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Subject: Kantar Hackathon 2018 Raspberry Pi Configuration Guide v2.1

Purpose

This document is intended to provide step by step instructions to staff attempting to flash and boot Raspberry Pi 3B with the custom Kantar Hackathon project image and to conduct some rudimentary testing to confirm that the environment is fit for purpose for the Hackathon scheduled for May 17th.

Hardware Requirements:

- Raspberry Pi 3B or 3B+ (Recommend 3B though for standardization)
- SD card for use with the Raspberry Pi
- SD card slot on your machine or a USB adapter to allow it to be written to
- HDMI monitor and/or adapter to plug your Raspberry Pi for use with the Raspberry Pi Desktop

Software Requirements:

- Custom Hackathon Specific Raspberry Pi Image (Take latest version)
 - Site URL: <http://ktrhackathon2018.northcentralus.cloudapp.azure.com/>
 - Site Username: hackathon
 - Site Password: hackathon2018
- Imaging Software (this is what writes the image to your SD card):
 - Etcher: <https://etcher.io/>
- Putty – For remote SSH access (and PSCP file-transfer)
 - Download Putty from: <https://www.ssh.com/ssh/putty/download>
- RealVNC Viewer – For Remote Desktop (like) VNC Access (Take installed viewer or standalone):
 - RealVNC Viewer: <https://www.realvnc.com/en/connect/download/viewer/>
- WinSCP Compatible File Transfer Application (Need one for developers to transfer code to Pi)
 - Putty has a command line application called pscp that can be used to transfer files to the Pi
 - Filezilla - <https://filezilla-project.org/download.php>
 - WinSCP - <https://winscp.net/eng/download.php>

Network Requirements:

- Raspberry Pis in Kantar offices should be connected to the NETM wireless network if available
- Please consult with your local IT for guidance if there is no NETM network in your office
- Raspberry Pis will need to be available to internal staff/teams on the following ports at a minimum:
 - 22/tcp (SSH, SCP, file transfer)
 - 5900/tcp (VNC – Remote Desktop Access)
- Raspberry Pis will require outbound access to the following sites and services:
 - Azure's utopiahub1.azure-devices.net on ports 443/tcp, 5671/tcp, 8883/tcp

