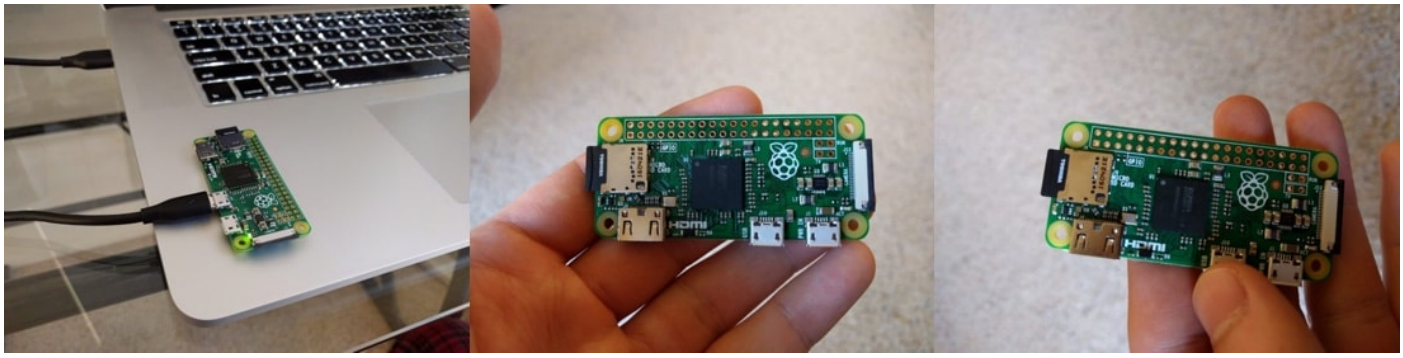
Connect To A Raspberry Pi Zero With A USB Cable And SSH

June 17, 2016 Nic Raboy Raspberry Pi (https://www.thepolyglotdeveloper.com/categories/raspberry-pi/)

As some of you may know, I have a hoarding problem. I am hoarding Raspberry Pi (https://www.raspberrypi.org/) microcomputers. In my personal collection I have one from each generation, making four standard units. Well, I recently picked up another unit, but this time a Raspberry Pi Zero. These things are about the size of a nine volt battery, but pack some serious punch. The problem is they are incredibly rare because they retail for only $5.00.

Unlike the standard Raspberry Pi units, these do not have WiFi, ethernet, or standard sized USB ports. This changes things when it comes to connecting. We're going to take a look at getting set up with one of these Pi Zero IoT devices and be on your way towards some cool hack projects.



Like with the standard Raspberry Pi units, it takes a micro SD card with the same flavors of Linux flashed to it. You'll note in my other tutorials (https://www.thepolyglotdeveloper.com/category/raspberry-pi/), I am using Raspbian, which is a flavor of Debian Linux. I am using the same for the Raspberry Pi Zero.

Flash the Pi Zero however you see fit. If you're using a Mac or Linux computer, you might check out my previous tutorial (https://www.thepolyglotdeveloper.com/2016/02/use-your-raspberry-pi-as-a-headless-system-without-a-monitor/) on the subject.

This is where things get a little different. Before we get ahead of ourselves, a lot of the material that follows will be from a set of instructions that helped me. These instructions can be found on GitHub (https://gist.github.com/gbaman/975e2db164b3ca2b51ae11e45e8fd40a) by Andrew Mulholland.

Configuring to Emulate Ethernet Over USB

Our long term goal will be to use SSH over USB. This means that we have to configure Raspbian to treat the USB port like an ethernet port. Mount the micro SD card in a computer (not Pi Zero) and open it with Finder, or Windows Explorer, or whatever it is that you use.

The first thing that you want to do is open a file at the root of the mounted drive called **config.txt**. In this file you want to add the following line at the very bottom:

```
dtoverlay=dwc2
```

The above line will set us up for the next file that we alter. The next file we alter is **cmdline.txt**, but it is a bit different. Parameters in this file are not delimited by new lines or commas, they are delimited by space characters. In this file we want to add the following:

```
modules-load=dwc2,g_ether
```

The above parameter should be added after the `rootwait` parameter. Yes the above parameter is a single parameter, meaning don't add a bunch of space characters to it. More information on networking over USB on Linux can be found here (http://www.linux-usb.org/usbnet/).

