(PART 3)

RASPBERRY PI IN THE SHACK

GETTING STARTED WITH REMOTE STATION OPERATION

Jack Weaver – AA5VZ

I love this hobby! Where else can you sit in a hotel room in Pittsburgh PA and enjoy a digital QSO on a laptop with a fellow Ham in France, using your transmitter & antenna in Texas via a Raspberry Pi computer connected to the internet? A strange thing to consider one's own signals passing overhead on their way to Europe and back!

December, 2017

INTRODUCTION

The Raspberry Pi Alternative for *WSJT-X*

Turn an inexpensive microcomputer into a digital communication machine.

Thomas Kocourek, N4FWD

In the "Eclectic Technology" column in the April 2017 issue of QST, *Chuck Kelly, W9MDO/VE1MDO, described a portable option for running* WSJT-X *digital mode software with a Raspberry Pi 3 microcomputer and a miniature LCD touchscreen. In this article, Thomas Kocourek, N4FWD, presents a similar solution, but with the emphasis on using the Pi as a dedicated home station computer for JT65, JT9, and WSPR — Ed.*

The author's station, with his Raspberry Pi 3 microcomputer at lower left, in its transparent case.

As we slide into the oncoming solar minimum, it's no surprise that we're seeing an uptick in popularity for digital modes, such as JT65 and JT9, as well as the WSPR digital beacon mode. JT65 and JT9 can support contacts on the HF bands under conditions that would render other modes unusable. And for those interested in HF propagation studies, WSPR is ideal.

All three modes are available in the free *WSJT-X* software package, created by Dr. Joe Taylor, K1JT. In addition to

around your ham shack. However, here is a list for those starting from scratch:

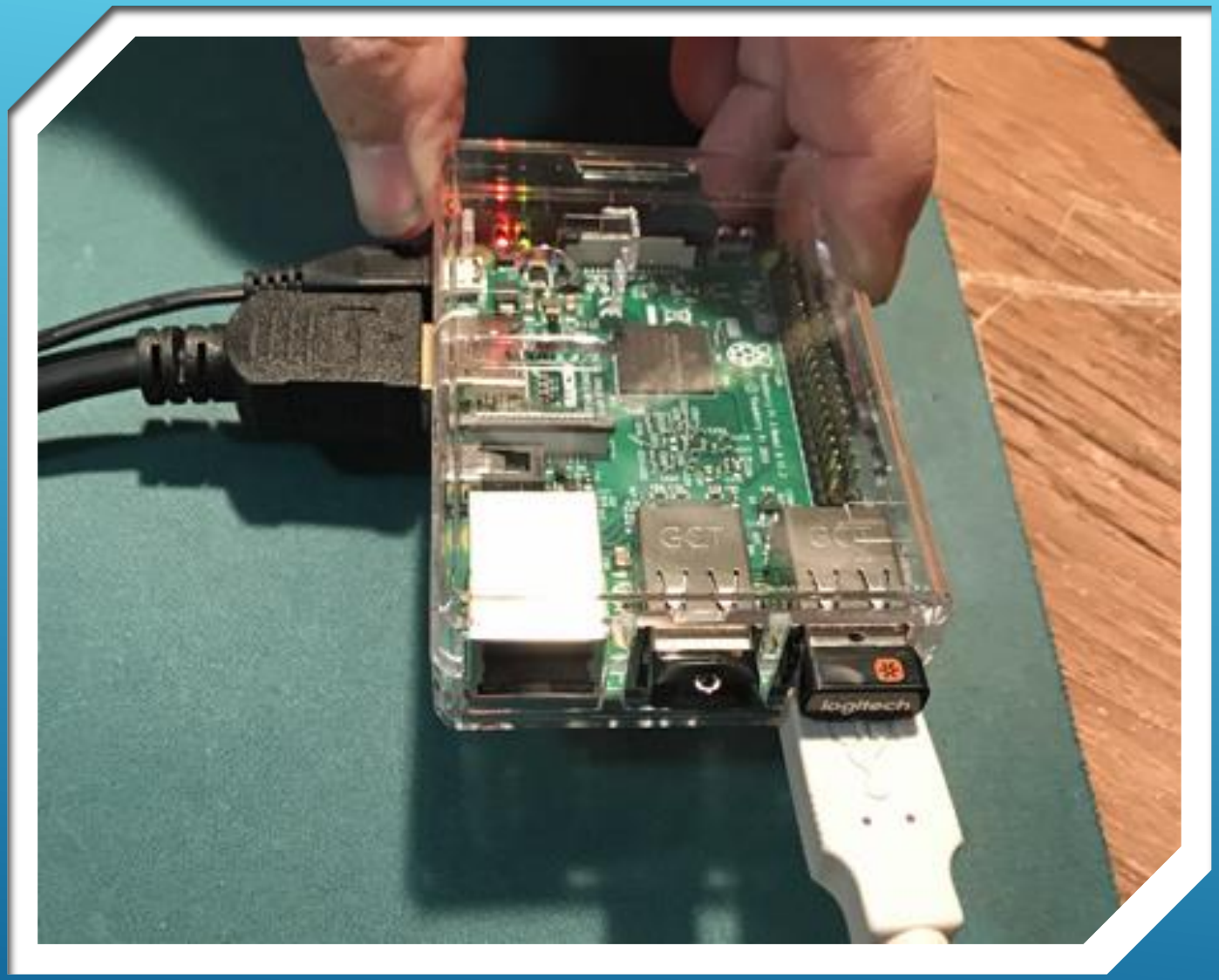
- **A Raspberry Pi 3 microcomputer**. For beginners, I strongly recommend a "kit," such as those offered by CanaKit (see Amazon and other sources), because these packages include almost everything you'll need, often including a case and power supply. Prices range

your monitor. Considering the small size of the Raspberry Pi, I'd recommend a lightweight cable to keep everything mechanically stable.

- **A USB "A-B" style cable**. This cable will link your Raspberry Pi to your interface or transceiver.
- **A keyboard and mouse**. To keep cabling to a minimum, I recommend a

WHERE IT ALL STARTED

QST Article, July 2017
Thomas Kocourek, N4FWD

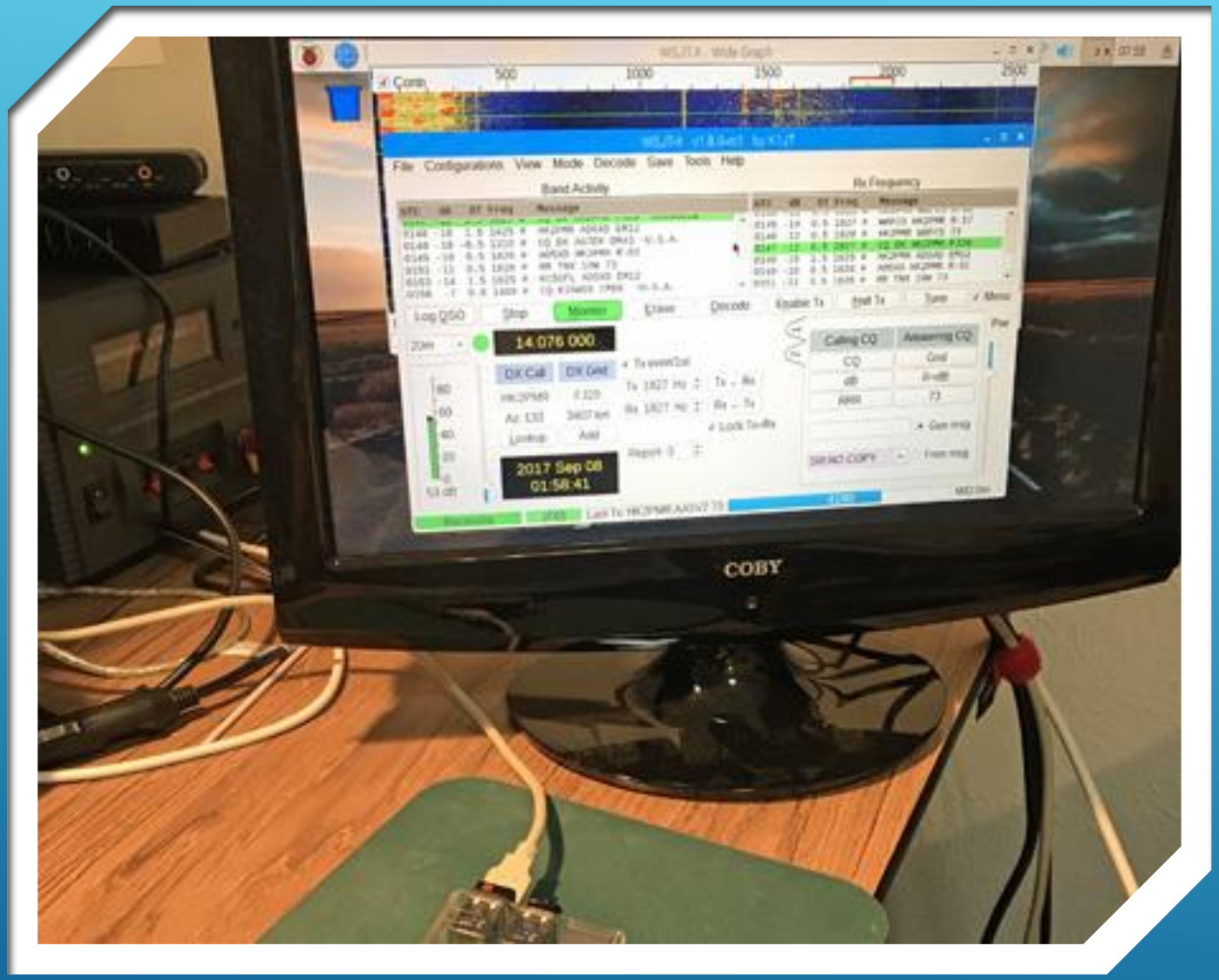


WHERE IT ALL STARTED

- My resulting station in 2017
- Raspberry Pi-3B shown

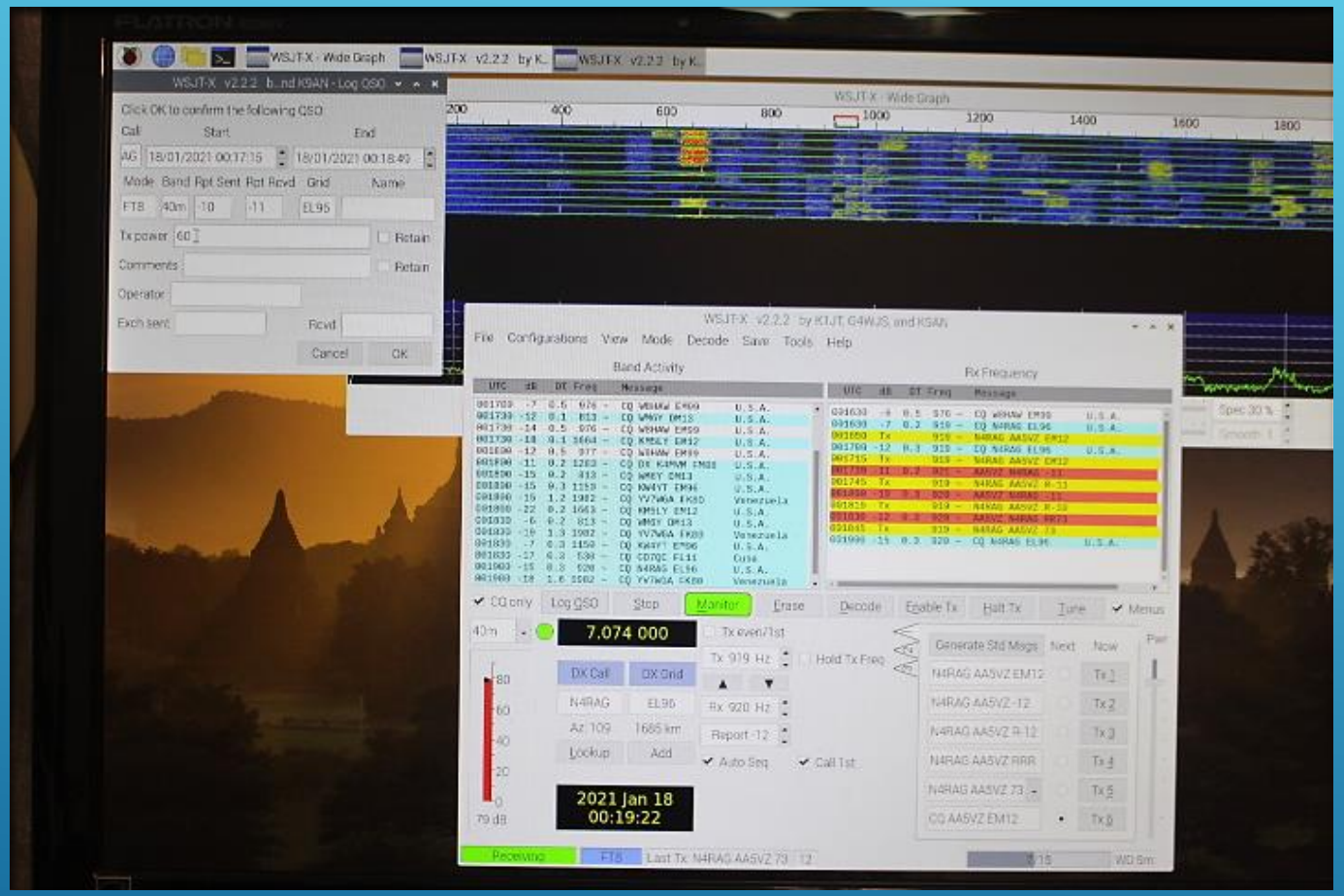
WHERE IT ALL STARTED

- **Wireless Keyboard with Touchpad**
- **Kenwood TS-590**
- **JT-65 Operating Mode**



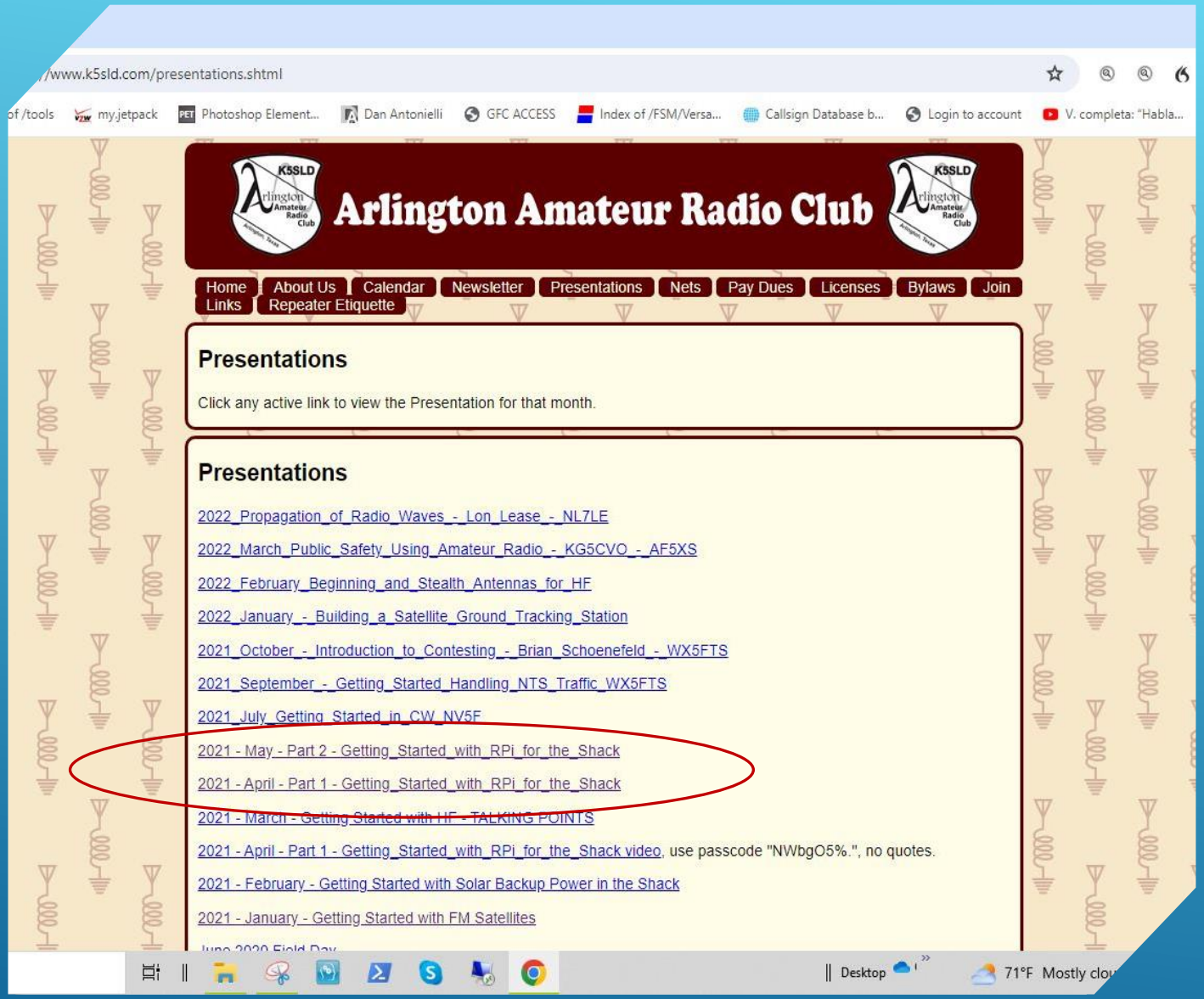
WHERE IT ALL STARTED

- **Successful Operation with JT-65, using equipment shown on previous slides.**



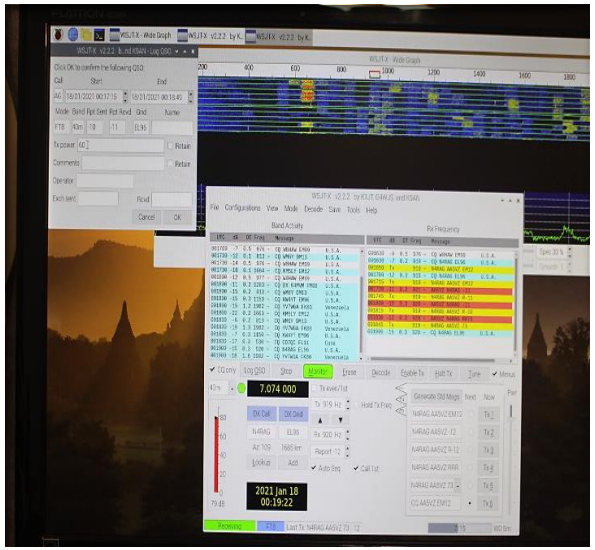
CURRENT ACTIVITY

- Raspberry Pi-4B
- FT-8 Digital Mode
- TS-590, TS-940, FT991A, FT-818
- Remote Station Operation from anywhere with a Laptop and Internet Cx