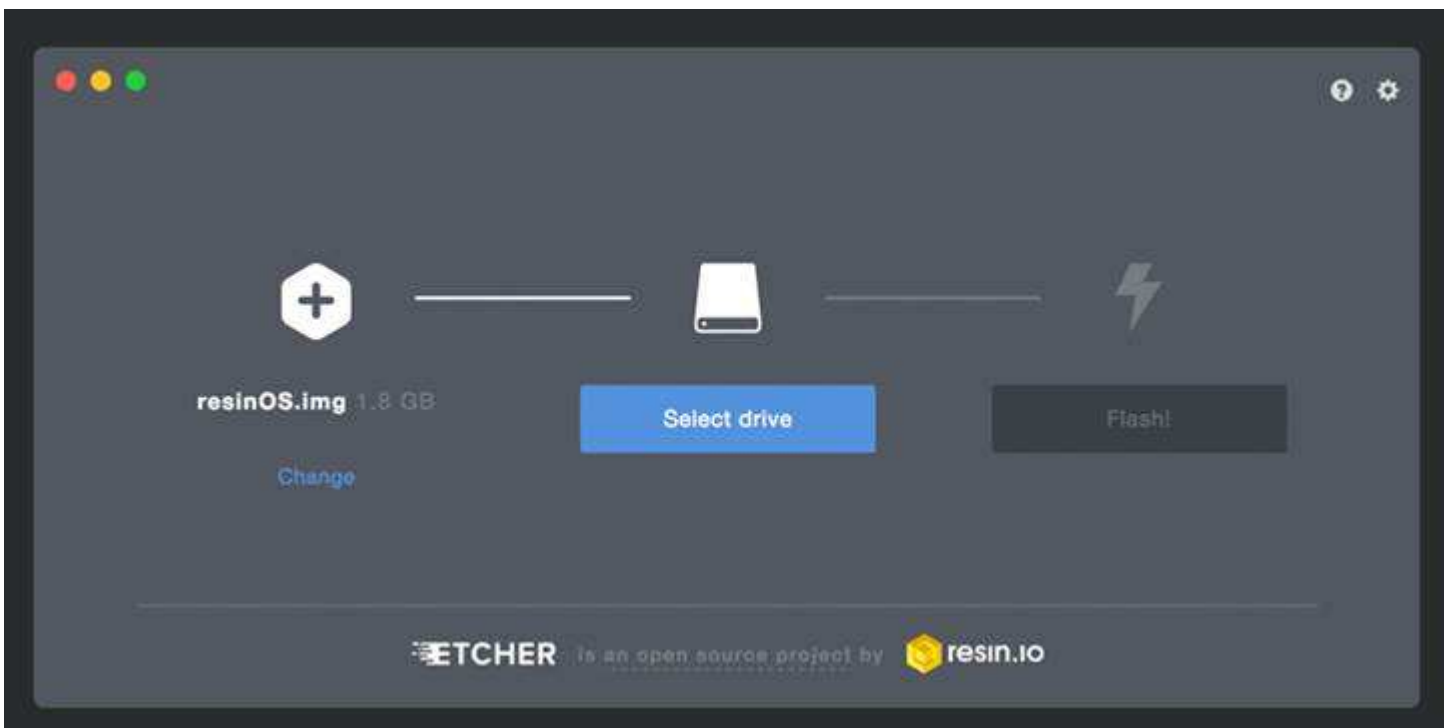
Considerations/Notes

- Pi Distribution Information
 - The Hackathon image is based on the latest version of the Raspbian Jessie Desktop from their last release in July 2017
 - The image has been updated in line with best practices and both SSH and VNC have been enabled
 - The default localization on the image is for the US, but can be reconfigured to best serve users in your environment
 - Jessie was selected for this project due to issues with the wpa_supplicant in the current Stretch distribution. Stretch introduced compatibility issues with NETM in the US between versions 2.3 and 2.4
 - The image has been compressed and should expand to use the full capacity of your SD card on first boot

- Please be mindful that depending on your SD card and its capacity, it may take up to a minute for the first boot to run its course, so do not reboot it without having waited at least a minute if it goes black screen (you will likely corrupt the image and need to reflash if you reboot it while it is resizing)
- Network Information
 - Kantar IT Risk & Compliance has mandated that the Pis be restricted to the NETM wireless network in Kantar offices that have the NETM network deployed; Other offices should check with their local IT staff for guidance on how to proceed (keeping in mind the other networking requirements)
 - Kantar's NETM wireless network will require that the staff configuring the device to provide their AD credentials to allow the device to join the network; A configuration script has been provided to configure this access securely
- The Hackathon image includes the .NET Core 2.0 Runtime installed as per the following:
 - https://blogs.msdn.microsoft.com/david/2017/07/20/setting_up_raspian_and_dotnet_core_2_0_on_a_raspberry_pi/

Hackathon Image Preparation

- Download the latest Hackathon image from:
 - Site URL: <http://ktrhackathon2018.northcentralus.cloudapp.azure.com/>
 - Site Username: hackathon
 - Site Password: hackathon2018
- Using Etcher (which allows for on the fly decompression of the image), please do the following:
 - Open Etcher and select the Hackathon image .zip file
 - Select the SD card you want to write the image to
 - Review your selections and click 'Flash!' to begin writing to your SD card