UPDATE 12/11/2016: As pointed out by some readers, the Raspberry Pi Foundation is disabling SSH by default in Raspbian Pixel as a security precaution. More information on the subject can be found here (https://www.raspberrypi.org/blog/a-security-update-for-raspbian-pixel/). To enable SSH, create a file called **ssh** and save it to the root directory of the **boot** mount on the SD card. The file can be blank, and it has no extensions. It should exist at the same location as the other files that were edited.

At this point the micro SD can be inserted into the Pi Zero.

Connecting to the Pi Zero with USB and SSH

To connect to the Raspberry Pi Zero over USB you'll need Bonjour or similar installed on your host computer. I'm using a Mac so I was fortunate enough to already be in the clear. For Windows you should be fine installing iTunes or QuickTime and for Linux the Avahi Daemon (http://linux.die.net/man/8/avahi-daemon). Many Linux distributions should have it already installed.

With it installed, power on the Pi Zero with the USB data cable. I made sure to use the port labeled **USB**, not **PWR**. This port allows you to power the Pi Zero and do data transfer. Once connected, give it some time because it will have to configure some things for the first time.

When you feel the Pi Zero is ready, enter the following from your Mac or Linux Terminal:

```
ssh pi@raspberrypi.local
```

If you're using Windows you'll have to use PuTTY or similar. Notice in my SSH command I provided the **pi** user? If you're using Raspbian, it is the only user on a fresh installation. The password will be **raspberry** until you change it or add a new user.

You should be connected! You won't be able to install anything or run updates because you're not connected to the internet, but at least you have full headless Linux control.

Conclusion

Raspberry Pi and IoT is awesome. As a long time Raspberry Pi (https://www.raspberrypi.org/) fanatic, the Pi Zero, if you can get a hold of one, is $5.00 well spent. You get a fast IoT device at the size of a pack of gum. Since the hardware doesn't have WiFi or BLE, we had to configure Raspbian to allow ethernet emulation over USB. Once we did this we were able to SSH into the Pi Zero as if it was somewhere on our network. A perfect jumpstart for our Internet of Things adventure.

A video version of this article can be seen below.

Connect To A Raspberry Pi Zero With A USB Cable And SSH

BONJOUR (HTTPS://WWW.THEPOLYGLOTDEVELOPER.COM/TAGS/BONJOUR/)

INTERNET OF THINGS (HTTPS://WWW.THEPOLYGLOTDEVELOPER.COM/TAGS/INTERNET-OF-THINGS/) IOT (HTTPS://WWW.THEPOLYGLOTDEVELOPER.COM/TAGS/IOT/)

PI ZERO (HTTPS://WWW.THEPOLYGLOTDEVELOPER.COM/TAGS/PI-ZERO/) SSH (HTTPS://WWW.THEPOLYGLOTDEVELOPER.COM/TAGS/SSH/)

Nic Raboy

Nic Raboy is an advocate of modern web and mobile development technologies. He has experience in Java, JavaScript, Golang and a variety of frameworks such as Angular, NativeScript, and Apache Cordova. Nic writes about his development experiences related to making web and mobile development easier to understand.

disqus_KwvpGv0abu • 2 years ago

Hi
when i try to run ssh connection over the network (wifi modem) it run perfectly and with default password but when i follow your steps then authentication fails :(

Daniyal-Ahmed:~ apple$ ssh pi@raspberrypi.local
pi@raspberrypi.local's password:
Permission denied, please try again.

57 • Reply • Share ›

Michael Douglas Pacheco • 2 years ago

ssh: Could not resolve hostname raspberrypi.local: Name or service not known

4 • Reply • Share ›

Nic Raboy Mod ➚ Michael Douglas Pacheco • 2 years ago

Any more info than this? Mac, Windows, Linux? The tools you're using, etc?

As seen in my step by step video it works fine for me, so I'd like to hear what's causing you to be stuck

I'd like to hear what's causing you to be stuck.

1 • Reply • Share ›

David E. Barrera ➚ Nic Raboy • 2 years ago

This happened to me recently... I'm using a Mac, burned the image (Jessie Lite) with etcher, modified the files and placed the microSD into the RPi Zero (1.3)... When trying to connect via SSH, I get the same error:

ssh: Could not resolve hostname raspberrypi.local: nodename nor servname provided, or not known

Funny thing is that this error happens with RPi Zero 1.3, but it works with RPi Zero W, but I guess it is because the W is connected to the same network, for I try to connect when I'm in a different network (one that the Zero W is not connected) and then I get the same error as above...

Edit: The more I watch the video, the more I think its a cable problem... Funny thing is that cable I use, is the one I use for my mobile phones... Anyways, I'll buy a cable tomorrow...