BACKGROUND

- www.k5sld.com
- Presentations Tab
- Updates expected for Parts 1 and 2
- Part 3 will be added



GETTING STARTED…

MOVING FORWARD

- Assemble a Raspberry Pi-4 Workstation
- Load the base Operating System (O/S)
- Install and Configure Ham Radio Apps
- Interface the Pi with your Station
- Get on the Air!
- 3A - Add LAN Remote Operation Capability
- 3B - Add WAN Remote Operation Capability

PART 1 (REVIEW)

- **Procured a Pi-4 kit**
- **Assembled the components**
- **Assembled a Pi-4 work-station**
- **Installed NOOBS**
- **Installed/Updated the O/S**
- **Backed up our System SD Card(s)**
- **Allowed time for familiarization**

PART 1 (REVIEW)

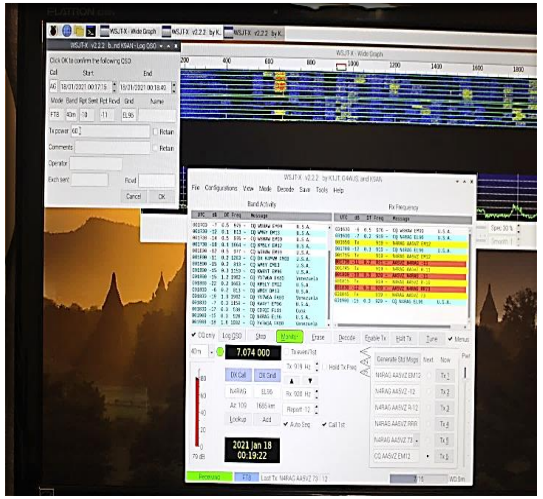
- **Recommended add'l tools and free software to format and back up SD cards and System Files (see below)**

- **https://www.sdcard.org/**
- Download / Install "SD Memory Card Formatter for Windows"

- **https://sourceforge.net/projects/etcher.mirror/**
- Download / Install "Etcher"

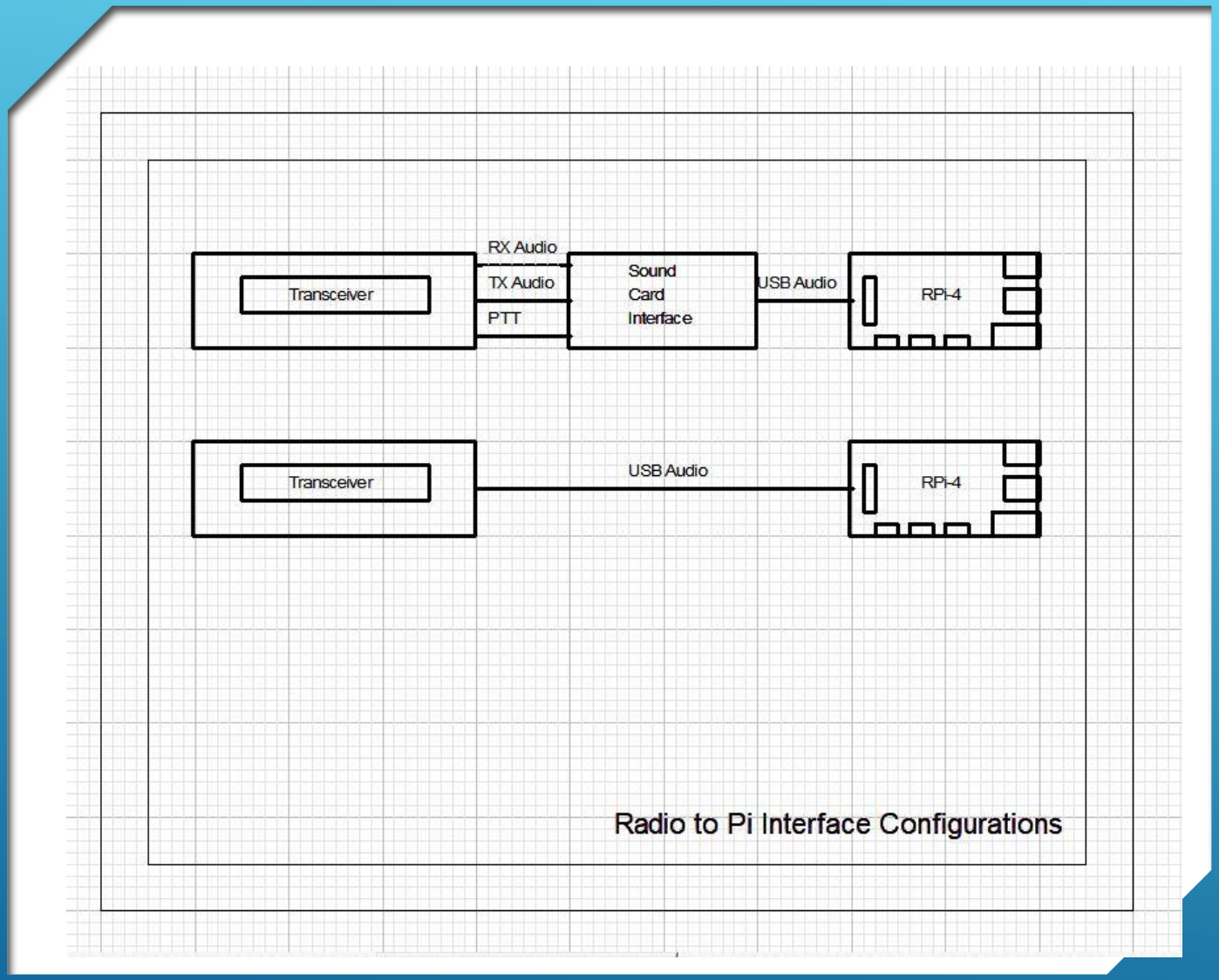
BTW…

- Current price of typical Raspberry Pi-4B kit, purchased on-line today.
- About the same price as Pre-Covid era.
- Down from more than $250.00, and nearly non-existent, two years ago.



PART 2 (REVIEW)

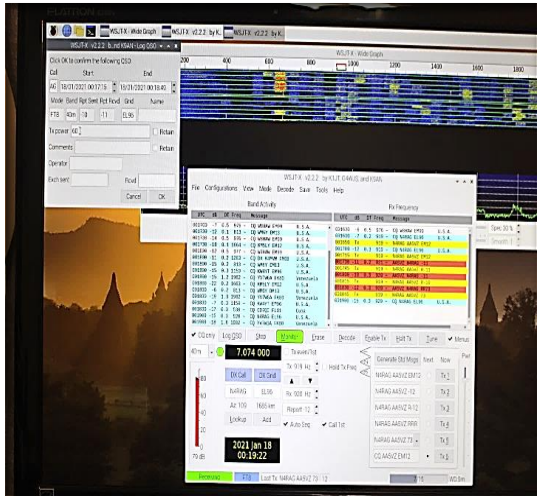
- Install WSJT-X (FT-8, JT-65, and others)
- Interface the Pi-4 to your Radio
  - Audio Sound Card
  - Direct (USB)
- Configure the Interface
- Configure WSJT-X App
- Configure your Radio
- Get on the Air
- Have Fun!



PI TO RADIO INTERFACE

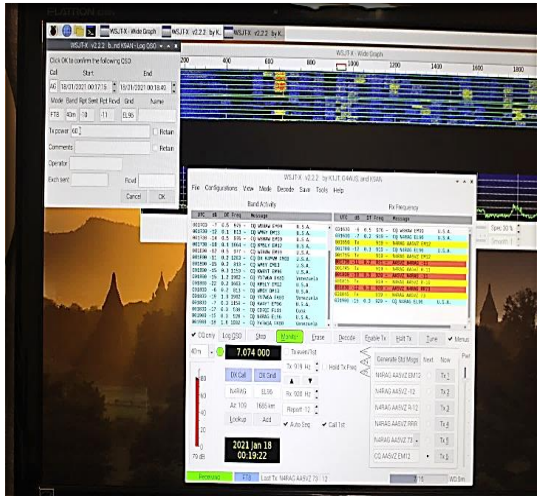
- Depending on the radio, you will use one of these two connections.
- Ex:
- TS-940 and FT-818 use top method
- FT-991A and TS-590 use bottom method

DEMONSTRATION



PART 3-A (TODAY)

- Configure the Pi-4 for “Headless” LAN operation
- Obtain Connection Parameters from the Pi-4
- Install “RealVNC Viewer” on Laptop or other Remote Computer
  - Create an Account (optional)
- Establish REMOTE connection via LAN
- Reminder on having radio and interface connected to the Pi-4 and configured accordingly. (from Part 2)
- Open the WSJT-X App (previously installed)
- Get on the Air
- Have Fun!

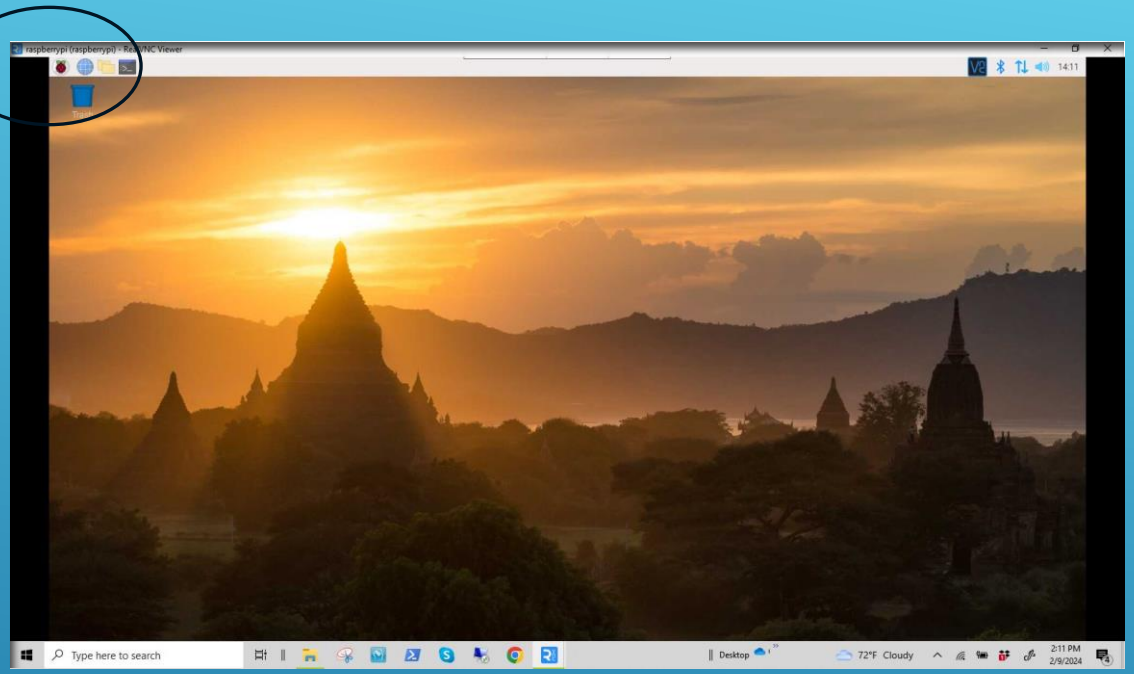


PART 3-B

- Configure system for WAN operation
- Install “RealVNC CONNECT” on Laptop or other Remote Computer
  - Create an Account (required)
- Configure Pi-4 for Remote Cloud Connections
- Establish REMOTE connection via Internet
- Open the WSJT-X App
- Get on the Air
- Have Fun!

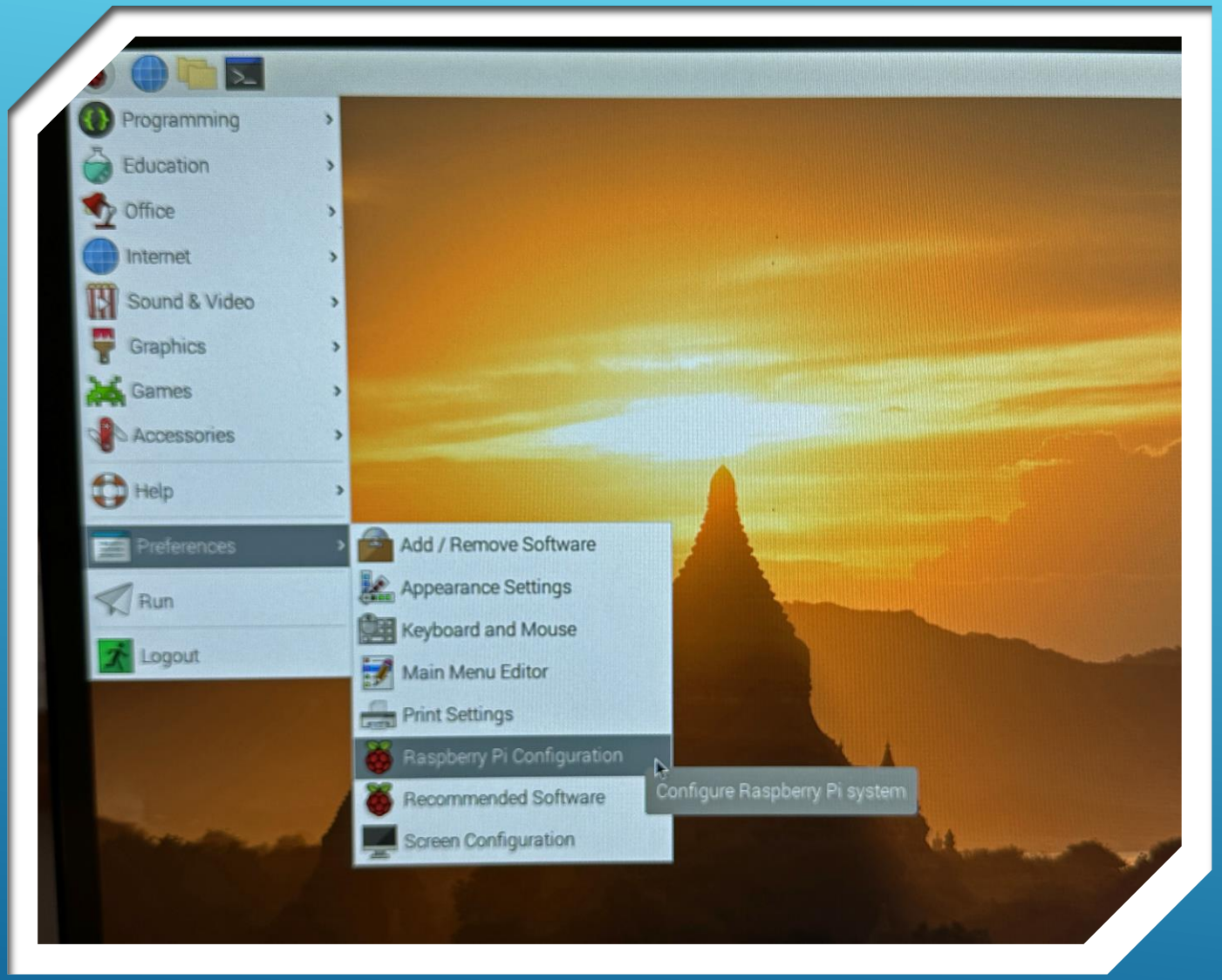
…OFF WE GO

STEP 1



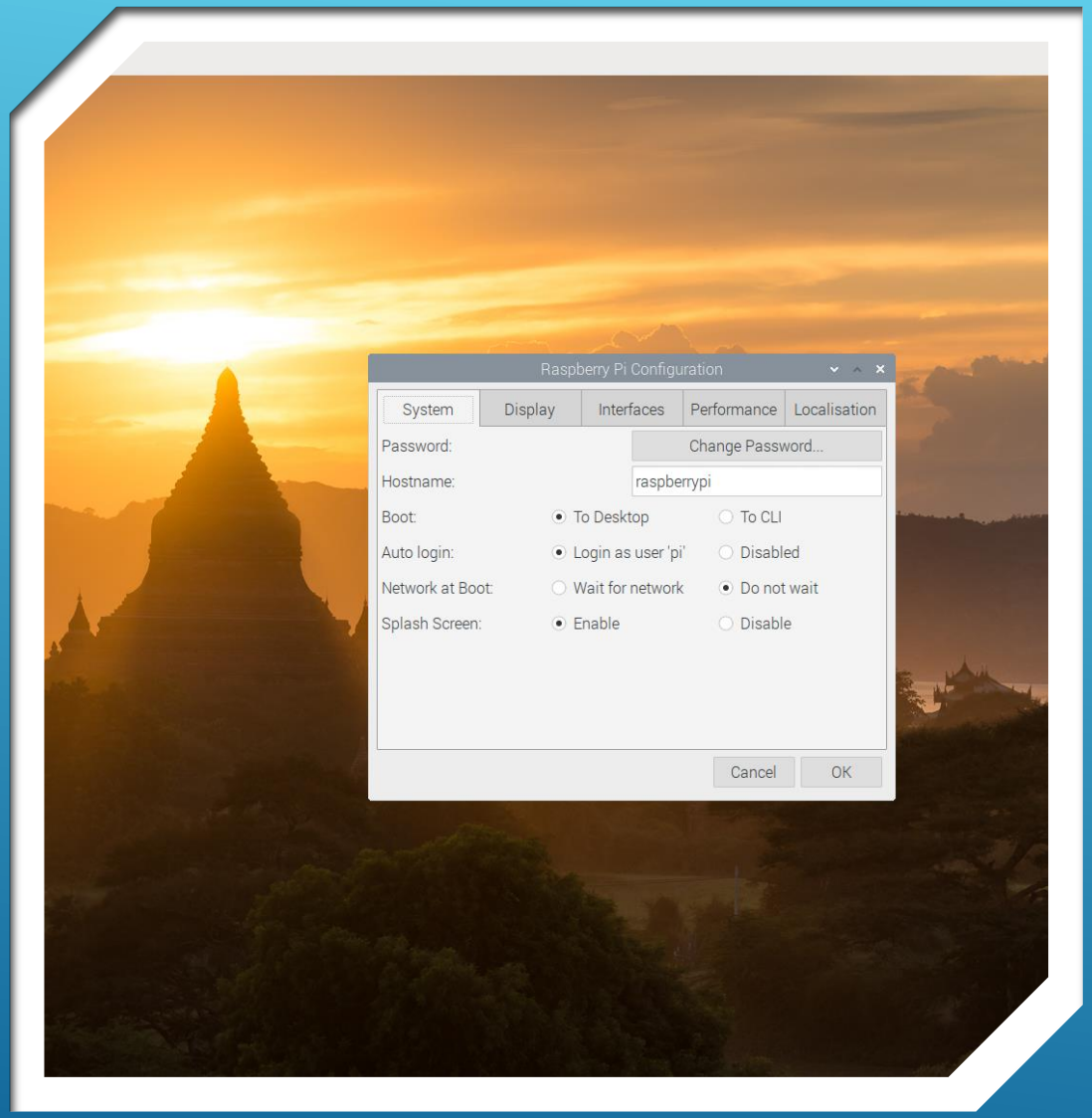
- Ensure Raspberry Pi-4 workstation is powered up and the home screen is displayed on the workstation monitor.
- Open the Raspberry Pi drop-down menu by clicking on the raspberry icon (upper left).