Hackathon Raspberry Pi Setup

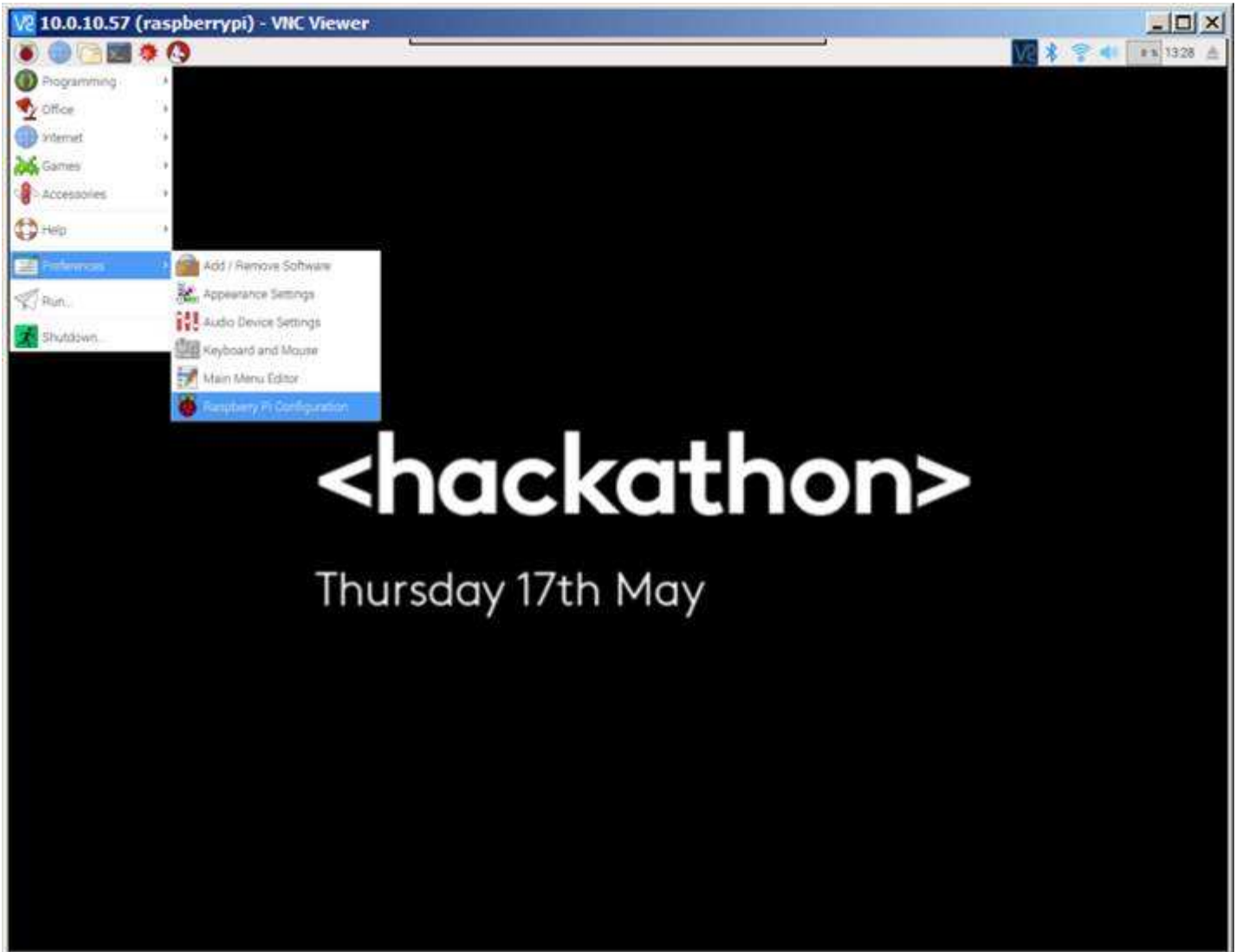
- On the initial boot of the Hackathon image the system will attempt to resize the Hackathon image to take full advantage of the SD card. The image uncompressed comes in at 6GB, but it should expand to full on boot
- As stated previously, depending on the SD card used, it can take up to a minute for it to successfully resize the image to capacity, so if the system boots and then seems to go black screen, please be patient for at least a minute before rebooting or taking any sort of drastic action. You will corrupt the image if you reboot it mid-execution.
- Upon successful boot, you should be greeted with a login prompt:
 - Username: **pi**
 - Password: **hackathon2018**

Localization Configuration

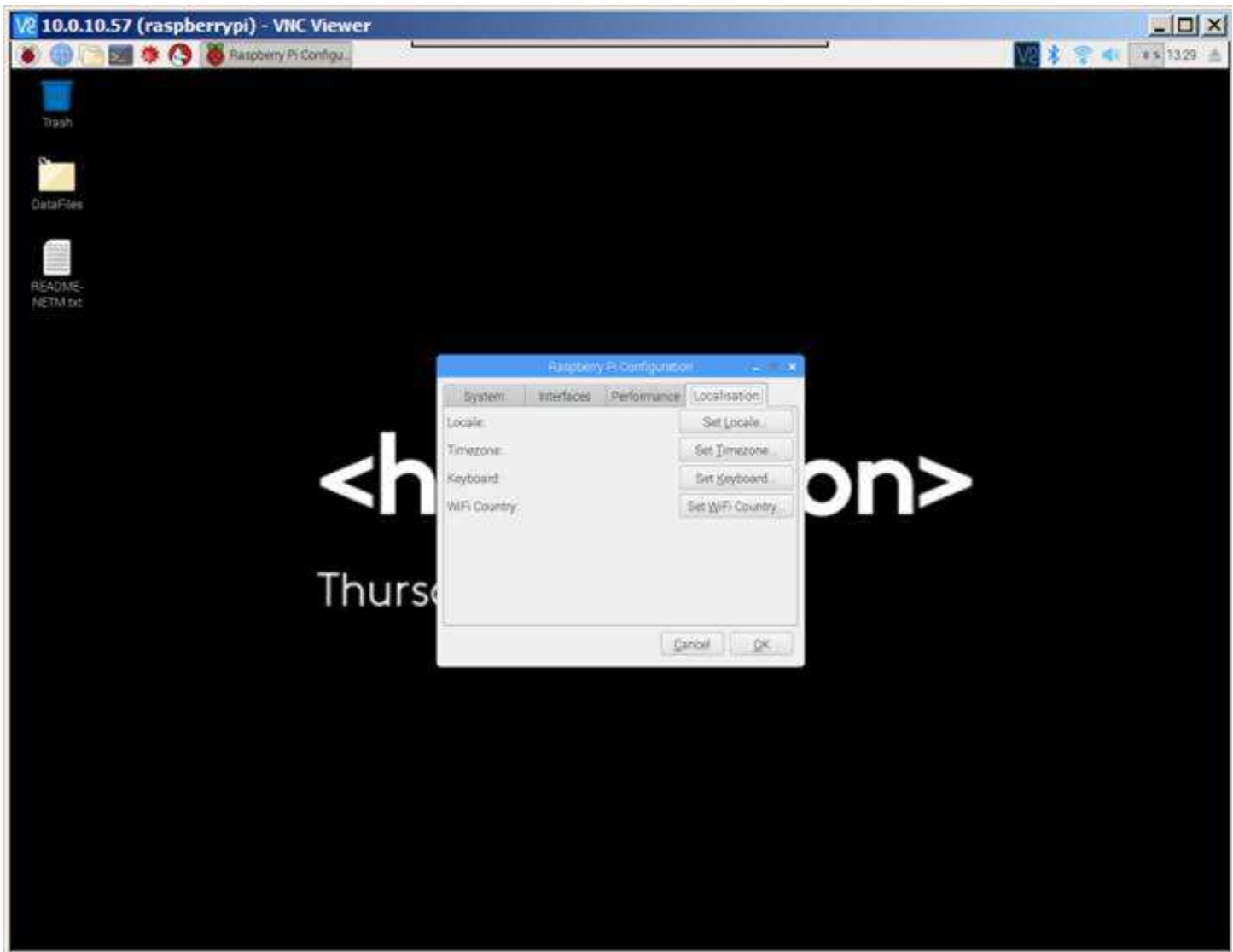
- Now that you are logged into your Pi, we need to update the localization options for your environment
- The default settings for this image are for the United States and Central time zone
- Most options can be set via the GUI configuration tools, but in the course of our setup we found that the keyboard settings did not seem to hold, so we will cover both the graphical and command line forms of raspi-config..