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Owen Bramley • 2 years ago

Hi, I recently bought a raspberry pi zero and was trying to set this up. I ran into the dreaded "Connection refused" even though I had setup the pi properly I'm soooo close and really want to get this running. Hoping that it is not something that I need to do with a monitor! Thanks a lot

Raspberry pi zero
2017-01-11-raspbian-jessie.img
using mac + default terminal

1 • Reply • Share ›

Nic Raboy Mod ➚ Owen Bramley • 2 years ago

Did you watch the video I made doing it start to finish?

1 • Reply • Share ›

Maté Gwozdz ➚ Owen Bramley • 2 years ago

I am not even getting to the "connection refused", I have the same raspbian image.

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Tosnic • 6 months ago

That did not work for me at all. I followed this guide and another guide on YT (by N-O-D-E), which are both pretty much the same. I used at least 3 different USB cables and tried it on a passive USB hub, Laptop and one of the USB 2.0 ports of my mobo. Sometimes Windows 7 would try to install drivers, sometimes not. Putty always reports "Unable to open connection to raspberrypi.local Host does not exist".

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Nic Raboy Mod ➚ Tosnic • 6 months ago

Unfortunately, I haven't used Windows recently and cannot advise. Sorry.

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Abigail Cember • 8 months ago

Question: If my computer has an internet connection, and I have an ssh connection to my Raspberry Pi, does that not mean that I can take things straight from the internet and install them onto Pi? You seemed to me saying in the video that this is *not* possible, but I don't quite understand why. I'm brand new to using Pi, but this is what I'm trying to do (i.e. take some software from GitHub). This video solves the ssh issue, but I obviously still need the internet somehow, and I was hoping to do that for now with USB... Thank you!

• Reply • Share ›

Nic Raboy Mod ➚ Abigail Cember • 8 months ago

I believe you can share the host's Internet conntenction if you configure the host. To my knowledge it is not a configuration on the Raspberry Pi. However i could be wrong about all of this.

You might try something like this for convenience:

https://www.thepolyglotdeve...

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Abigail Cember ➚ Nic Raboy • 7 months ago

Thanks, Nic! Another question: I configured my Raspberry Pi as demonstrated in your video, and I also installed Bonjour on my Windows machine so that a .local host should be discoverable over wifi. For a while, I was able to successfully ssh into the Raspberry Pi through GitBash and at home with the network that was configured on the Pi's SD card. However, this suddenly stopped working -- and part of the problem is that I don't actually know which method was working in the first place (i.e. was I connected over wifi or over USB?). Do you have any idea why ssh might have have stopped working or how to troubleshoot it? (And by 'not working', I mean that I now get the 'ssh: Could not resolve hostname raspberrypi.local: Name or service not known' error, despite doing everything the same as I was before)...

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Feras Allaou • a year ago

Thanks a lot for this tutorial, it works like a charm, how ever, I just want to mention that doing this will not make the usb port usable for other purposes, I mean if you want to connect an external keyboard you will be surprised that it's not working any more, you have to undo the steps above to get it back, of course you have to reboot :)

Thanks again.

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Nic Raboy Mod ➚ Feras Allaou • a year ago

Thanks for sharing :-)

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shuhweet ➚ Feras Allaou • a year ago

Good info. Its not really an issue though, if you backup your files before you modify them. :) Then you can simply copy the originals over the edited files.

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Yan JH • a year ago

For me, it's a cable problem, I replace a longger usb cable with a short one, it's work!
I use a RPI Zero W, this article is great.

Reply • Share ›

Nic Raboy Mod ➚ Yan JH • a year ago

Thanks!

Reply • Share ›

Mark Perino • a year ago

I could not get this to work on a Pi W Zero until I manually set the interface on the Pi to a static IP. It would not work on Linux, or Windows PC's as a managing host.
Yes, I also needed to create/touch the ssh file.

I mounted up the root partition of the SD card. Added the following to the bottom of /etc/network/interfaces:

allow-hotplug usb0

iface usb0 inet static
address 192.168.7.2
netmask 255.255.255.0
network 192.168.7.0
broadcast 192.168.7.255
gateway 192.168.7.1

This means that the Pi will not need to DHCP, and will be there waiting on 192.168.7.2.
I set the Ethernet on the PC (Linux or Windows) to 192.168.7.3, then ssh pi@192.168.7.2 worked.