CONFIGURE THE RASPBERRY PI-4 FOR "HEADLESS" OPERATION



CONFIGURE THE RASPBERRY PI-4 FOR "HEADLESS" OPERATION

- **Go to the Configuration Screen by scrolling down to "Preferences" and clicking on "Raspberry Pi Configuration".**

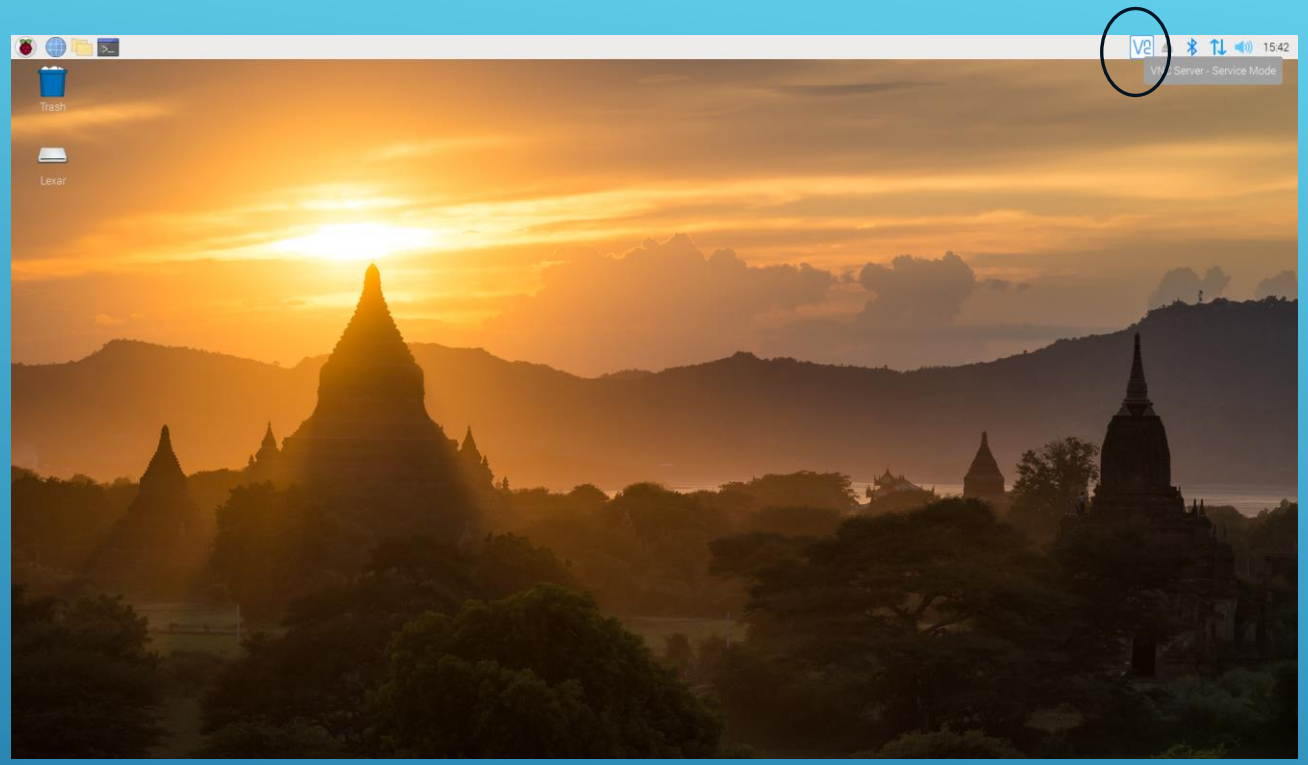


- "System" config. screen is displayed.
- Write down the default Hostname shown, "raspberrypi" in this case. You will use this information later.
- *Ensure "Login as user 'pi' " is enabled.
- DO NOT click "OK" yet.
- Rather, click on the "Interfaces" tab.

CONFIGURE THE RASPBERRY PI-4 FOR "HEADLESS" OPERATION

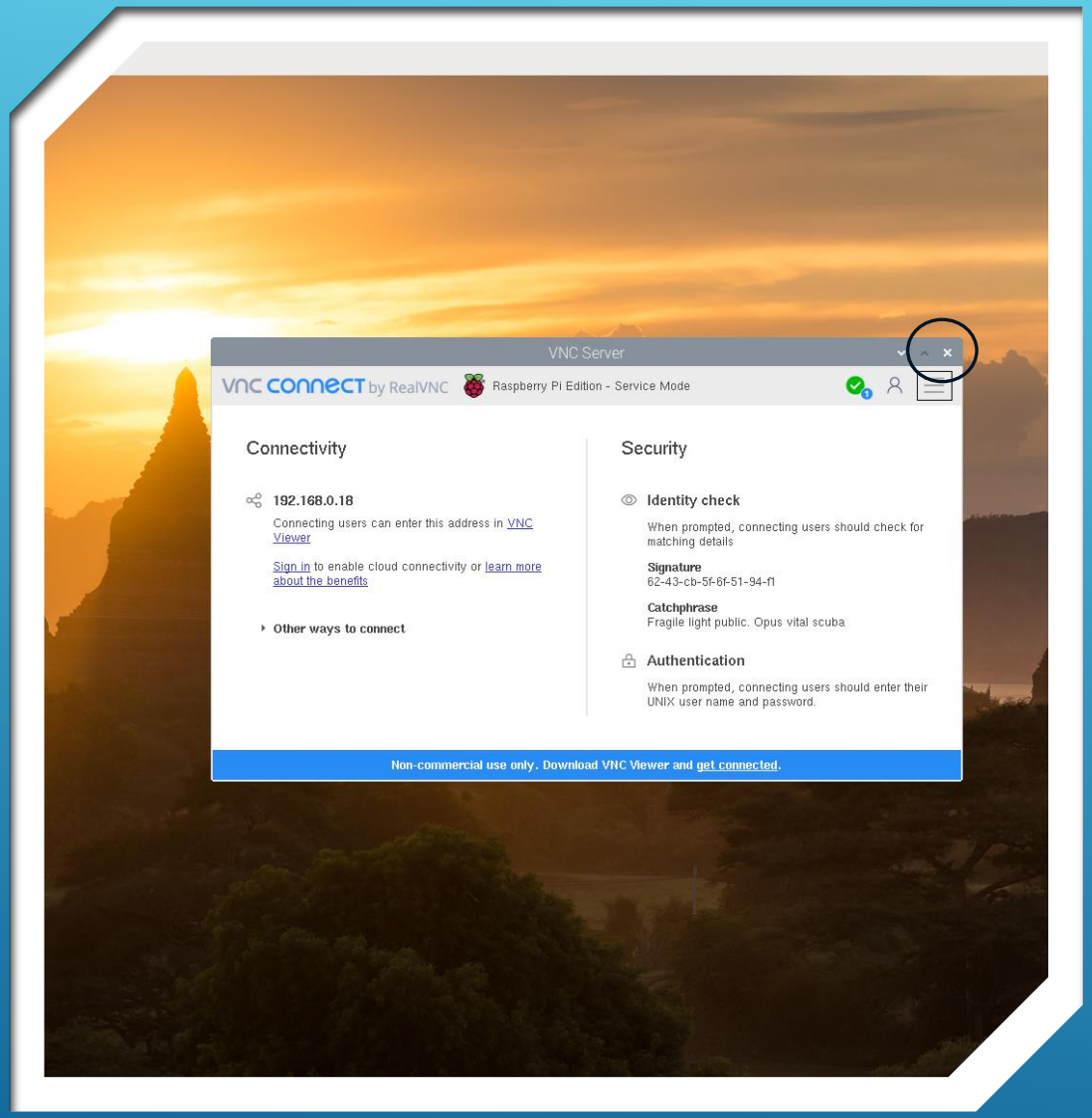
- "Interfaces" configuration screen is displayed.
- Ensure "SSH" and "VNC" buttons indicate "Enabled".
- Click "OK".
- Display returns to the home screen.

CONFIGURE THE RASPBERRY PI-4 FOR "HEADLESS" OPERATION



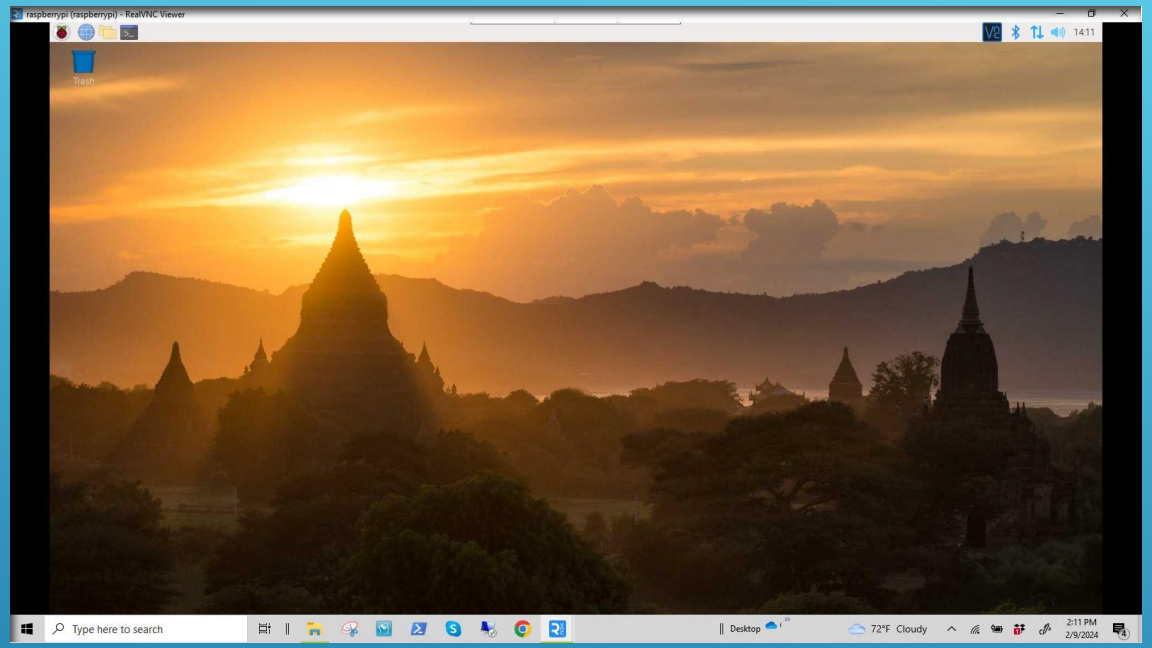
- **Finally, Open the VNC Server screen by clicking on the VNC Icon (upper right area).**

CONFIGURE THE RASPBERRY PI-4 FOR "HEADLESS" OPERATION



- Under the “Connectivity” title, the IP address for the raspberry pi device is displayed in the format, 192.168.x.yy.
- Write down the number-string shown, for future reference.
- This is the address to access the Raspberry pi device for connectivity on the local (LAN) network.
- Close the screen by clicking the “X” in the upper RH corner of the text screen.

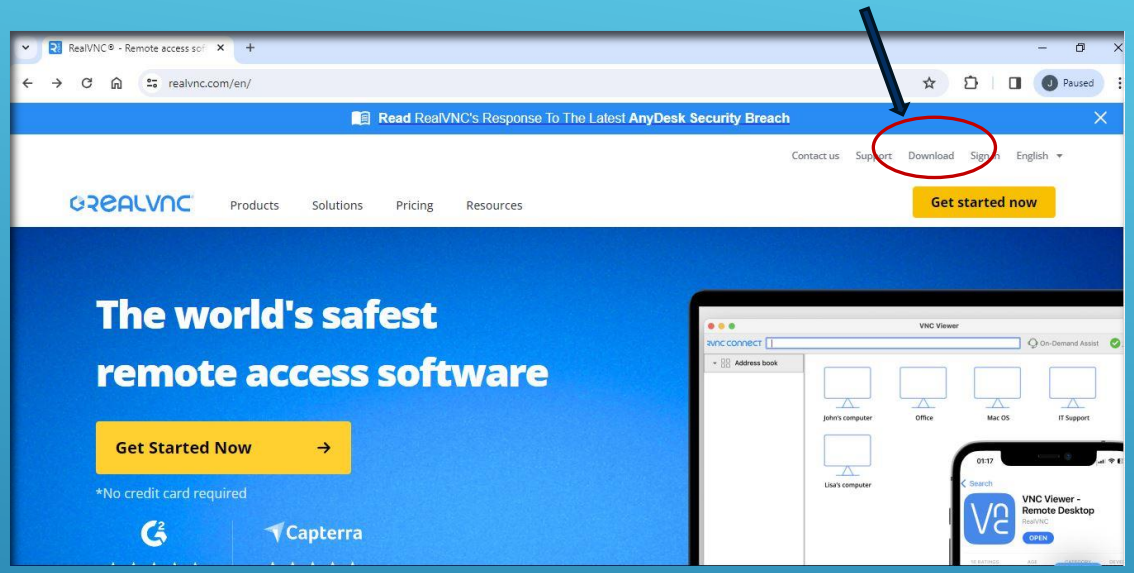
CONFIGURE THE RASPBERRY PI-4 FOR “HEADLESS” OPERATION



- That's it for configuring the Pi for remote connectivity as the "Server".
- Keep the Raspberry Pi Workstation powered up and set on the home screen.
- Now we will configure the laptop for remote connectivity to the Pi, as the "Viewer".