Launch Raspberry Pi Configuration Tool via the Desktop

Click on the Raspberry Pi/Start icon -> Preferences -> Raspberry Pi Configuration



Once up click on the Localisation tab and it should look as follows:



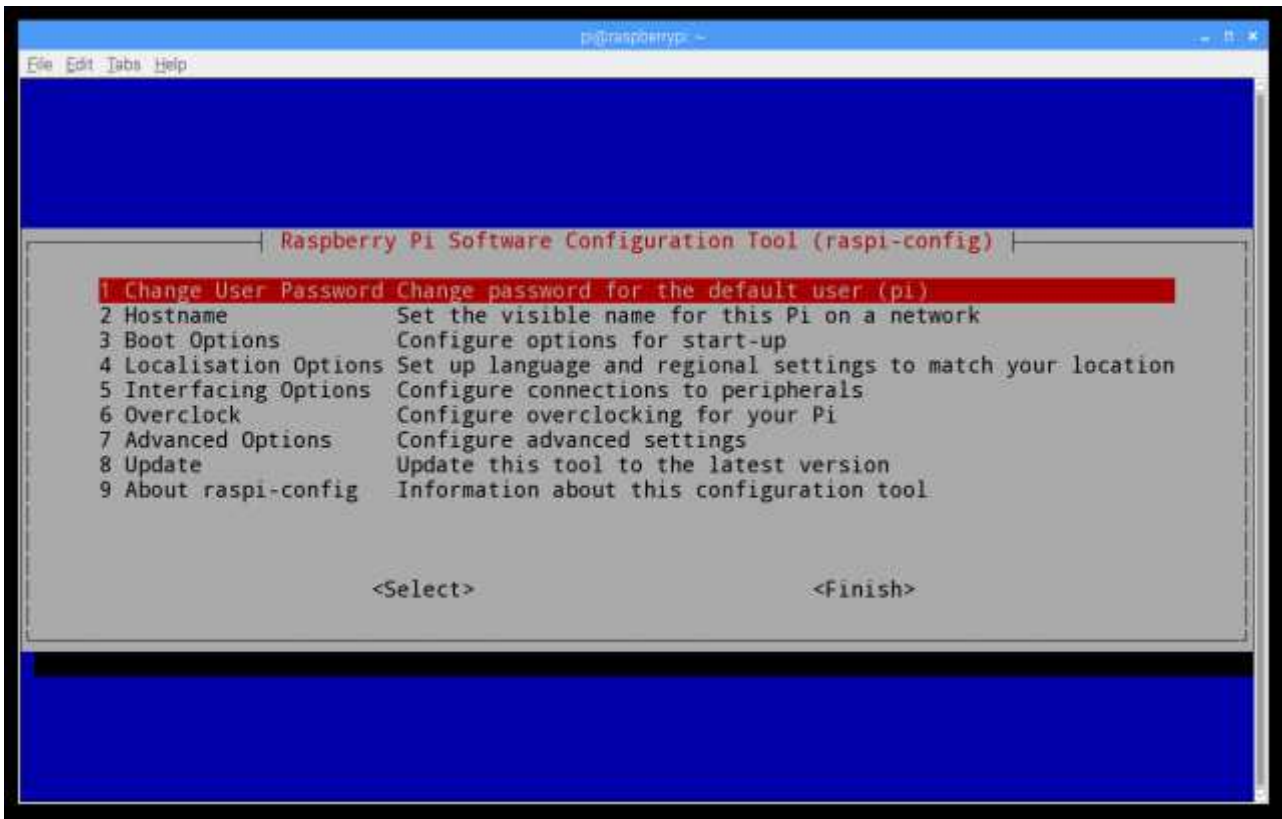
Please go through each of these items and set the option that best suites the requirements of your geographical location and click 'OK'.