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Nic Raboy Mod ➚ Mark Perino • a year ago

Thanks for sharing your solution for the wireless edition of the Pi Zero.

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helpdeskdan • a year ago

Hoping this helps somebody:

Firstly, "To enable SSH, create a file called ssh and save it to the boot directory." Perhaps you mean the boot mount, not the boot directory? There are two partitions on the SD, you want the boot one and it should be placed in /, not in the boot directory. A one liner would be "touch /media/helpdeskdan/boot/ssh" to create the required file assuming Ubuntu mounted it and my username is helpdeskdan.

Secondly, for the life of me, I could not get any avahi to work over usb. So, I used IPv6 on Linux. dmesg | tail to get the interface, you may see enp0s29f7u3 or something weird like that instead of usb0. If ifconfig does not show it as being up, do 'sudo ifconfig enp0s29f7u3 up' to bring it up. Ifconfig enp0s29f7u3 again to make sure it has an ipv6 address starting with "fe80". If so, do a quick ping to the all hosts like so: 'ping6 -I enp0s29f7u3 ff02::1'. An 'ip -6 neighbor show' should now show the random fe80 that got picked on the pi interface. Combining that address and the interface separated by %, you can do "ssh -6 pi@fe80::2ed6:9cb4:7f60:6d74%enp0s29f7u3" And, that should get you into the pi.

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Nic Raboy Mod ➚ helpdeskdan • a year ago

Hey thanks for pointing this out. I fixed my poor phrasing. In regards to the Linux stuff, I'm going to leave it in the comments rather than the article. I think it will be valuable to a lot of people.

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helpdeskdan ➚ Nic Raboy • a year ago

Thank you! As for IPv6, it works for Mac & Windows too but the commands will be different.

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surak • a year ago

It works. Maybe you should point out that this is dependent on the /etc/hostname of the pi, of course. Interestingly, I didn't find a way to do so on the pi3.

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gratefulfrog • a year ago

Hi,

Sorry to jump in so late.

I have an rpi0 v1.3, linux Ubuntu 16.04 with avahi-daemon running. I am using a USB data cable that has been verified. I connect to the rpi0 USB port. I have tried with and without an externeal power supply on the pwr connector...

I modified the cmdline and config files as specified and added an ssh file to the Raspian Stretch Lite image at /boot.
After days of trying, I simply cannot get an ssh:

$ ssh pi@raspberry.pi.local

$ ssh pi@raspberrypi.local
ssh: Could not resolve hostname raspberrypi.local: Name or service not known

Any help would be greatly appreciated.

• Reply • Share ›

Nic Raboy Mod ➚ gratefulfrog • a year ago

I must be living under a rock. Didn't know a new version of Rasbian was out. Let me give it a try this weekend and report back

• Reply • Share ›

gratefulfrog ➚ Nic Raboy • a year ago

I was able to make your technique work on my RPI 0 Wifi, no problem, but with the v1.3 there seems to be no way.

I further tested with an OTG cable and screen and key board connected and the RPI 0 v1.3 works fine otherwise, but there is no way to connect with ssh, it seems...

Thanks for your help, though, I really appreciate it!

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Antoni Carlson • 2 years ago

Etcher for mac is also fantastic for writing sd cards!

• Reply • Share ›

Maxime Adams • 2 years ago

Hey! I've just got my hands over this tiny raspberry and I've flashed the drive, made the change in the config.txt and cmdline.txt file. I created the ssh file and plugged the sd card in my raspberry pi. I tried connecting over ssh but the host wasn't recognized. I plugged the sd card back in my computer, everything was fine except the ssh file had been removed. Do you have any idea how to fix it ? Thanks :)

BTW I'm using ubuntu 16.04 on my computer and Jessis pixel on the raspberry pi zero..

• Reply • Share ›

Jonas • 2 years ago

Hi
i done everthing corectly and all works on other windows devices¨
but on my lenovo yoga 500-17isk(win 10, i5 6300u, nvdia 940m) it shows like COM serial port and not as network adapter
if somebody knows pls help
thx Jonas
j.zaverka@gmail.com

• Reply • Share ›

Tchaly • 2 years ago

Hi,

I've installed my Raspbian Jessie pixel via NOOBS, The modification in config.txt and cmdline.txt are done as described then I created an empty ssh file in the same partition, yet, when the Pi (Zero W) boot, the ssh file is removed.
Anyway, It is well recognized as a "Netchip Technology, Inc. Linux-USB Ethernet/RNDIS Gadget" from my computer, but, when I ssh the pi zero via the wlan0 interface and then type ifconfig there is an usb0 interfaces with an ipv4 adress associated (which is good, or mayby not because the wlan0 and usb0 are not on the same subnet).
When I try to ssh pi@raspberrypi.local from my computer it says unknown host and when I try to ssh via the ipv4 adress associated to the usb0 interface of the Pi Zero W it says connection refused. I don't get it, do you have any idea of what's wrong ? Maybe the problem is due to the NOOBS installation ?