CONFIGURE THE RASPBERRY PI-4 FOR "HEADLESS" OPERATION

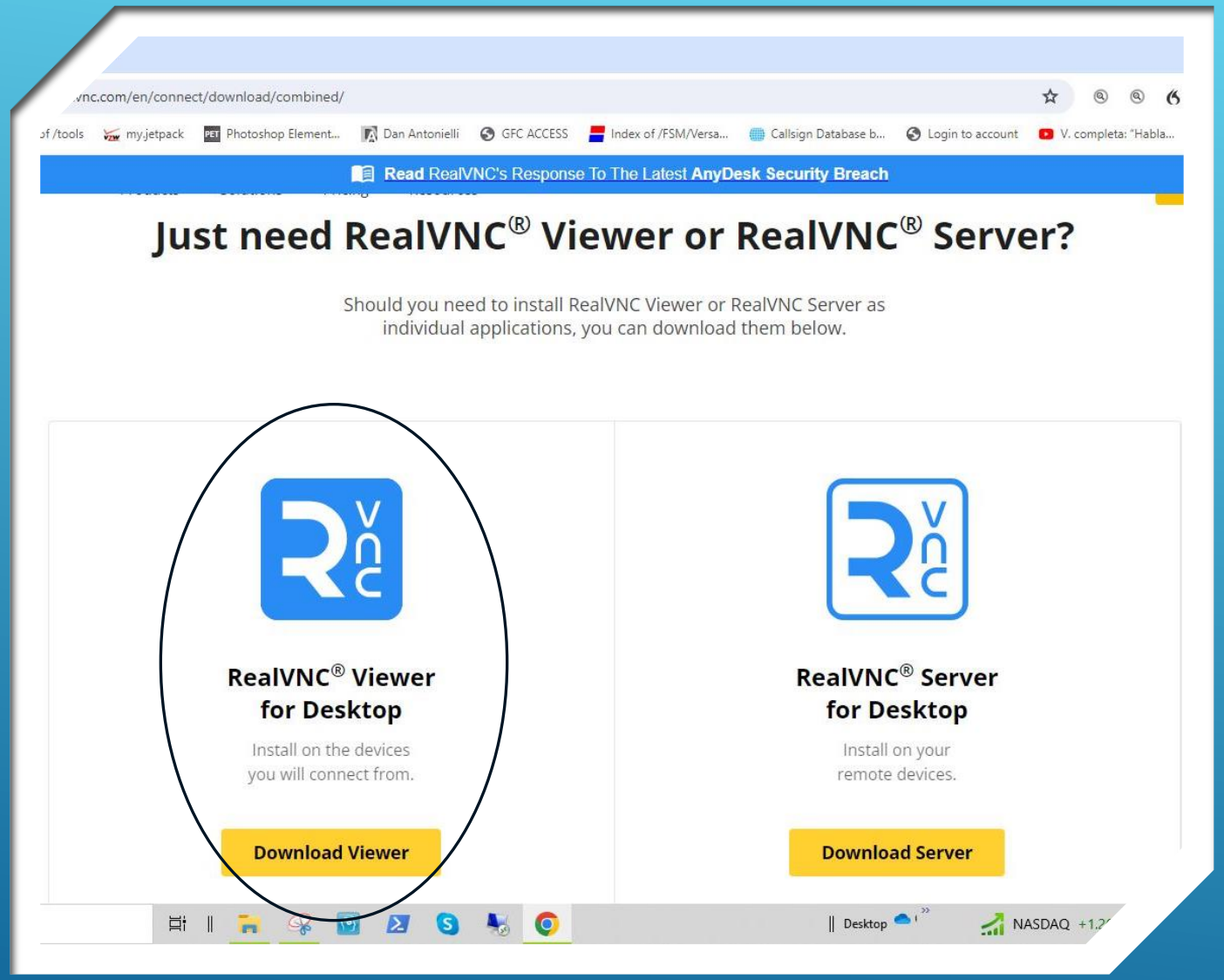
STEP 2



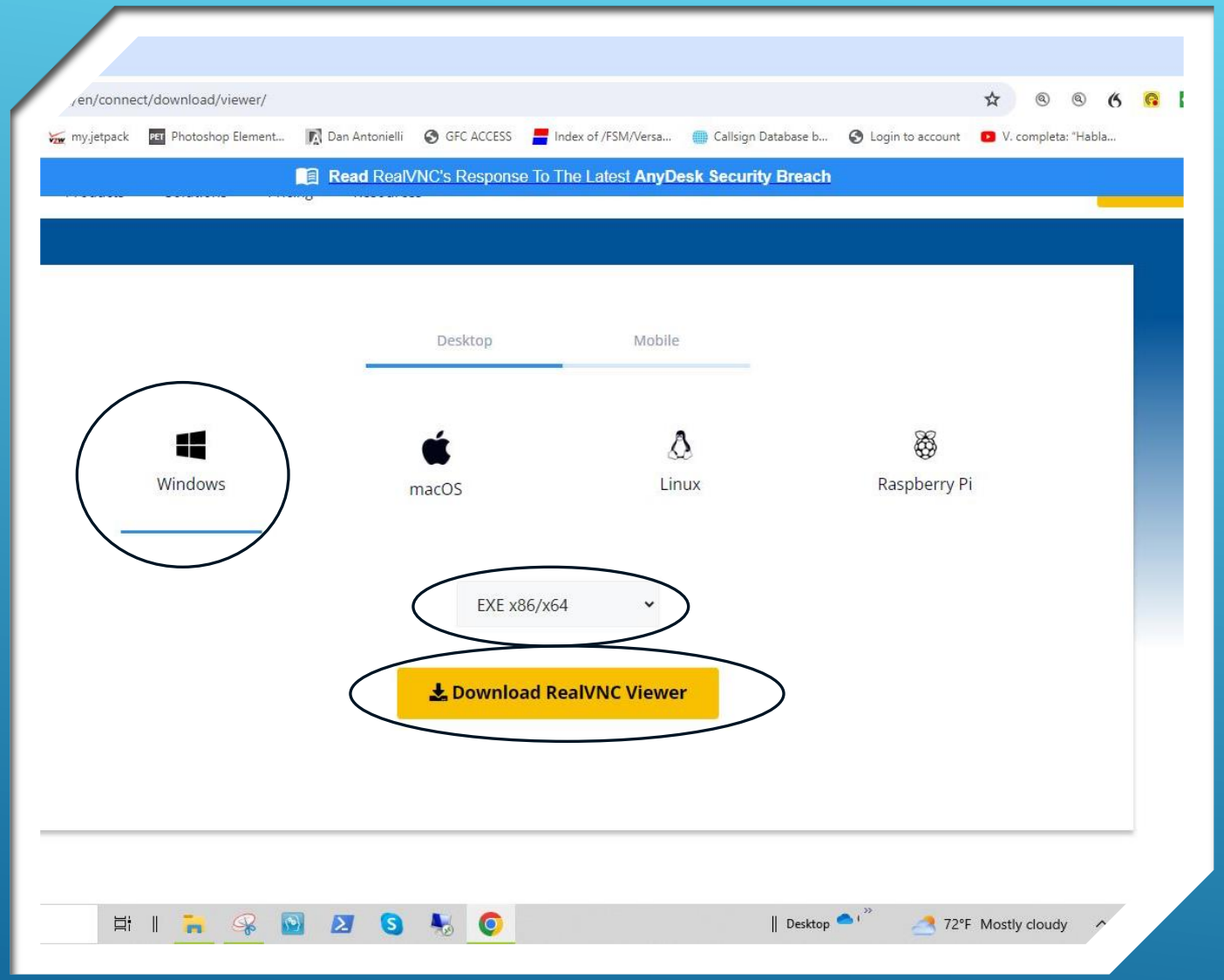
- Go to RealVNC Homepage
- www.realvnc.com
- Click on “Download”

INSTALL REAL_VNC VIEWER ON LAPTOP

INSTALL REAL_VNC VIEWER ON LAPTOP



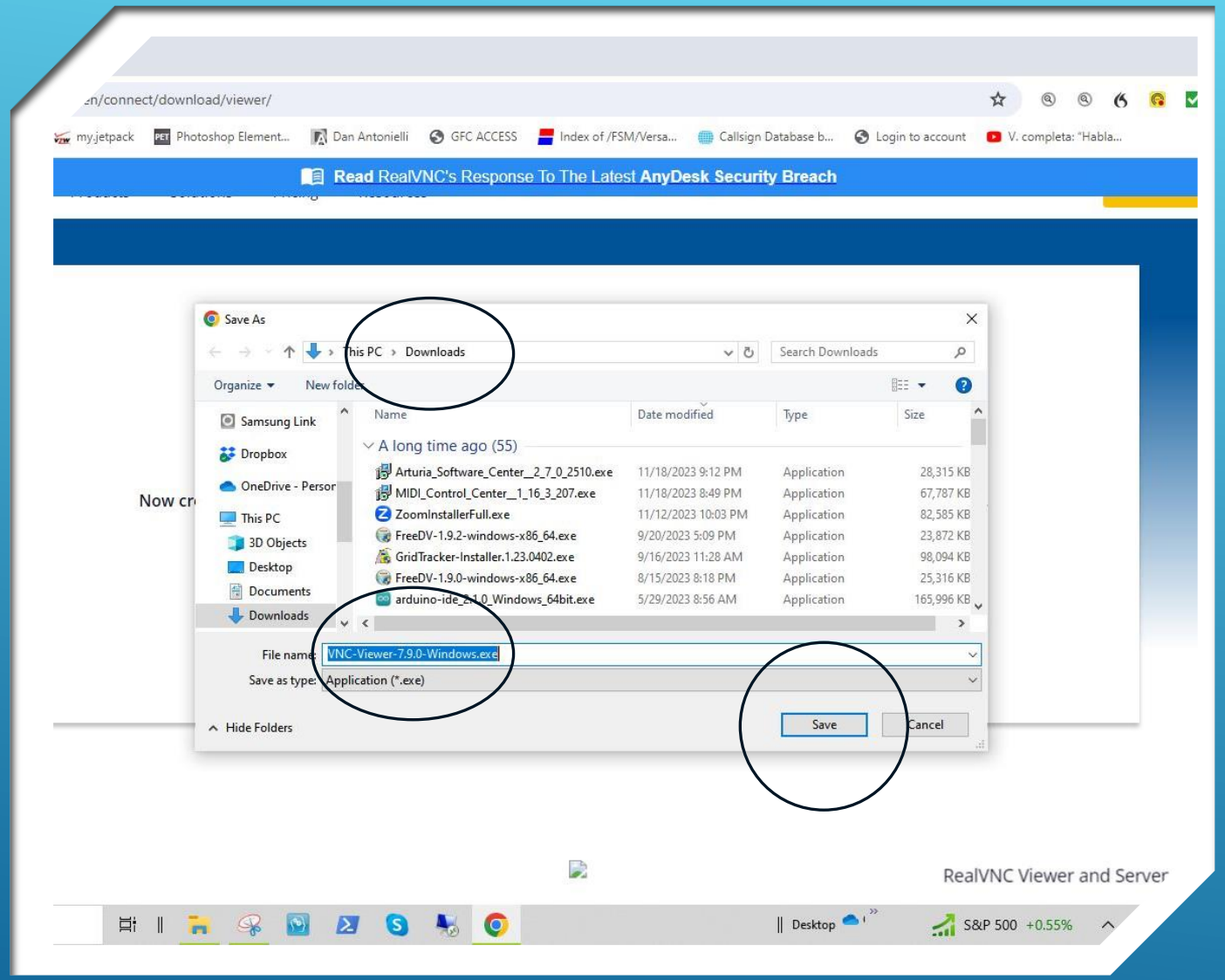
- Scroll down to “RealVNC Viewer for Desktop”
- Click “Download Viewer”



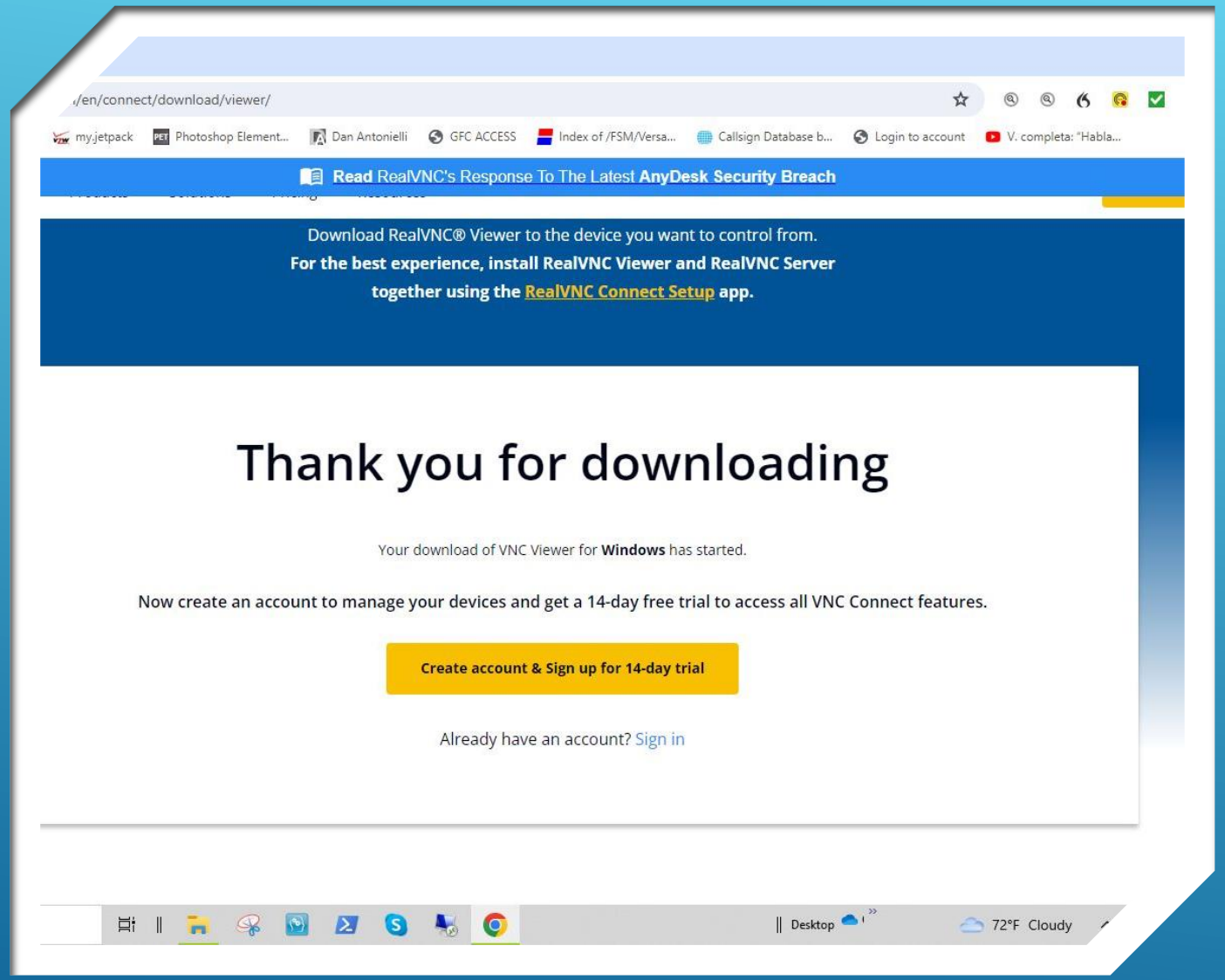
INSTALL REAL_VNC VIEWER ON LAPTOP

- **Choose computer type to download to…**
- **Windows, EXE x86/x64 in my case**
- **Click “Download RealVNC Viewer”**

INSTALL REAL_VNC VIEWER ON LAPTOP



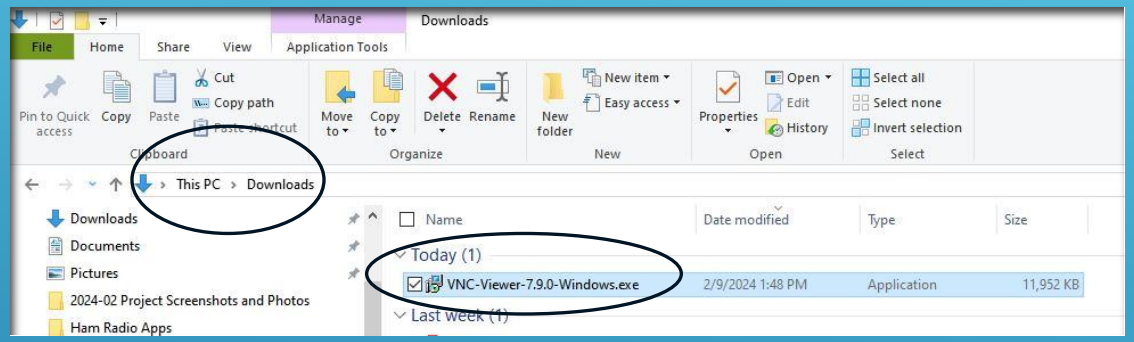
- **Verify destination to save the file being downloaded**
- **Press “Save”**



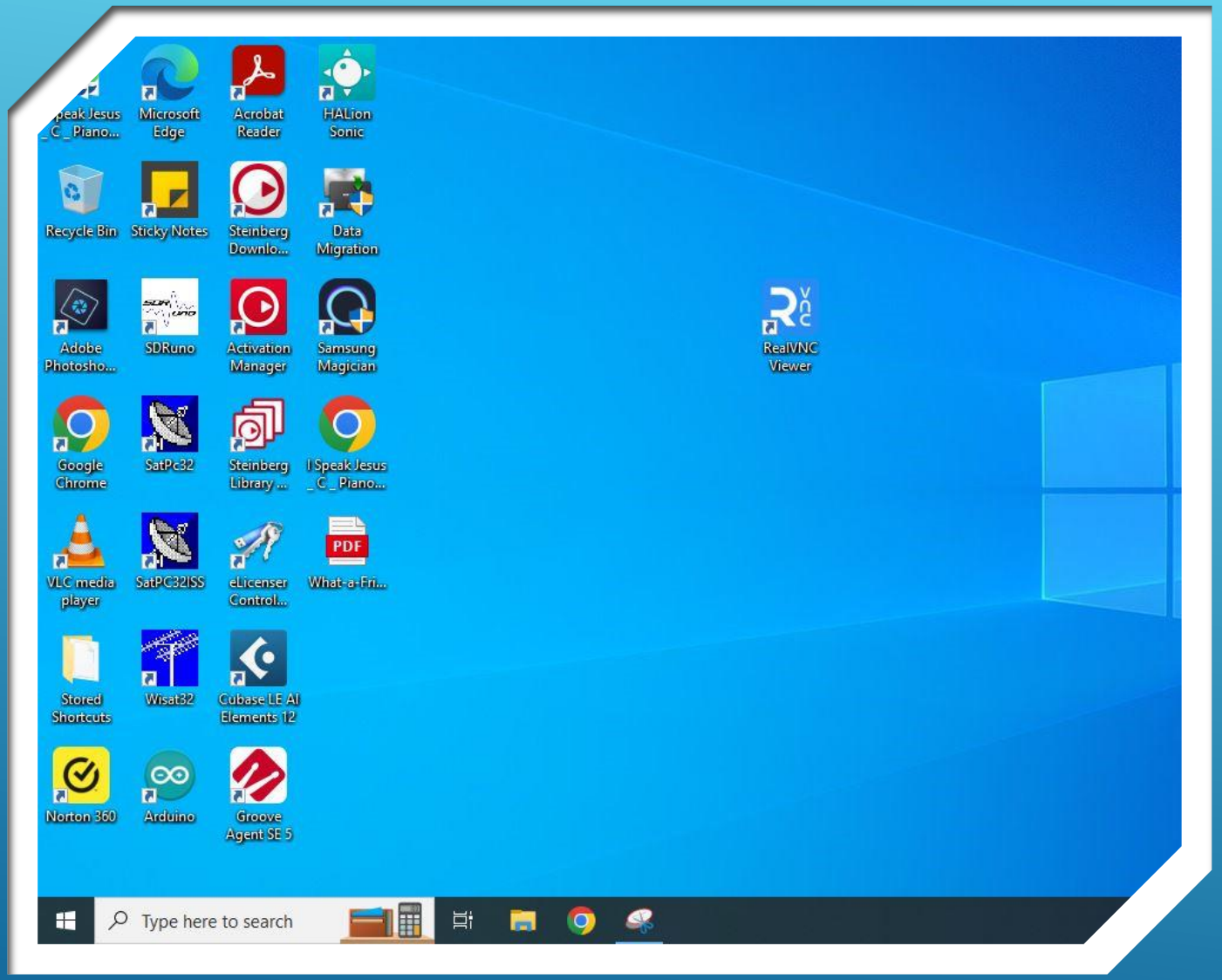
INSTALL REAL_VNC VIEWER ON LAPTOP

- **Download is COMPLETE**
- **Creating an account with Real VNC is Optional for now…**
- **But, required later for Part 3-B**

INSTALL REAL_VNC VIEWER ON LAPTOP



- To Install RealVNC Viewer
- Open the Downloads directory on the laptop.
- Double-click on the VNC Viewer .exe file you just downloaded.
- Follow the prompts to complete the installation