At this point it may very well ask you to reboot, so please go ahead and do so. (Go to the Raspberry Pi start button and click Shutdown and one of the options is Reboot)

Once back online, just to make certain the most critical item (the keyboard) is updated appropriately, we are going to set this via the command line raspi-config utility.

- Click on the terminal icon on the launch bar at the top (looks like a DOS prompt)
- Type in 'sudo raspi-config' and hit enter

Your window should now look like:



Please go to the Localisation Options section and select 'I3 Change Keyboard Layout'

On each page select:

- Keyboard Model: Generic 104-key PC
- Country of Origin of Keyboard: Select 'English (US)' or scroll to the bottom and select 'Other' if not appropriate
 - If need to change scroll through the list and find the relevant setting for your environment
- Keyboard Layout: Select the generic option at the top (unless one makes more sense for your environment)
- Key to Function As AltGr: Select The default for the keyboard layout
- Compose Key: Select as needed (default to no compose key)
- Use Ctrl-Alt-Backspace to terminate X-Server: Select Yes
- Once you set that you will be back at the menu and use Tab to go to Finish

At this point I would suggest a reboot to ensure that everything is set as it should.

Network Configuration

Now that the localization configuration issues have been sorted, we are going to focus on getting the Raspberry Pi on the network.

- Kantar NETM capable offices
 - Open a terminal session and type in: `sudo /bin/configure-netm.sh`
 - Enter your Kantar e-mail address
 - Enter your AD password (this will not echo to the console)
 - Enter your AD password again (to verify no typos)
 - The script then updates the `wpa_supplicant` with your details in a hashed format
 - Go ahead and reboot and the Pi should automatically connect to NETM

```
pi@raspberrypi:~ $ sudo /bin/configure-netm.sh
NETM WPA Supplicant Creation Script

Please enter your KT e-mail address: kantaruser@kantar.com

Please enter your KT password (will not be echoed):
Please enter your KT password again (will not be echoed):
Passwords match, moving ahead.
Hashed password = a032af073b81dc9e11d912ae8516eac6
No pre-existing NETM section in /etc/wpa_supplicant/wpa_supplicant.conf, moving
ahead.
pi@raspberrypi:~ $
```

- Please note that NETM can be somewhat problematic, so if upon reboot you find that it didn't connect, I would suggest you try 2 to 3 more reboots to see if it sorts itself out. If that doesn't work, please contact the Hackathon project team and we will attempt to assist
- Additionally, please note that NETM based Pis **should not** have wireless managed via the wireless widget in the GUI; It modifies the network configuration and disables the manually created configuration to facilitate NETM connectivity. The issue can be sorted by deleting all of the network sections from the /etc/wpa_supplicant/wpa_supplicant.conf section (do "sudo nano /etc/wpa_supplicant/wpa_supplicant.conf" if it becomes necessary) and re-running the /bin/configure-netm.sh script
- Non-Kantar NETM offices
 - In the upper right corner of the screen between the Bluetooth and Speaker icons is a up and down arrow with little red Xs in it
 - Go ahead and click on this icon and it should generate a list of wireless networks that are in your area
 - Please select the appropriate network for your environment and it will prompt you for the passphrase for that network
 - Once entered the icon should change to the standard wireless icon and you should be connected to the network



