Pi is a very basic computing platform for those who are privileged enough to place a smartphone in their pocket each day. At the same time, in the less developed world, many people only have access to the internet by a cruder version of such a phone. In this way, the people of developing nations are even more disconnected from understanding how computers work through their limited internet access on these smart devices. The mobile computing revolution seems to be exacerbating a greater disconnect of knowledge for technology consumers, leaving them an impossible path to becoming viable technology creators.

The Raspberry Pi offers the potential to improve not only libraries and library services, but also the lives of library patrons. Whether by providing a learning platform or serving as the beginning stage for a new web server architecture, the Raspberry Pi is a revolutionary platform that fits perfectly with the mission of all libraries, no matter the type, size, or location. Librarians should seek out Raspberry Pi learning and grant funding opportunities to add these devices to their technology infrastructure. At the same time, getting these devices in the hands of library patrons can positively impact their learning today and in the future. ✞

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REFERENCES

About us. (n.d.). Retrieved from http://www.raspberrypi.org/about *FAQs*. (n.d.). Retrieved from http://www.raspberrypi.org/faqs#performanceSpeed

Getting Started. (n.d.). Retrieved from the arkOS wiki: https://wiki.arkos.io/wiki/Getting_Started

Pearce, R. (2013). arkOS: Building the anti-cloud (on a Raspberry Pi). *TechWorld*. Retrieved from http://www.techworld.com.au/article/528273/arkos_building_anti-cloud_raspberry_pi_/?fp=16&fpid=1

Shimpi, A. L. (2014, January 28). It begins: AMD announces its first ARM based server SoC, 64-bit/8-core Opteron A1100. *RSS*. Retrieved from http://www.anandtech.com/show/7724/it-begins-amd-announces-its-first-arm-based-server-soc-64bit8core-opteron-a1100

Raspberry Pi. (2013). Retrieved from Wikipedia: http://en.wikipedia.org/w/index.php?title=Raspberry_Pi&oldid=563858222

Raspberry Pi Model B Starter KitMCM Part #: 83-14275. (n.d.). Retrieved from http://www.mcmelectronics.com/product/RASPBERRY-PI-RASPBRRY-PCBA-/83-14275