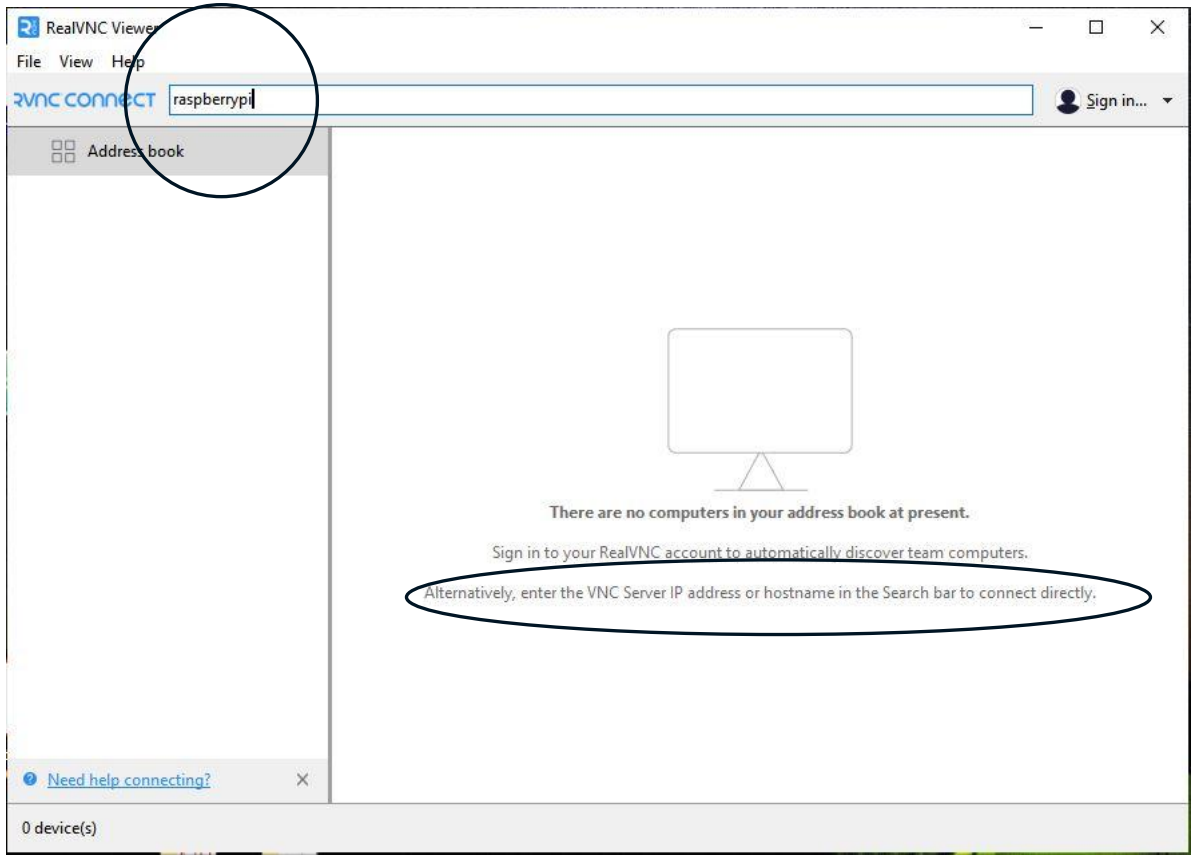


INSTALL REAL_VNC VIEWER ON LAPTOP

- **Place “RealVNC Viewer” Icon on the desktop**
- **Double-Click the Icon to open “RealVNC Viewer” on the laptop**

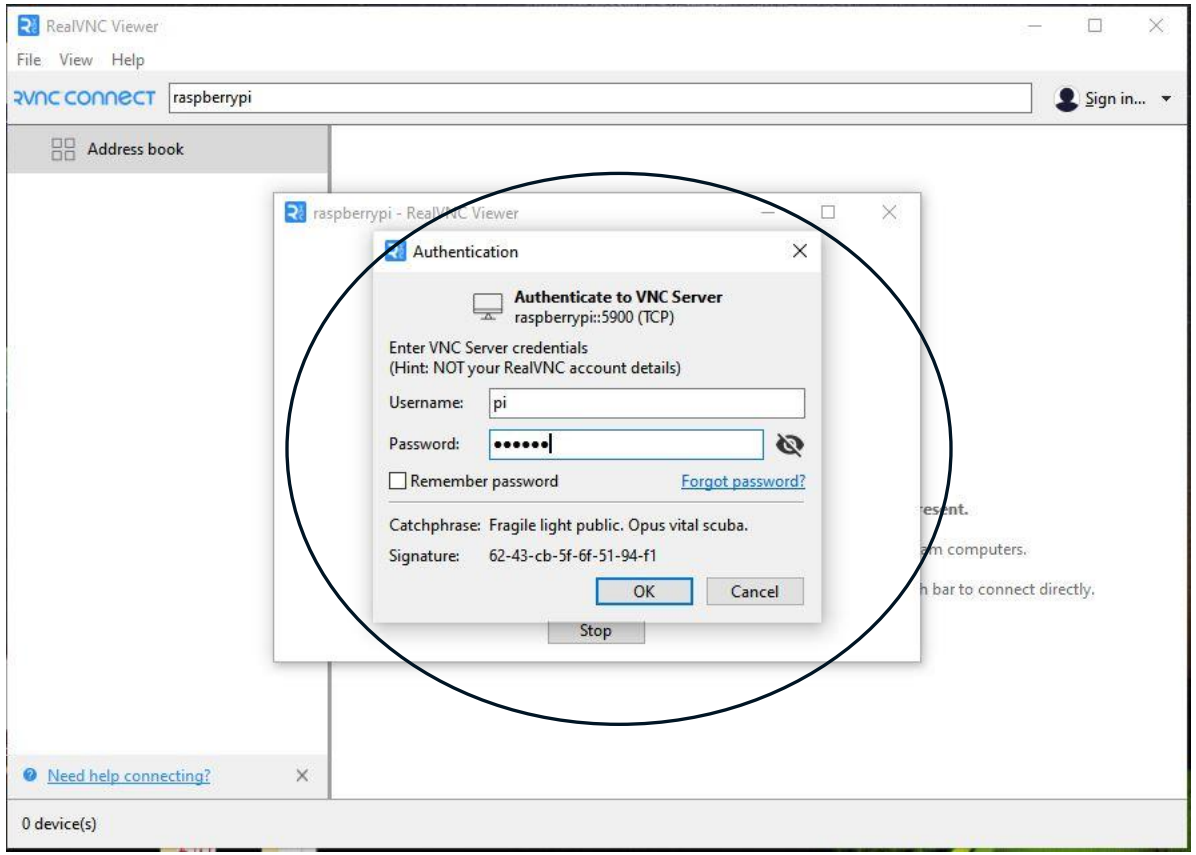
STEP 3

ESTABLISH REMOTE LAN CONNECTION TO THE RASPBERRY PI

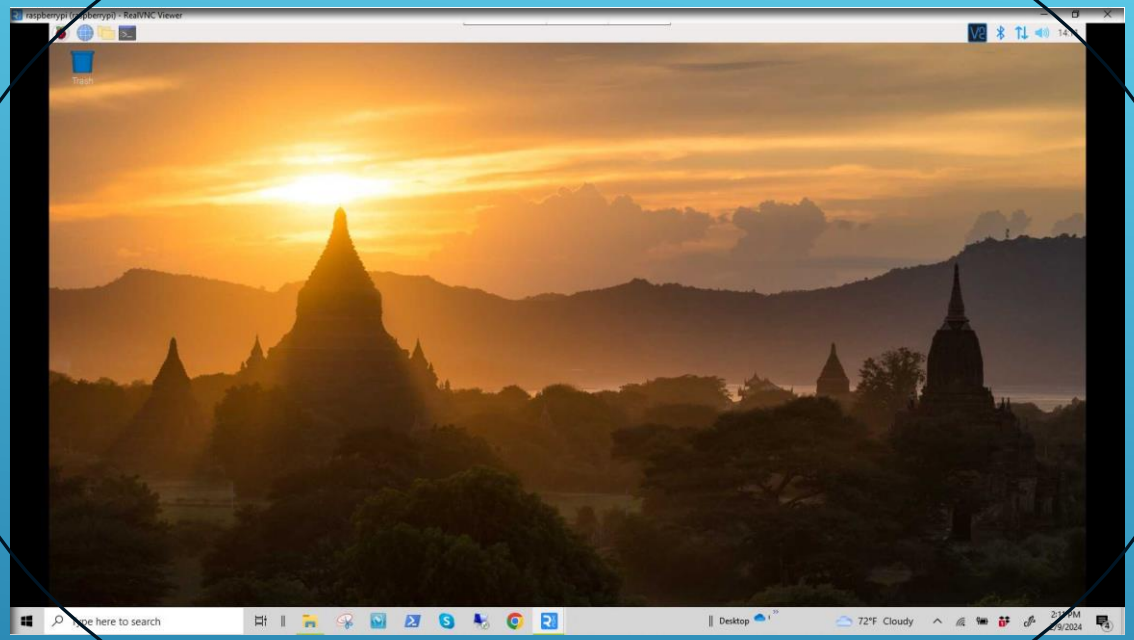


- **Ensure Raspberry Pi is already booted to the Homepage and connected to the internet.**
- **Open "RealVNC Viewer" on the Laptop**
- **Type in the RPI Hostname "raspberrypi", or the PI's IP address (derived earlier).**

ESTABLISH REMOTE CONNECTION TO THE RASPBERRY PI



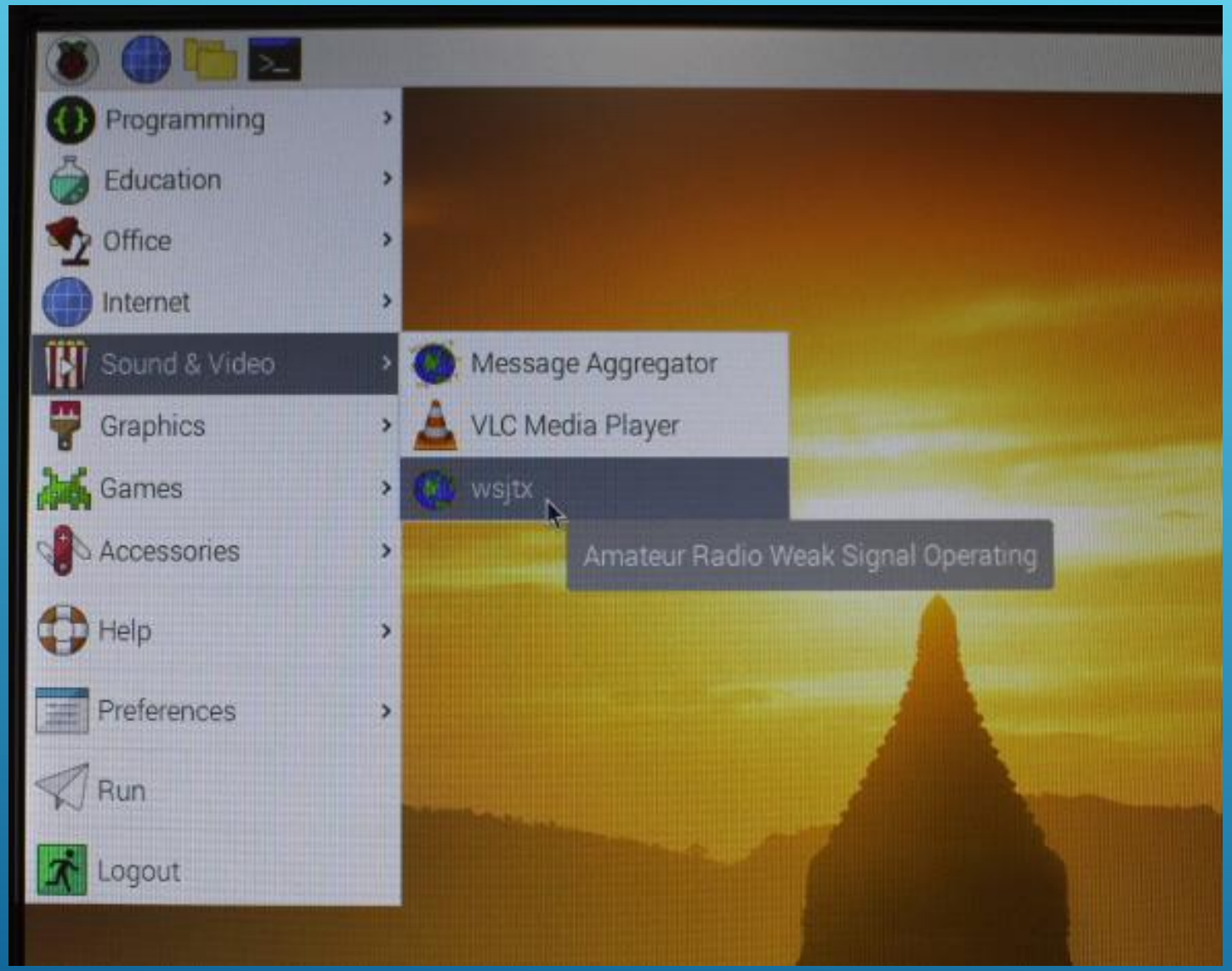
- An “Authentication” window appears when the pi device has been located.
- Type in the Raspberry PI’s sign-in credentials and click “OK”
- Username is “pi”
- Password is either the Pi’s default password “raspberry”, or a different password if you had changed it previously.



- Remote connection is successful if you see the Pi home screen on the laptop.
- All corresponding mouse and keyboard commands from this screen on the laptop are now controlling the Pi.
- The Pi workstation monitor is no longer needed at this stage.
- This feature is also known as “headless” operation.
- The laptop remains connected, and the Pi can be controlled from anywhere within reception range of the network’s WiFi router.
- Think of the implications!!!

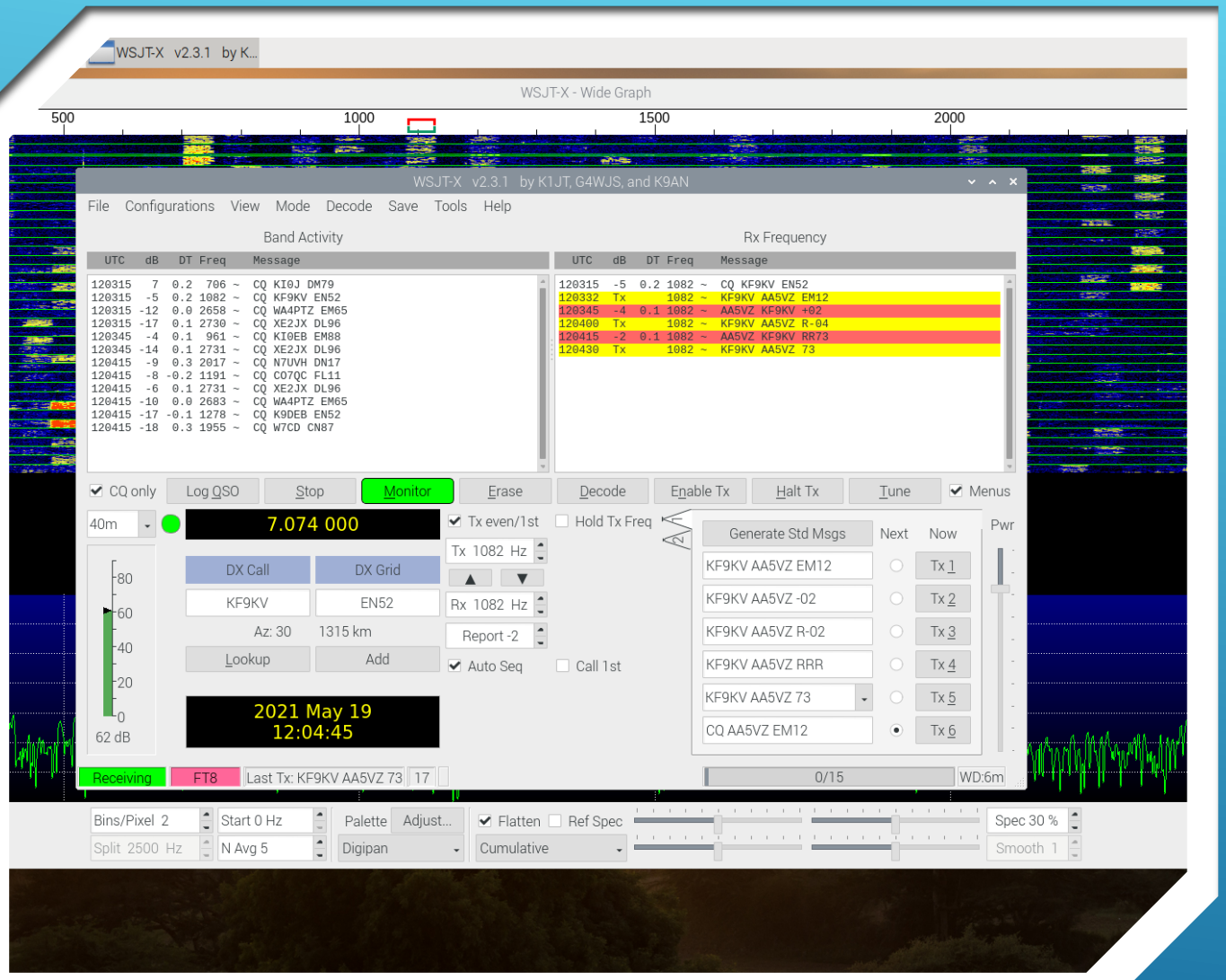
SUCCESS!!! LAPTOP SCREEN MIRRORS THE PI-4 SCREEN. THE PI CAN NOW BE CONTROLLED BY THE LAPTOP.

STEP 4



GETTING ON THE AIR - REMOTE

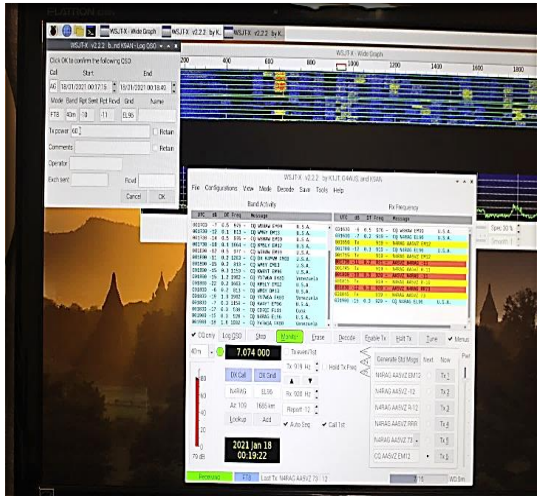
- **Reminder to have radio and interface connected to the Pi-4 and configured accordingly. (from Part 2 Presentation)**
- Open the WSJT-X Program from the menu screen



GET ON THE AIR… HAVE FUN!