Verifying Network Connectivity

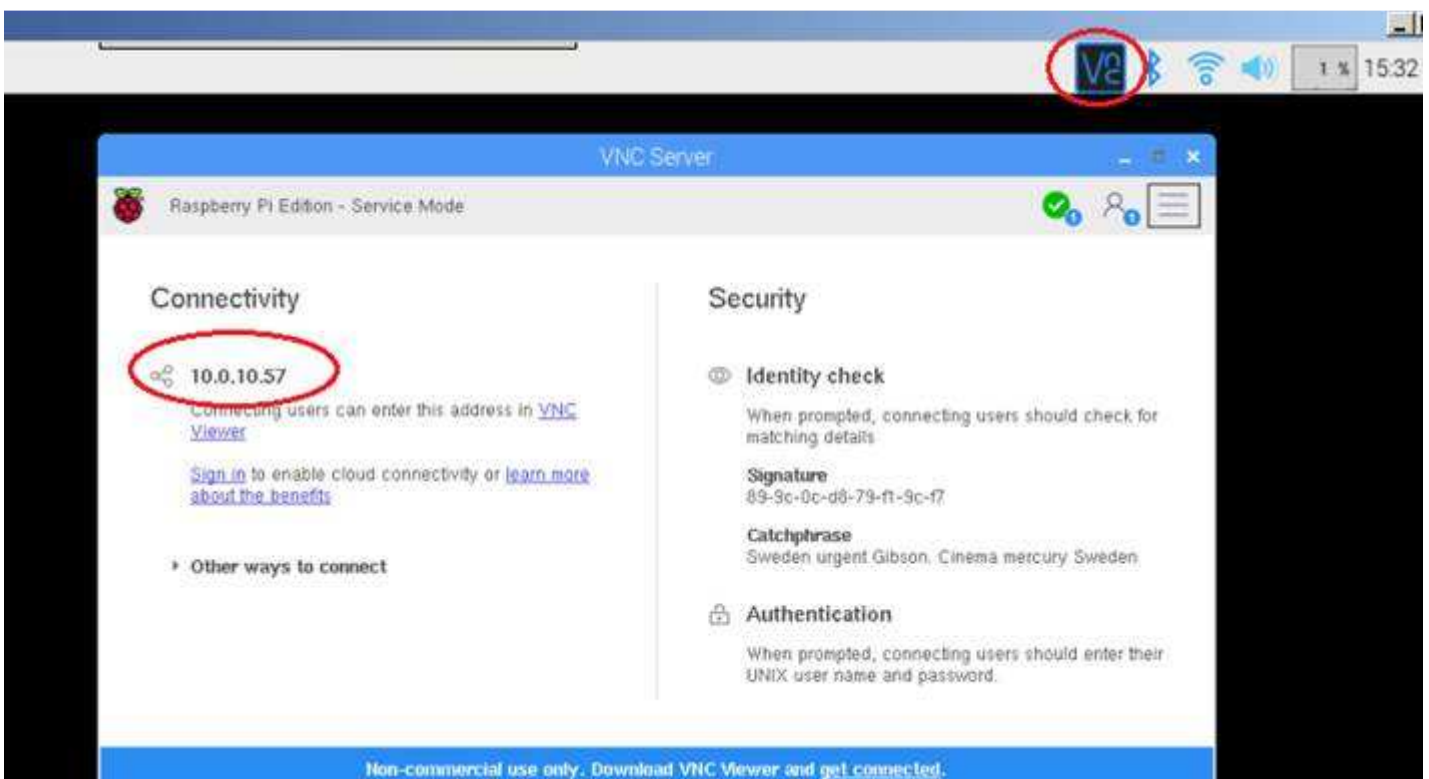
Once you believe your machine is now on the network, let's run a few basic checks:

Raspberry Pi IP Address

- Open a terminal session and type in `ifconfig wlan0` (if connected to wireless; use `eth0` if wired); It should look something like:


```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~ $ ifconfig wlan0  
wlan0      Link encap:Ethernet  HWaddr b8:27:eb:40:33:ae  
            inet addr:10.0.10.57  Bcast:10.0.10.255  Mask:255.255.255.0  
            inet6 addr: fe80::ba27:ebff:fe40:33ae/64 Scope:Link  
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
            RX packets:7111 errors:0 dropped:0 overruns:0 frame:0  
            TX packets:8139 errors:0 dropped:0 overruns:0 carrier:0  
            collisions:0 txqueuelen:1000  
            RX bytes:621470 (606.9 KiB)  TX bytes:4861302 (4.6 MiB)  
  
pi@raspberrypi:~ $
```

- Take note of this IP since it will be critical for remote access to the device in the future
- Alternatively, you can click on the VNC icon in the upper right corner of your screen and it will show you this as well:

