Connecting to WiFi from headless machine that nevertheless has an Ethernet interface

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1 Abstract

We have worked out a procedure as well as assembled a hardware platform to help the process of connecting a headless computer with both Ethernet and WiFi interfaces to a pure WiFi network. The suggested method needs the use of a special helper computer that is configured for the task and also a normal laptop or desktop that must have both cabled Ethernet as well as WiFi interfaces.

2 Introduction

We have several times come across the situation where a computer, called the service computer, shall be connected to a network through WiFi connectivity. If this is a machine to which You easily can connect a keyboard and

a display the connection procedure is trivial, but in some cases the service computer is a headless computer and we have no direct access to any user interfaces. In some of these case the computer still does have an Ethernet connection in addition to the WiFi and this may be used for configuring the WiFi protected connection. This would also be simple procedure if the local network does have cabled Ethernet connections side by side with the WiFi, but what to do when only WiFi is provided?

One method to accomplish this mechanism is to use an intermediate computer, here called the helper computer, in the middle. The helper computer should be set up with Distributed Host Configuration Protocol (DHCP) server listening on the cabled Ethernet port. We will connect another suitable computer to this interface and get access to the helper machine. Though this connection we configure the WiFi and connect the helper computer to the local network. We then disconnect the Ethernet cable and log in to the helper through the local WiFi network. We now connect the server SBC to the Ethernet port of the helper. The service computer will now obtain an IP-adress from the helper DHCP server and we may use this connection to log in to the server and configure WiFi protected setup.

3 Service computer capabilities

The capabilities we need from the service computer to be able to use the procedures lined out is this paper is simply: it must have both cabled Ethernet and WiFi. Both interfaces may be provided by USB dongles and the cabled Ethernet may be removed after WiFi configuration is completed. On our demonstration system, described below we obtain WiFi connectivity through the use of an EDUP EP-DB1607 - the one with detachable antenna. The two network interfaces show up as eth0 and wlan0.

The service computer we use for this demonstration system is the NanoPi 1-Bay NAS with a NanoPi NEO2 computer. As boot device and /usr filsystem we use a SanDisk Ultra microSDHC μSD card of size 16 GB. The speed is claimed to be up to 98 MB/s. The disk bay is populated with a Seagate FireCuda hybride, 1 TB, SATA disk. This disk will hold the /home filesystem.

4 Helper computer configuration

For our first experiment we used a NanoPi NEO mounted in a 3D printed case. The NanoPi NEO is built around an Allwinner H3, Quad-core Cortex-A7 with CPU speeds up to 1.2GHz. It does have 10/100 MBit/s Ethernet,

but no WiFi hardware. We used the nanopineo_sd_friendlycorexenial_4.14-_armhf_20191219. To obtain WiFi we inserted an EDUP EP-N8508 as sold by friendlyelec. This USB dongle sports a Realtek RTL8188CUS chip. Initially thesshd daemon is running, root logins are allowed, and the root password is **fa**.

The helper computer must be set up with a DHCP server that listens only on the cabled Ethernet interface, we use dnsmasq.The command **systemctl status dnsmasq.service** tell us that after installing the operating system the dnsmasq is installed, but disabled. Configuring ther dnsmasq should be done when there is no other DHCP server on the cabled Ethernet. This could be done during the first time the helper is connected to a local WiFi network and the Ethernet cable has been disconnected. See the section on configuring the helper machine for details.

The helper should have a unique name that is not common, we edit the **/etc/hostname** to contain the name **conhelp**.

As the helper shall be a DHCP server and nameserver for cabled Ethenet the most convenient is to set a fixed IP-address on the eth0. Edit the **/etc/network/interfaces** to contain a line of the sort:

```
auto eth0
iface eth0 inet static
        address 192.168.42.1
        netmask 255.255.255.0
```

The network address is set to 192.168.42 and the IP-address is 192.168.42.1

The configuration file for dnsmasq is **/etc/dnsmasq.conf** and as a start the program should listen only on the cabled Ethernet, here **eth0**. On about line 106 in **dnsmasq.conf** we see the line **#interface=**. Replace this line or add another at the same place with **interface=eth0**. Then on about line 158 we see the **#dhcp-range=192.168.0.50,192.168.0.150,12h** uncomment this line or add another, but change the third octett to the same as was selected for the helpers IP-address, viz.: **dhcp-range=192.168.42.50,-192.168.42.150,12h**. Now the helper will reply to DHCP requests on eth0 with address in the given range. We leaver it like that even when there will mostv likely be only one client.

When both the interfaces and dnsmask.conf has been chahged the dnsmasq should be enabled with: **systemctl enable dnsmasq.service** and started with **systemctl start dnsmasq.service**. To assert everything works a reboot may be wise: **reboot**.

5 Connection procedure

The procedure is two steps where the first step is to configure the helper to connect to the local WiFi network and obtain an IP-address. We will then use the helper as an intermediate machine to configure WiFi on the service machine.

5.1 Configuring the helper machine

Connect the cabled Ethernet of the helper to an ordinary computer that is not a DHCP server. Many laptop conmputers does not have any cabled Ethernet and in this case we have had good experience with the D-Link DUB-1312 and also with the PIMORONI, ADP003, Three Port USB Hub with Ethernet. This command computer will now obtain an IP-adress from the helper. Use the IP-address of the helper to log in as root with ssh. The password for root has not been changed and is **fa**. Once logged in to the helper machine through cabled Ethernet one should turn on the WiFi radio with the **nmcli radion wifi on**. To see a list of access points use the **nmcli device wifi list**. Select one access point and connect the WiFi to it with **nmcli device wifi connect <network> password <passphrase>** where the network should be the name of one of the networks seen from the list and the passphrase is the secret password for that network. Once connected one may disconnect the Ethernet cable and log in to the helper machine using ssh. To disconnect from a network use **nmcli device disconnect wlan0**.

When the helper has been around to a number of networks one may want to remore uninteresting names from the NetworkManager's table. One may display all known connections with: **nmcli connection show** and possibly delete one with: **nmcli connection delete <connection name>**

5.2 Configuring the service machine

When logged in to the helper through the WiFi network one should connect the service machine to the helper using cabled Ethernet. The service will now obtain an IP-address from the DHCP on the helper. To see what IP-address has been assigned to the service one may list the **/var/lib/misc/dnsmasq.leases**. Now do a login to the service and configure the WiFi to connect to the local network. Once the service machine has been connected one should log out and log in again through the WiFi network. Then one will probably want to remove the Etherent cable and do a reboot to make sure everything is working.