DEMONSTRATION

NEXT…

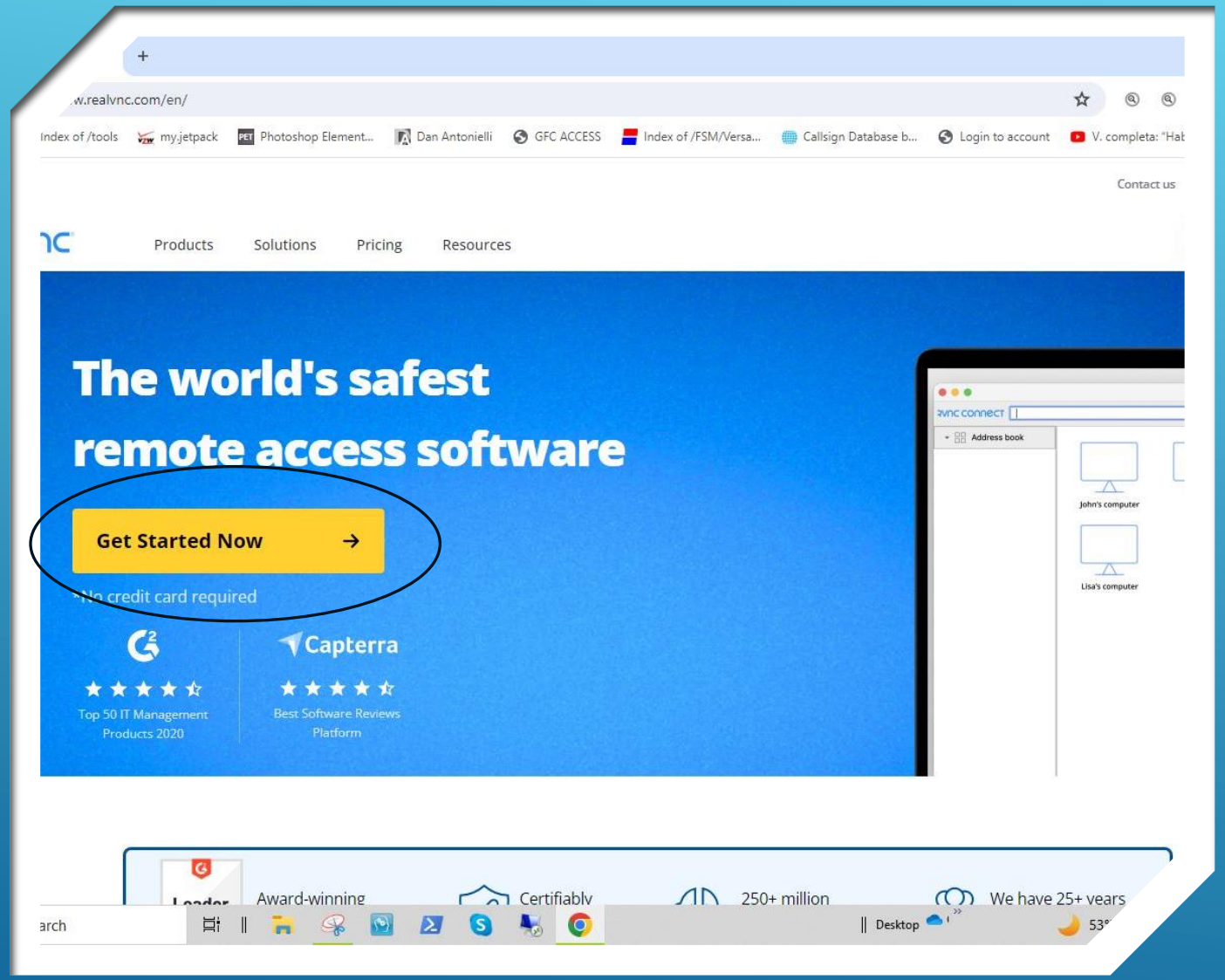


PART 3-B

- Configure system for remote wide area connectivity
- Install “RealVNC CONNECT” on Laptop or other Remote Computer
  - Create an Account (required)
- Establish REMOTE cloud connection from anywhere via Internet
- Open the WSJT-X App
- Get on the Air
- Have Fun!

…OFF WE GO AGAIN!

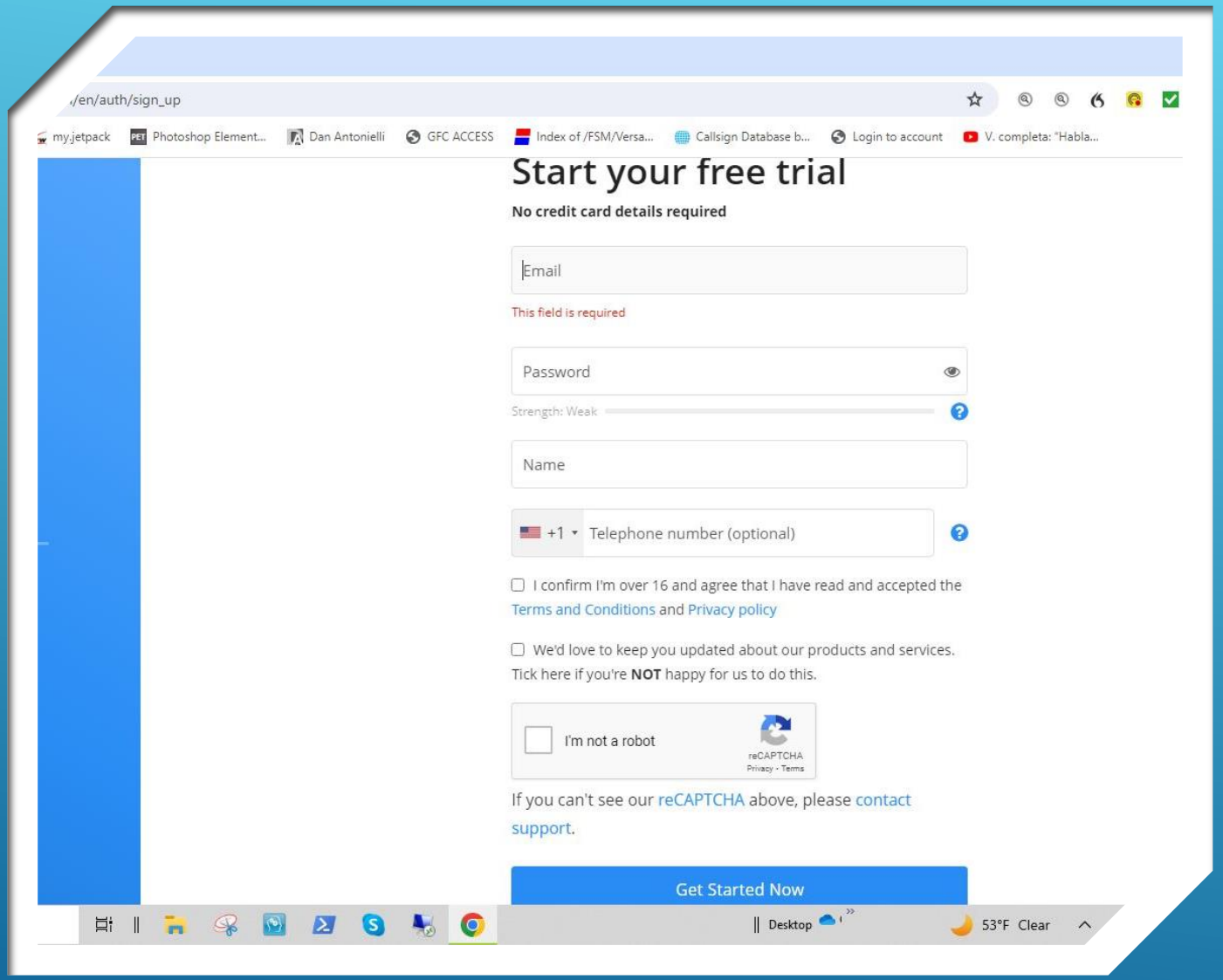
STEP 1



INSTALL "VNC CONNECT" ON LAPTOP

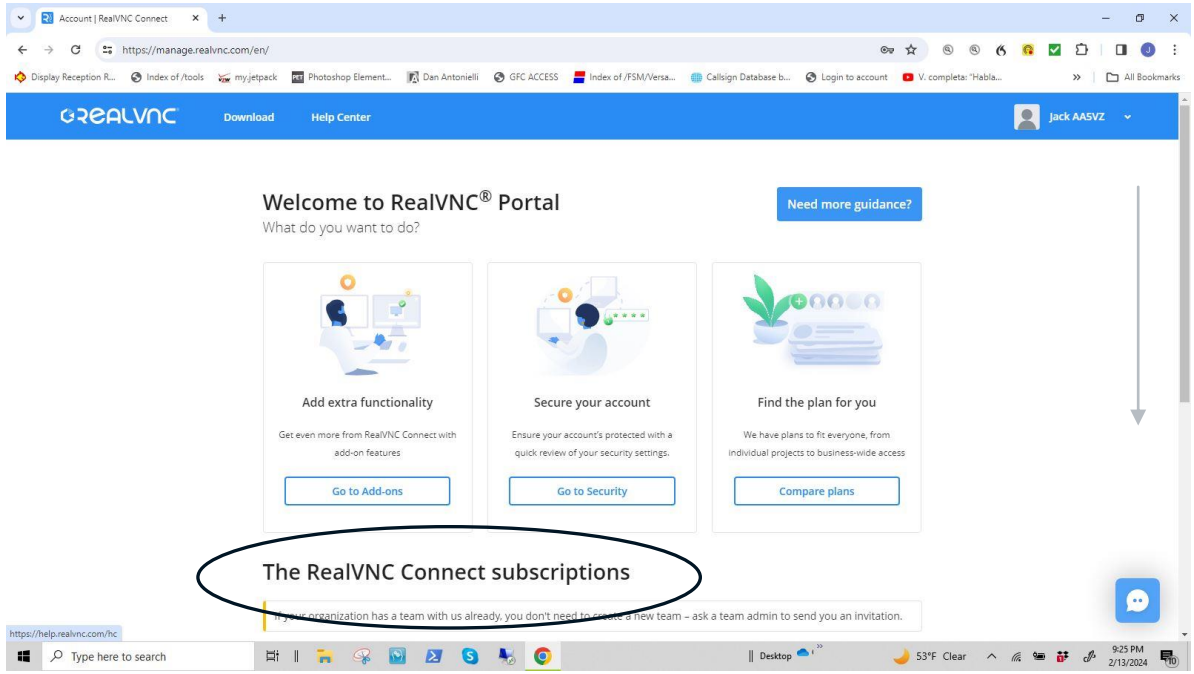
- **Go to RealVNC Homepage**
- **www.realvnc.com**
- **Click on "Get Started Now"**

INSTALL "VNC CONNECT" ON LAPTOP



- **Fill out the form accordingly**
- **Check "I'm not a robot"**
- **Click on "Get Started Now"**

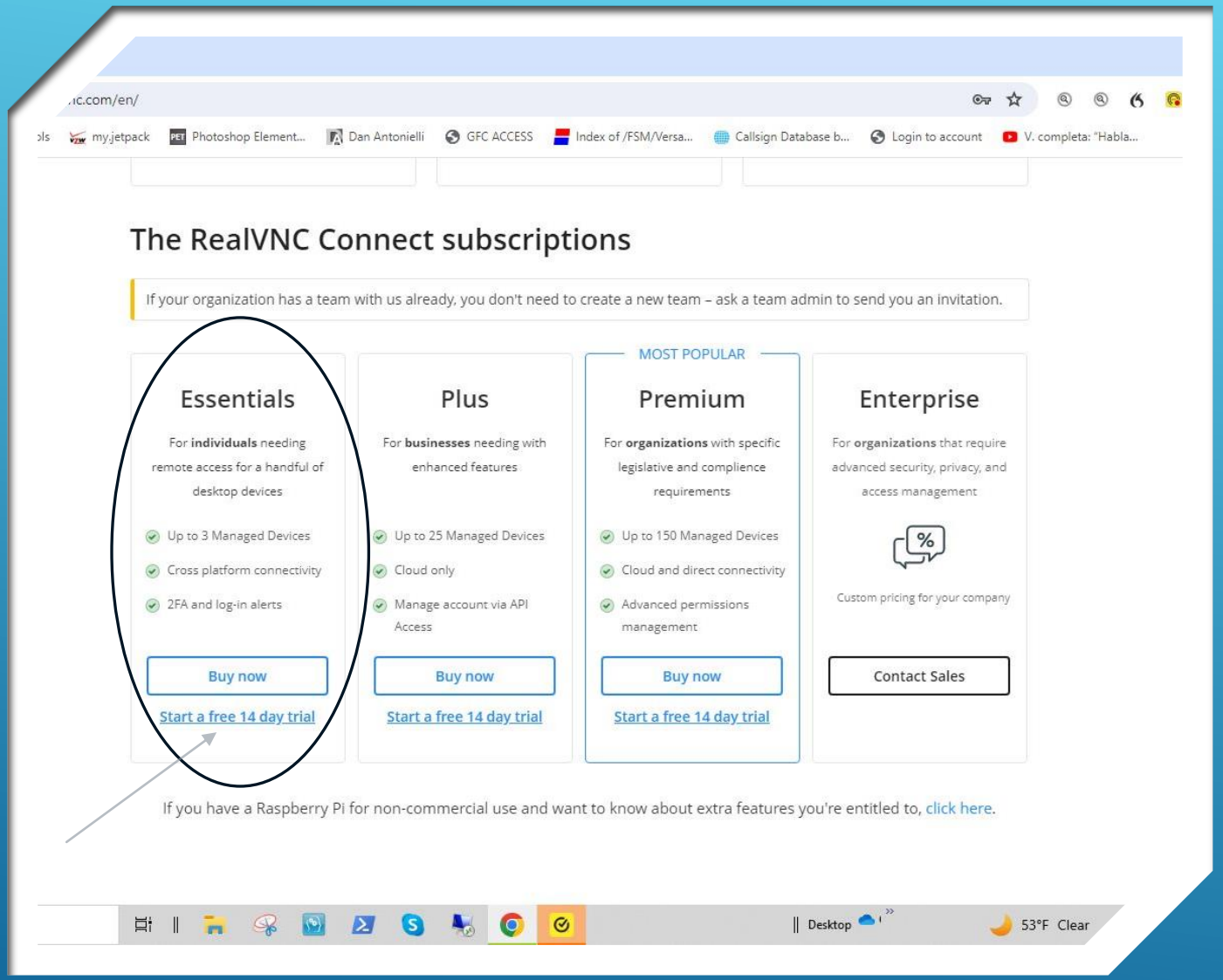
INSTALL "VNC CONNECT" ON LAPTOP



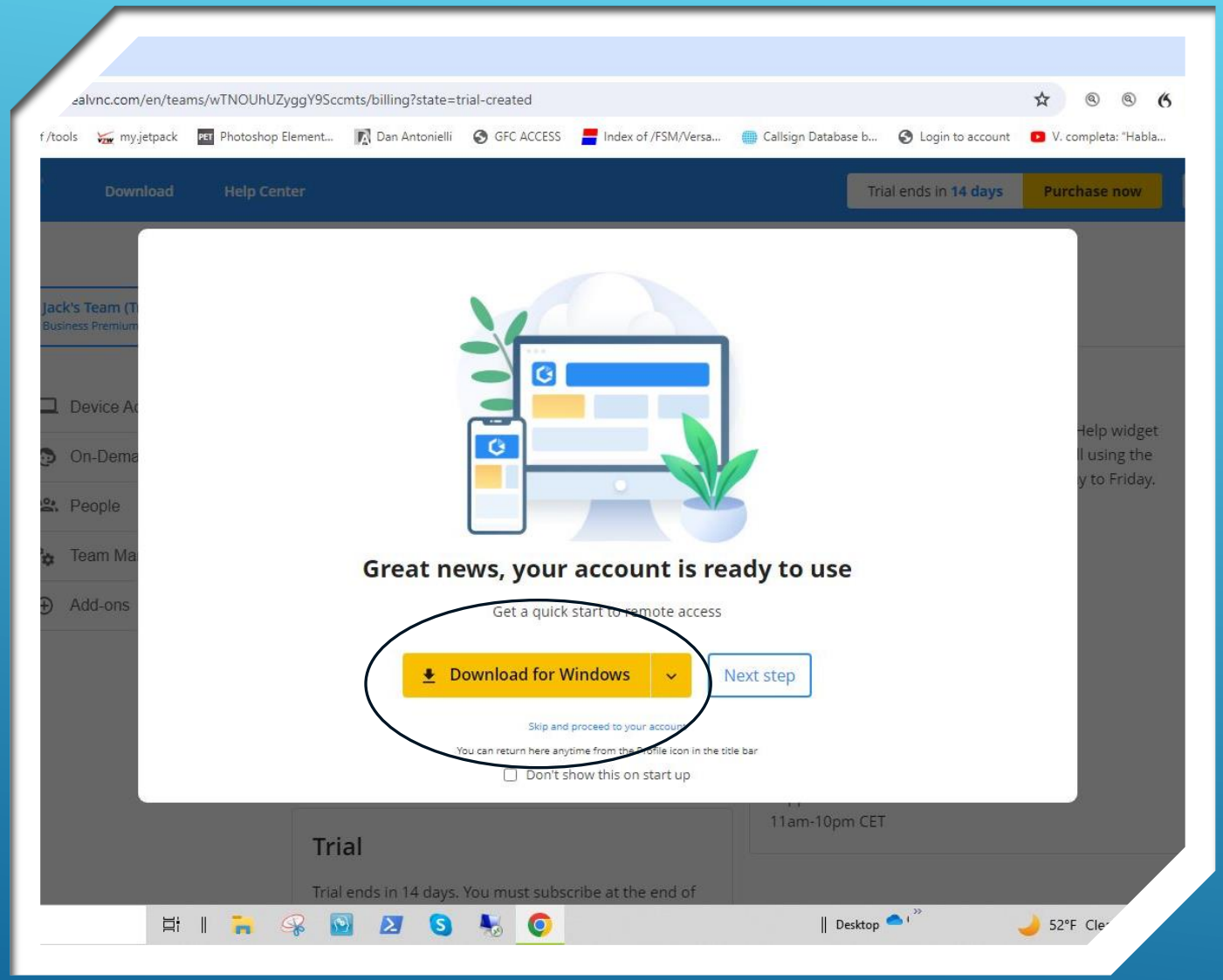
- "The Welcome to RealVNC Portal page appears"
- Scroll down to view "The RealVNC Connect Subscriptions" area.