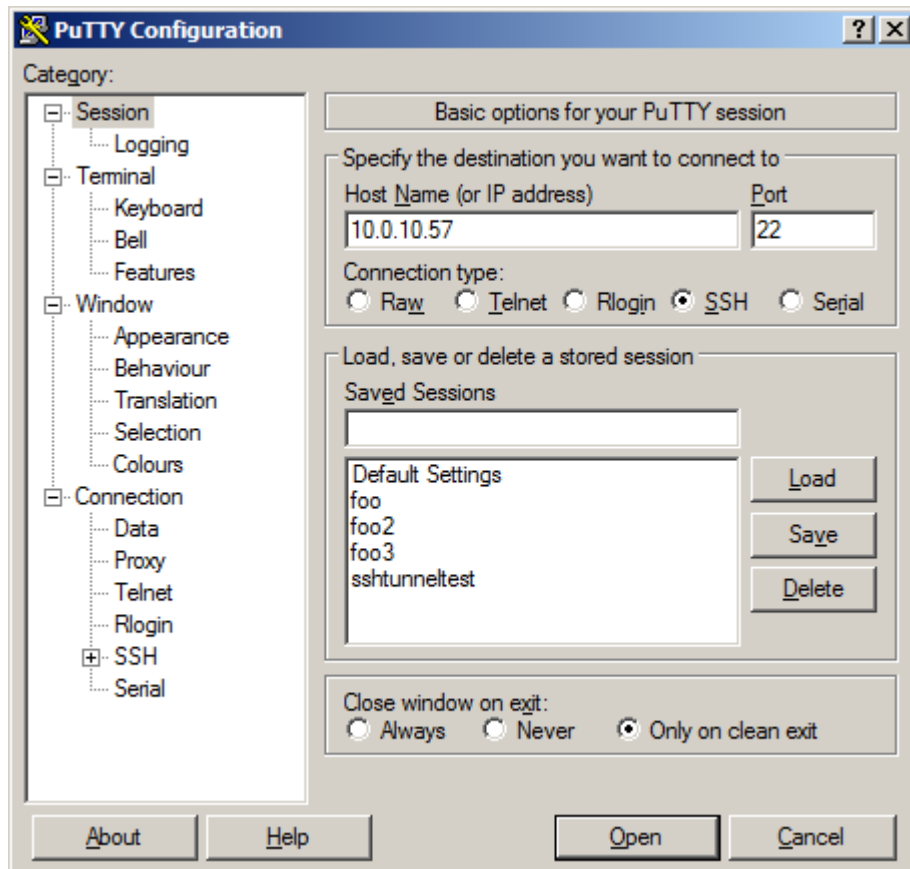


Determine Your External NATed IP Address (if needed for diagnostics and simple basic Internet access test)

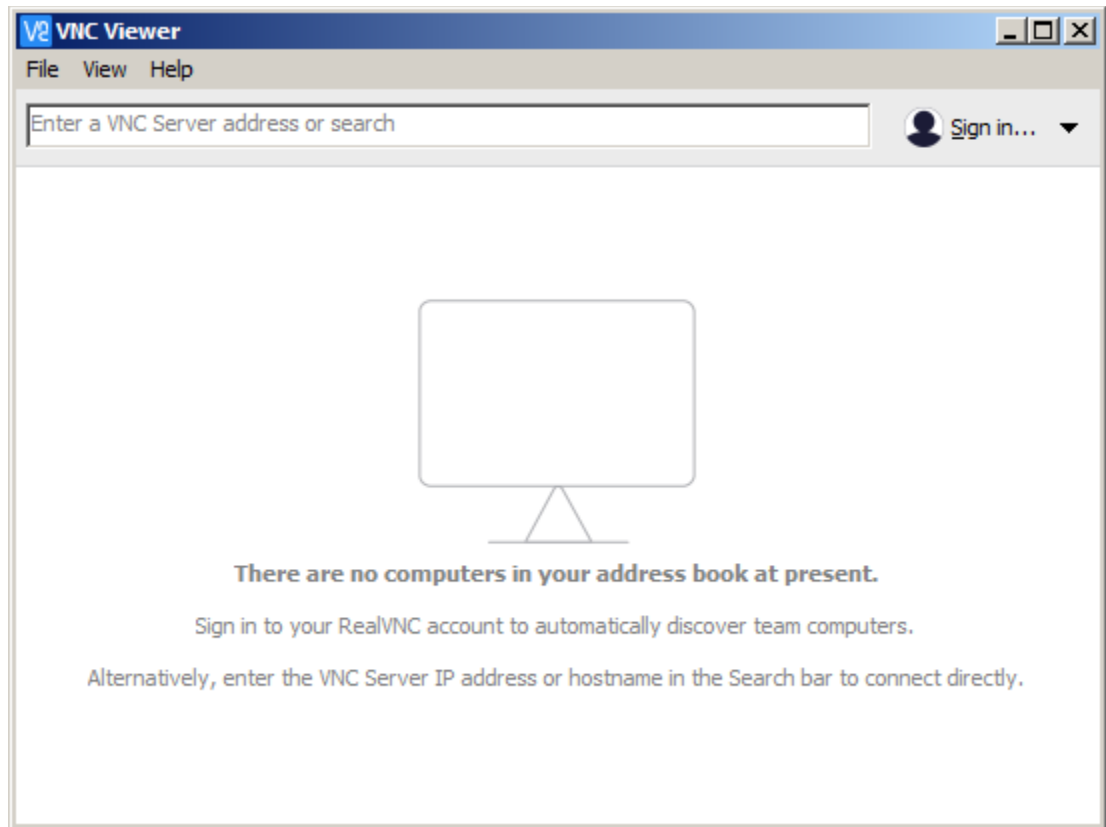
- In an effort to ensure that you have the relevant information handy in the event of an issue, let's take a moment and determine your external NAT IP address
- You can use the default Chromium browser on the Pi to go to:
 - google.com and type in 'whats my ip' and it will tell you
 - whatsmyip.org and it will tell you at the top of the page
 - canhazip.com and it will return just your IP address