Tchaly

EDIT : By the way I'm using a debian like distribution with my computer;
I've a RPIZero W and I'm on Raspbian Jessie Pixel (installed by NOOBS).

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Nic Raboy Mod → Tchaly • 2 years ago

This was written before the W series came out. I'm thinking you're having trouble because the USB emulation is a little different now that there is a wireless chip.
You probably need to adjust a few more settings so the two networks don't step on each other. In any scenario, with wireless available, the need for this guide isn't as strong. You might have more success with this:

https://www.thepolyglotdeve...

I used it for my Raspberry Pi Zero W without issues.

Best,

Reply • Share ›

Tchaly → Nic Raboy • 2 years ago

Hello,

Thanks for your reply. I effectively had to make some modifications in my settings. Actually I defined my own local network (192.168.1.0/24) binding each computers a static IP address (like 192.168.1.97 with of course a netmask 255.255.255.0). Then none of my linux computers had access to The Internet, so I had to remove routes. The one that indicate (ip source : 0.0.0.0 gateway: 192.168.1.1), I deleted them on each computer (debian based computers) with a /sbin/route del default gtw 192.168.1.1 (some may not face this problem, that is only because I defined a gateway when I defined the network interfaces), but, just in case I indicate It. For those who get unknown host on a ping you must indicate the -I interface option (like ping -I wlan0 192.1.168.1.99). For those who got the connection refused on ssh, try to do a ssh -b your.interface.ip.v4 pi@the.pi.interfaceip.v4. This will tells ssh to use a specific ip for the connection to your rpi0 or rpi0w.

Hope It'll help.

Regards,
Tchaly

Reply • Share ›

Mike Newham • 2 years ago

Hi all,

After a week of looking everywhere - i finally managed to ssh into my Raspberry Pi Zero W from my MacBook Air.

(I had edited cmdline and config. I had added ssh file (remove the .txt - you have to ensure you can see all filenames), i ensured my wireless adaptor and RnDIS gadget adaptor wer on the the same subnet and that the RnDIS had a static IP and that file sharing was turned on.)

Instead of ssh.pi@raspberrypi.local - I typed -

"sudo ssh pi@raspberrypi.local"

and got in after that!!

Woohoo..

Michael.

P.S. Now what do i do, i have Raspbian Pixel installed and i'd like to enable VNC without having to use a monitor. Cheers!

• Reply • Share ›

Nic Raboy Mod ➚ Mike Newham • 2 years ago

If you're using sudo to ssh, I think you're doing it wrong. Shouldn't need it

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Chase Ramsey • 2 years ago

Can you use this to connect to other pi's? In a a sense making a cluster....I'm still relatively new to computers and pi's so I'm not to certain on everything

• Reply • Share ›

Nic Raboy Mod ➚ Chase Ramsey • 2 years ago

I'm not sure why you'd want to cluster Pi Zeros. With the right accessories, it is probably possible, but I wouldn't.

• Reply • Share ›

Chase Ramsey ➚ Nic Raboy • 2 years ago

Okay thanks, trying to demonstrate clusters to my students

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Ray Benjamin • 2 years ago

I'm trying to do this, but I have a PC. How do I use Putty to connect over the USB cable? I've tried the most obvious things, but it says "Unable to open connection to raspberrypi Host does not exist." Help, please!

• Reply • Share ›

G Rick Marshall ➚ Ray Benjamin • 2 years ago

Windows 10 does not have the USB gadget installed by default. The only way I could get this to work on windows was to follow this tutorial: http://www.circuitbasics.co.... The relevant portion is below:

"You'll need to install a program called Bonjour on your computer before you can connect to the Pi over USB. Bonjour allows your computer to automatically recognize USB and ethernet devices like printers, scanners, and in this case the Raspberry Pi. Bonjour is packaged with iTunes and Adobe CS software, so it might already be installed on your computer."

• Reply • Share ›

Jeremy Bojnowski ➚ Ray Benjamin • 2 years ago

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