INSTALL "VNC CONNECT" ON LAPTOP

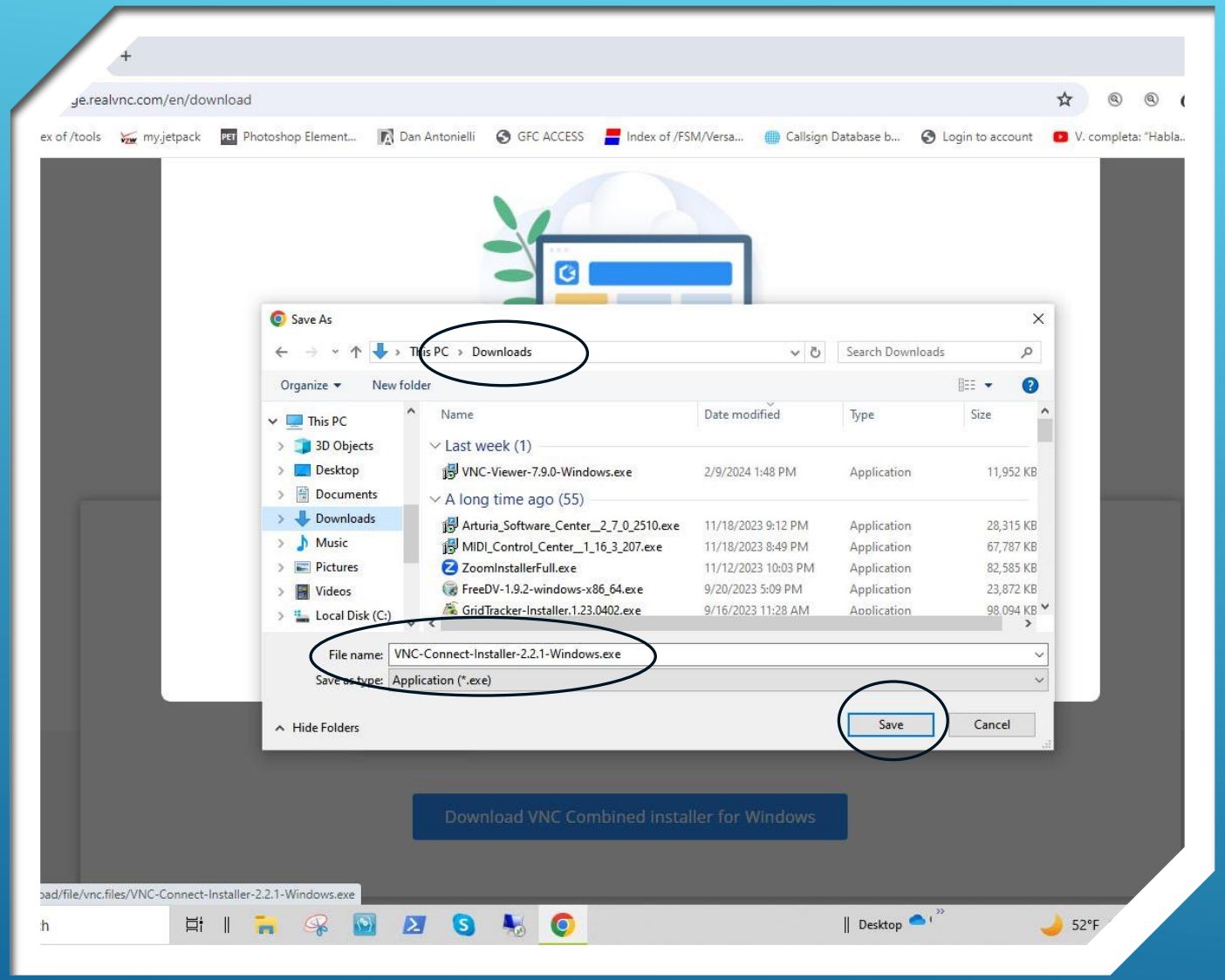
- **In the "Essentials" block, click on "Start a 14 day trial"…Not "Buy Now"**



INSTALL "VNC CONNECT" ON LAPTOP



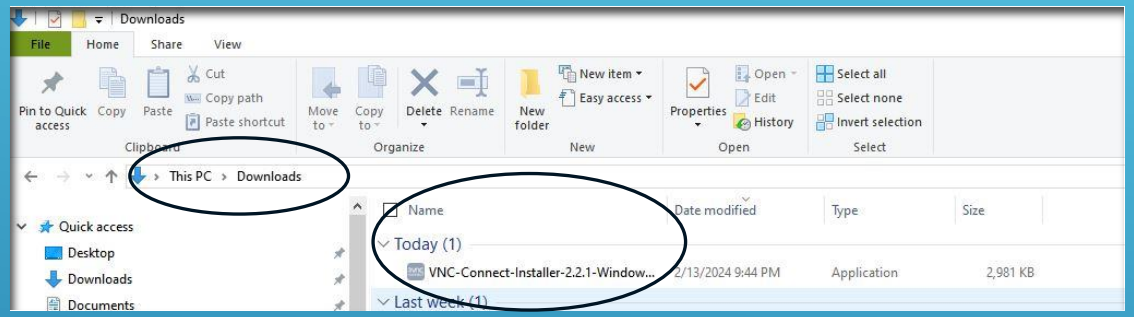
- **Click "Download for Windows"**
- **Note: <u>Do Not Click</u> "Next Step" at this time.**



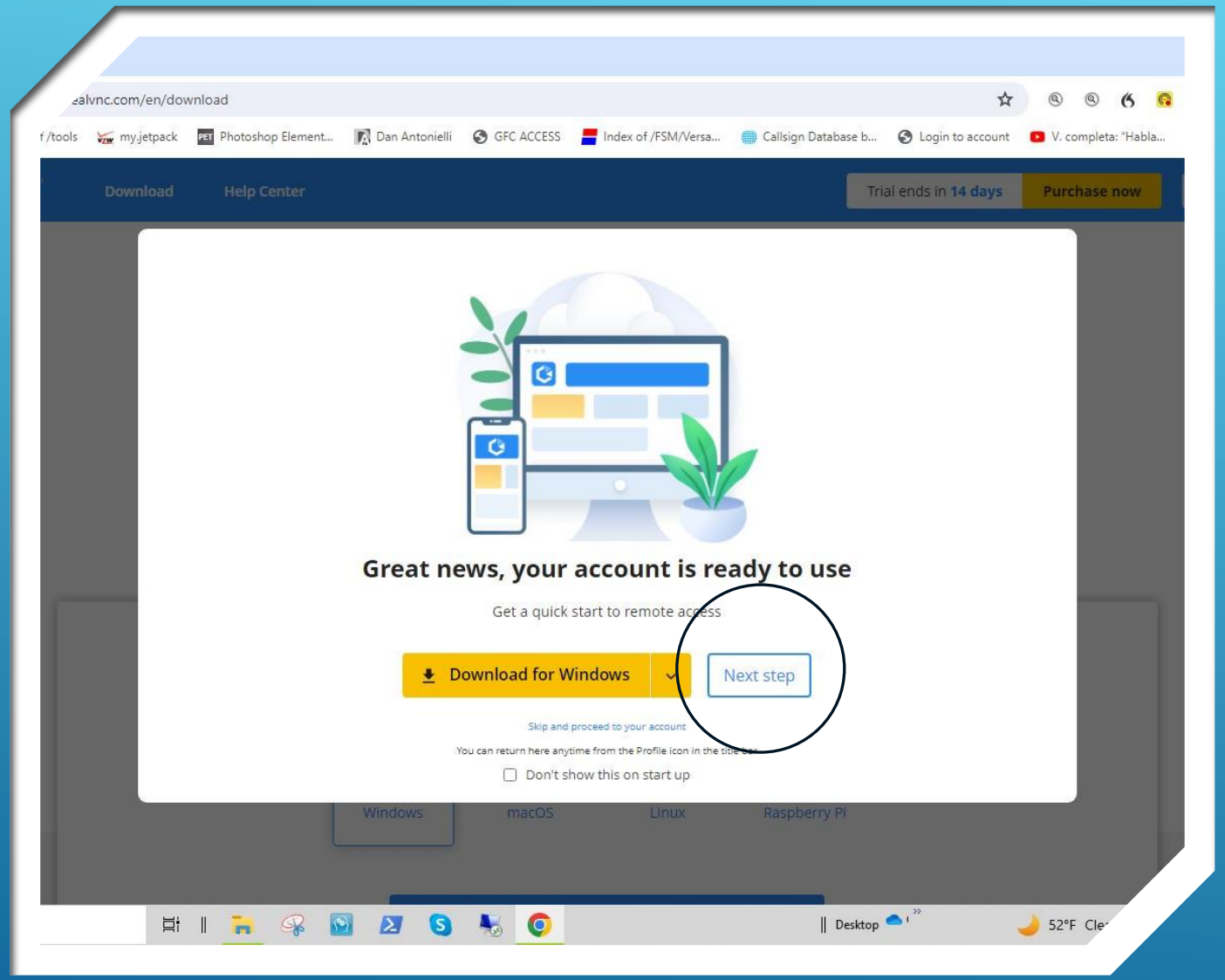
INSTALL "VNC CONNECT" ON LAPTOP

- **Verify destination to save the file being downloaded**
- **Click "Save"**

INSTALL “VNC CONNECT” ON LAPTOP

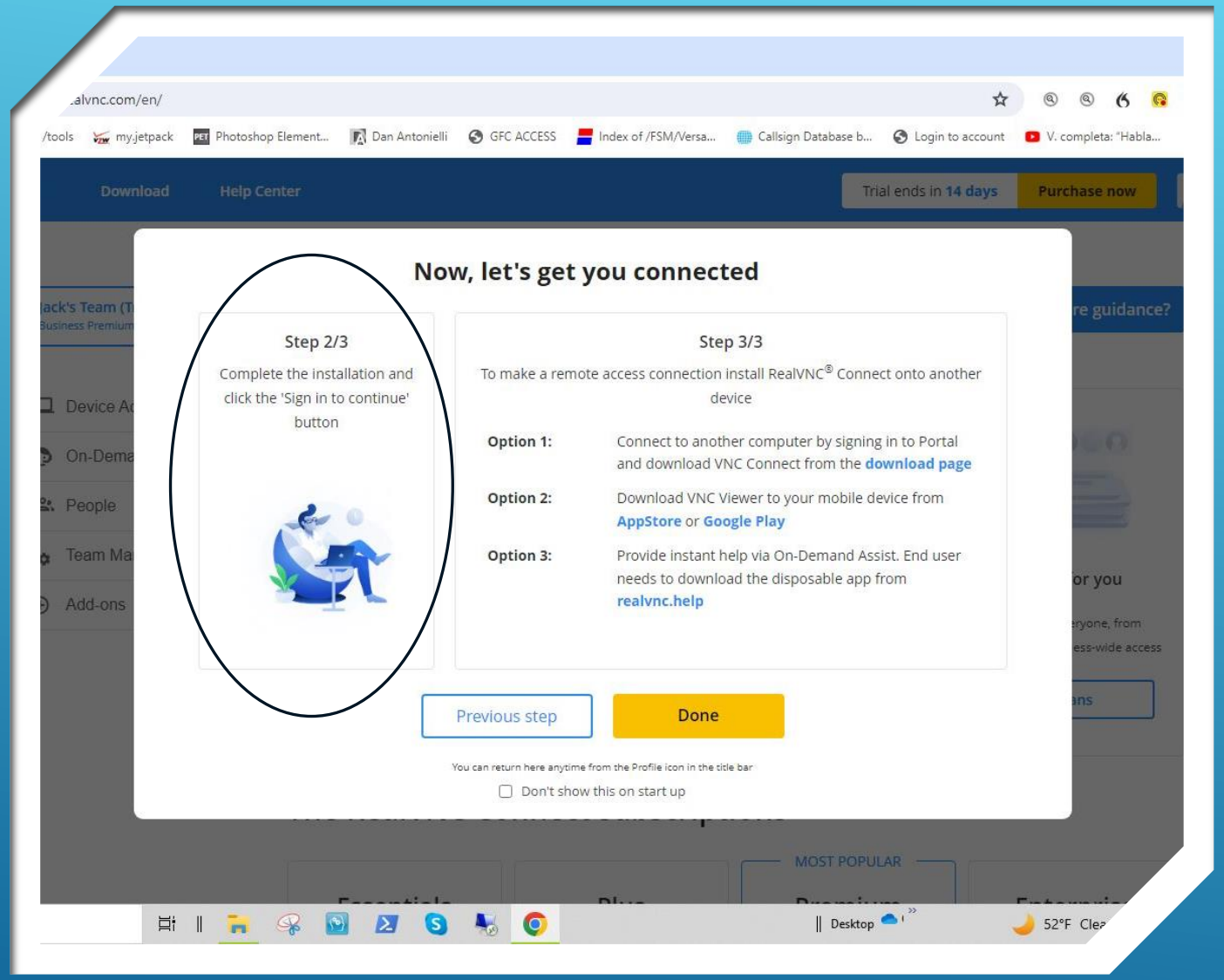


- **Check “Download” directory to confirm it is there**



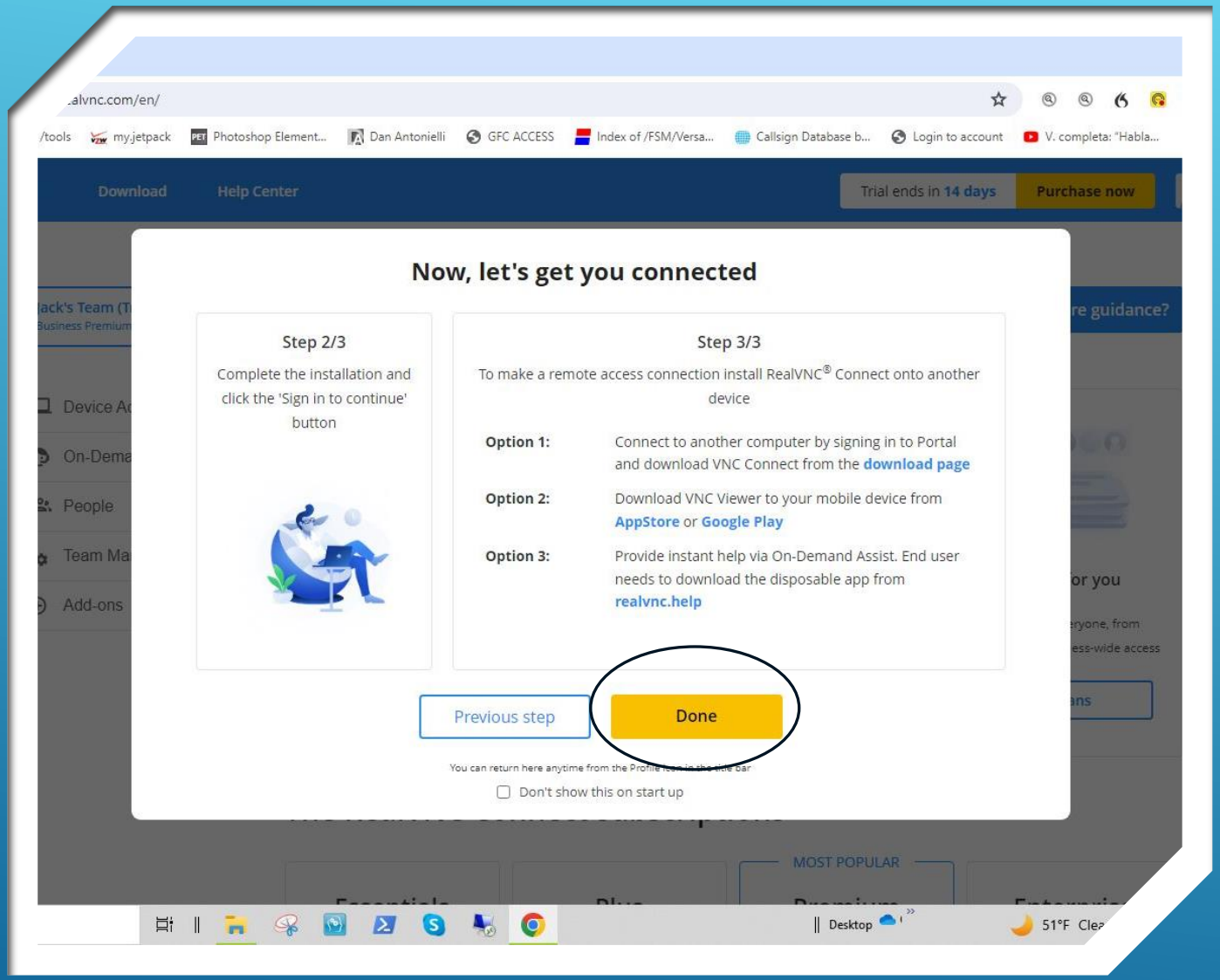
INSTALL "VNC CONNECT" ON LAPTOP

- **Download was successful!**
- **Now Click "Next Step"**



INSTALL "VNC CONNECT" ON LAPTOP

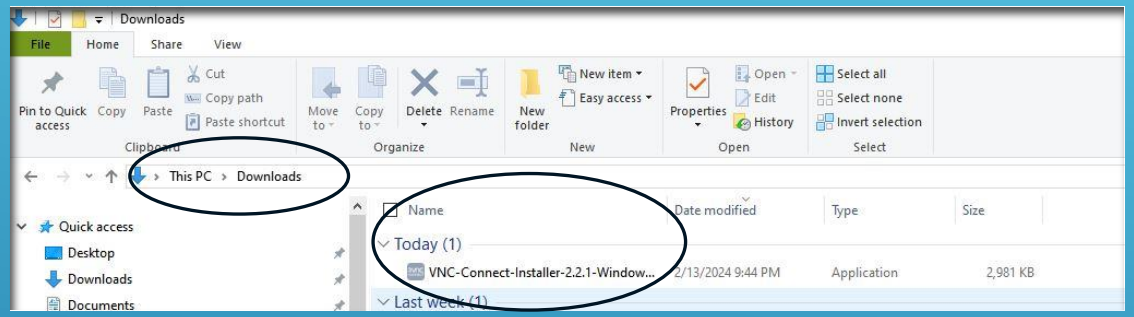
- **Follow instruction in step "2/3"**
- **To complete the installation, go to your download directory and "double-click" on the RealVNC connect.exe file you just downloaded**