Inbound Connectivity Checks

- With some very rudimentary checks out of the way, we now need to verify that users at your site can access the Raspberry Pis
- If the Pi is on the Kantar NETM network, we need to ensure that your laptop/desktop can reach it on the relevant ports from the user network
- Your Raspberry Pi is listening on ports 22/tcp (for SSH) and 5900/tcp (for VNC)
- It is imperative that the Pi be available via port 22/tcp from the user networks or it will be unable to participate in the event
- The VNC port is a nice alternative and allows people to remote “RDP” into the Pi without the overhead of having to attach a monitor and keyboard
- With that being said, let’s do some cursory inbound checks to your Pi
- SSH testing (Using port 22/tcp)
 - Download the windows ssh client putty from <https://www.ssh.com/ssh/putty/download> and launch it
 - Enter the IP address that you got in the previous steps and hit ‘Open’



- Accept the host key warning you will see and then you will be prompted for credentials, enter:
 - Username: pi
 - Password: hackathon2018
- If you are able to login, we have confirmed that users from the inside can connect to your Pi via SSH for both SSH remote terminal access as well as for file transfer via pscp, WinSCP or Filezilla (Please feel free to try them out at your leisure using the same credentials and similar methodology)
- VNC Testing (Using port 5900/tcp)
 - While not as critical as SSH access, in the event you need to remotely access the Raspberry Pi GUI this can be invaluable
 - Please go to <https://www.realvnc.com/en/connect/download/viewer/> and download either the standalone or installer version of the client
 - Once installed launch it and you will be presented with a screen similar to this:



- Please go ahead and enter the IP address that we determined in an earlier step and hit enter (do not use the Sign In on the right)
- If able to connect the application will prompt you for credentials and go ahead and provide the pi/hackathon2018 pair and click 'OK'
- If successful, you should be looking at the same desktop you were looking at earlier when attached directly to the Pi

Outbound Connectivity Checks

- Now that we have confirmed that the Raspberry Pi is accessible from the user networks, we need to confirm that the device can access some remote Azure service ports that will be part of the Hackathon Event
- For this rudimentary network connection testing we will use a terminal session (or shell if you ssh in) to use nmap to see if the relevant ports are open from the Pi to Azure.
- Open a terminal and type enter: `nmap -sT -p 443,5671,8883 utopiahub1.azure-devices.net`
- If all is working as expected, you should see as follows

```
pi@raspberrypi: ~
login as: pi
pi@10.0.10.57's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Jul  5 07:01:36 2017
pi@raspberrypi:~ $ nmap -sT -p 443,5671,8883 utopiahub1.azure-devices.net

Starting Nmap 6.47 ( http://nmap.org ) at 2018-05-06 16:04 CDT
Nmap scan report for utopiahub1.azure-devices.net (13.89.231.149)
Host is up (0.038s latency).
PORT      STATE SERVICE
443/tcp    open  https
5671/tcp   open  unknown
8883/tcp   open  unknown

Nmap done: 1 IP address (1 host up) scanned in 1.89 seconds
pi@raspberrypi:~ $
```

- The application developed during the Hackathon will be connecting to that remote service on the indicated ports. If any of them show as being closed or filtered, it is imperative that it be raised with the Hackathon project team as quickly as possible.

Potentially Helpful Resources

- WiFi NETM Debugging Notes:
 - <https://www.raspberrypi.org/forums/viewtopic.php?t=111100>
 - https://www.doc.ic.ac.uk/~ajd/Robotics/RoboticsResources/wifi_setup.txt
- General Resources and .NET
 - https://blogs.msdn.microsoft.com/david/2017/07/20/setting_up_raspian_and_dotnet_core_2_0_on_a_raspberry_pi/

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