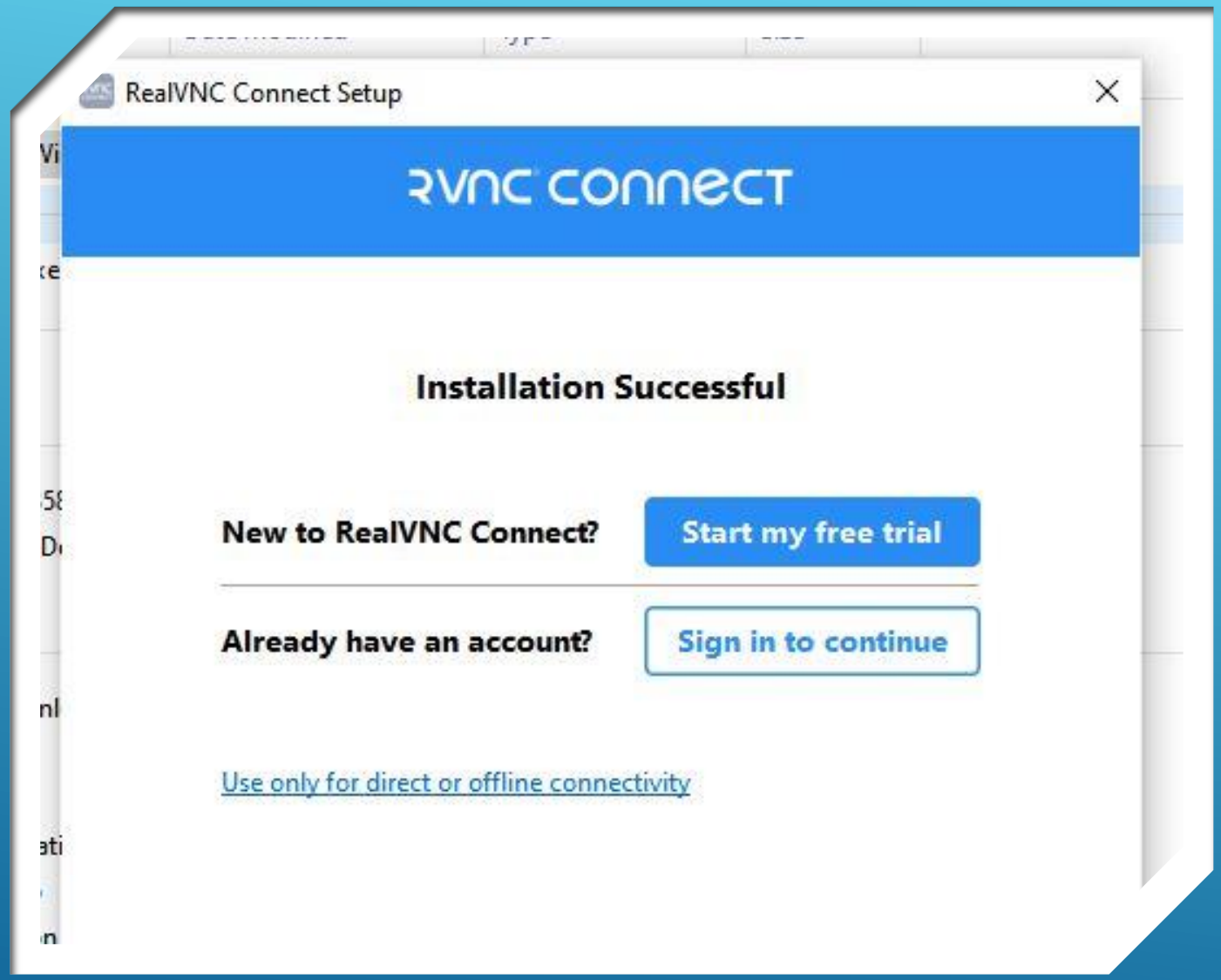
INSTALL "VNC CONNECT" ON LAPTOP

- **Steps Completed?**
- **Click "Done"**

INSTALL “VNC CONNECT” ON LAPTOP



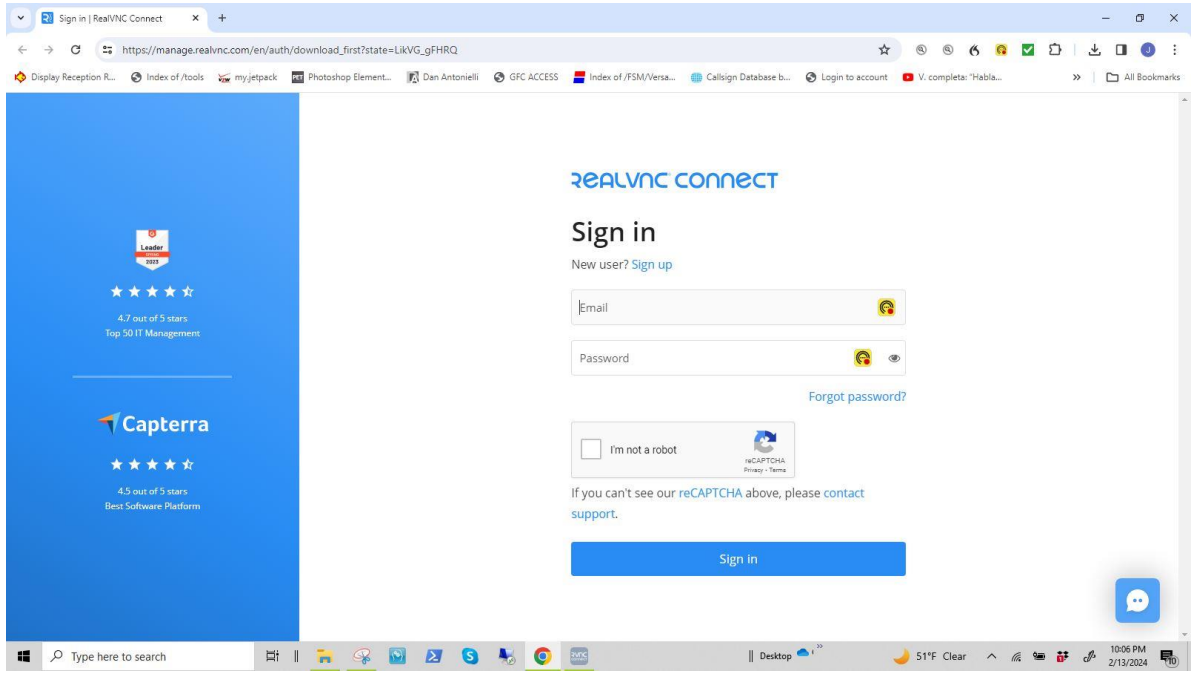
- To install VNC Connect, go to your download directory and “double-click” on the VNC Connect Installer.exe file you just downloaded.
- Follow the prompts during installation.



INSTALL "VNC CONNECT" ON LAPTOP

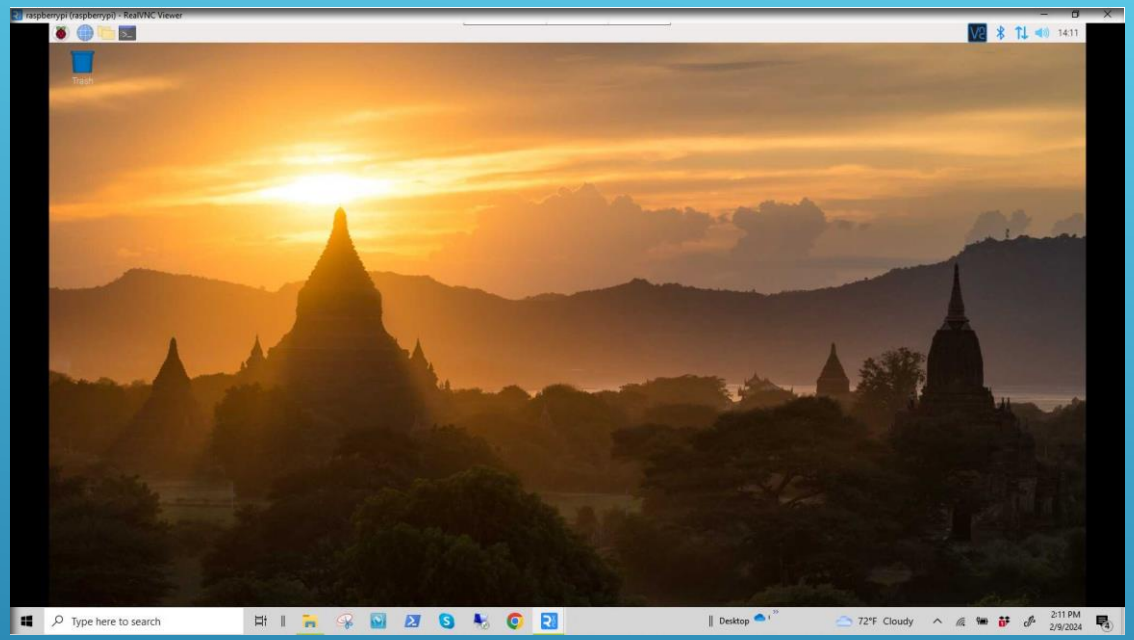
- **Success!**

INSTALL "VNC CONNECT" ON LAPTOP



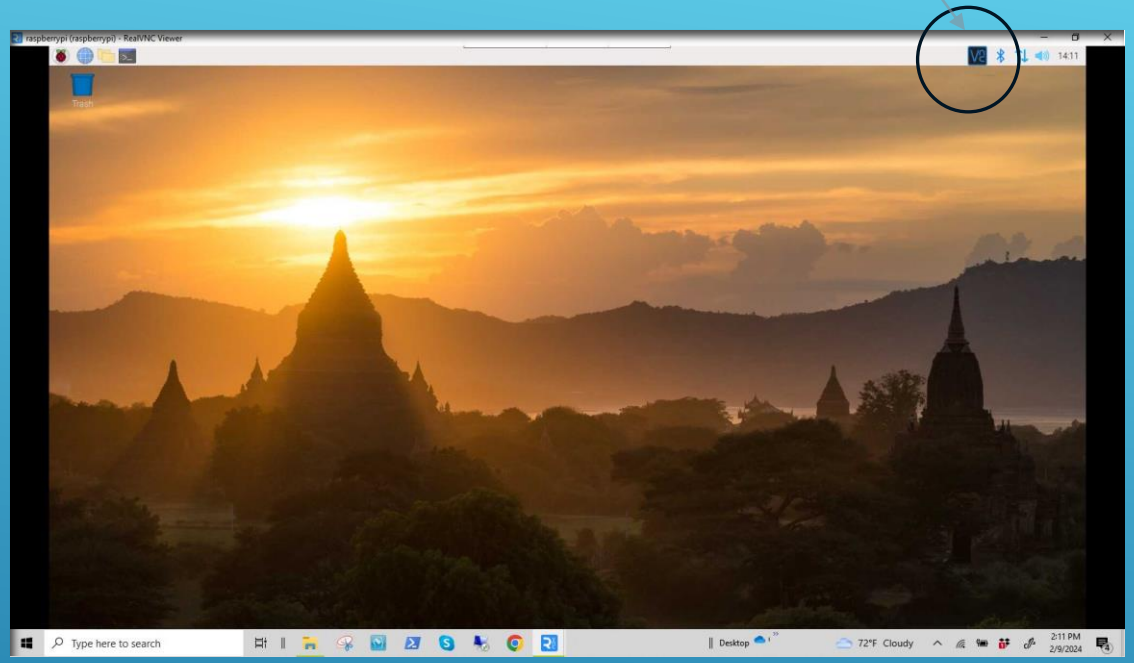
- **Sign in page for VNC Connect**

STEP 2



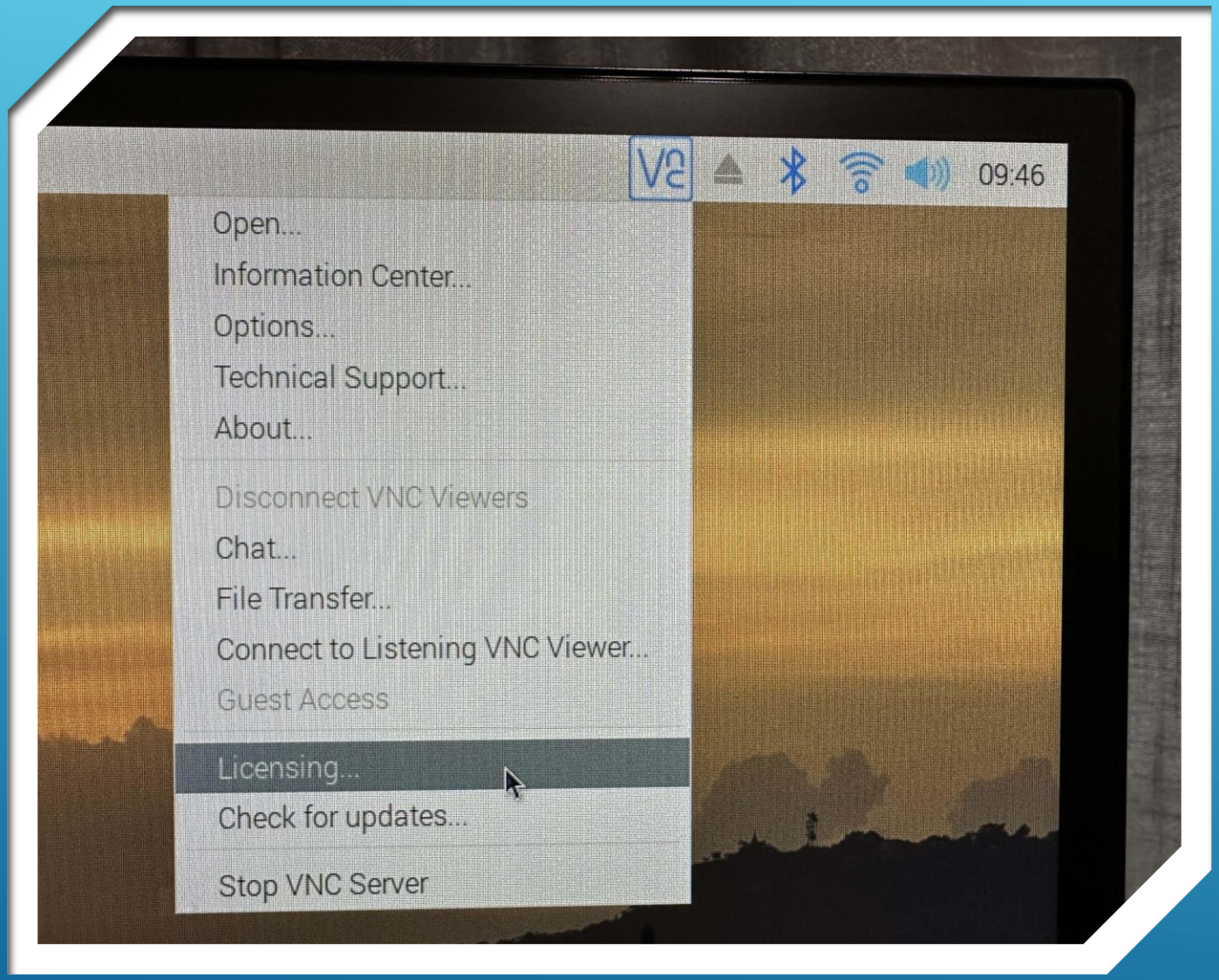
- **Ensure Raspberry Pi-4 workstation is:**
- **Powered up,**
- **Connected to the internet, and**
- **The home screen is displayed on the workstation monitor.**

CONFIGURE THE RASPBERRY PI-4 FOR INTERNET "CLOUD" CONNECTIVITY



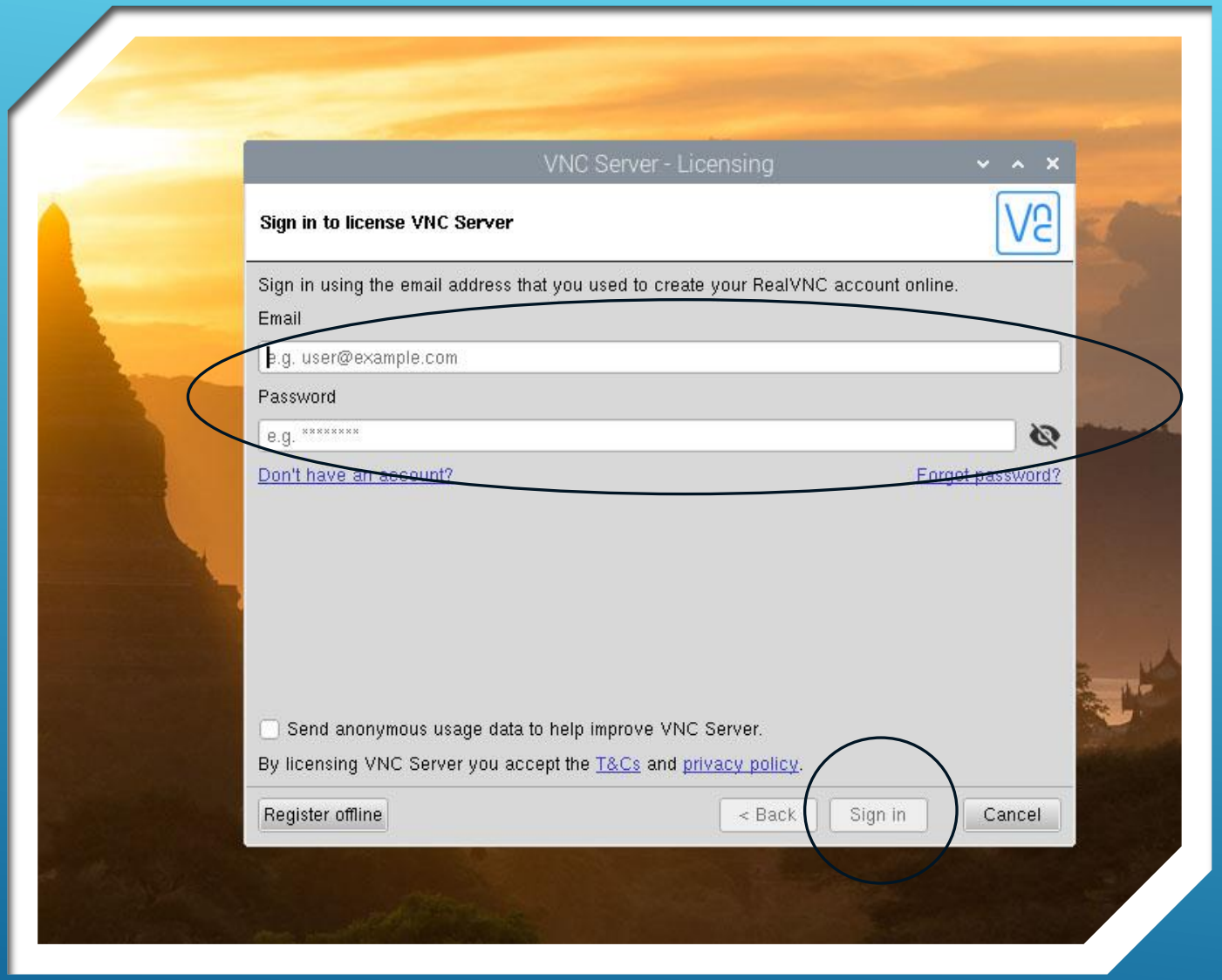
- "Right-Click" on the VNC icon.
- This will open the VNC Status drop-down menu

CONFIGURE THE RASPBERRY PI-4 FOR INTERNET "CLOUD" CONNECTIVITY



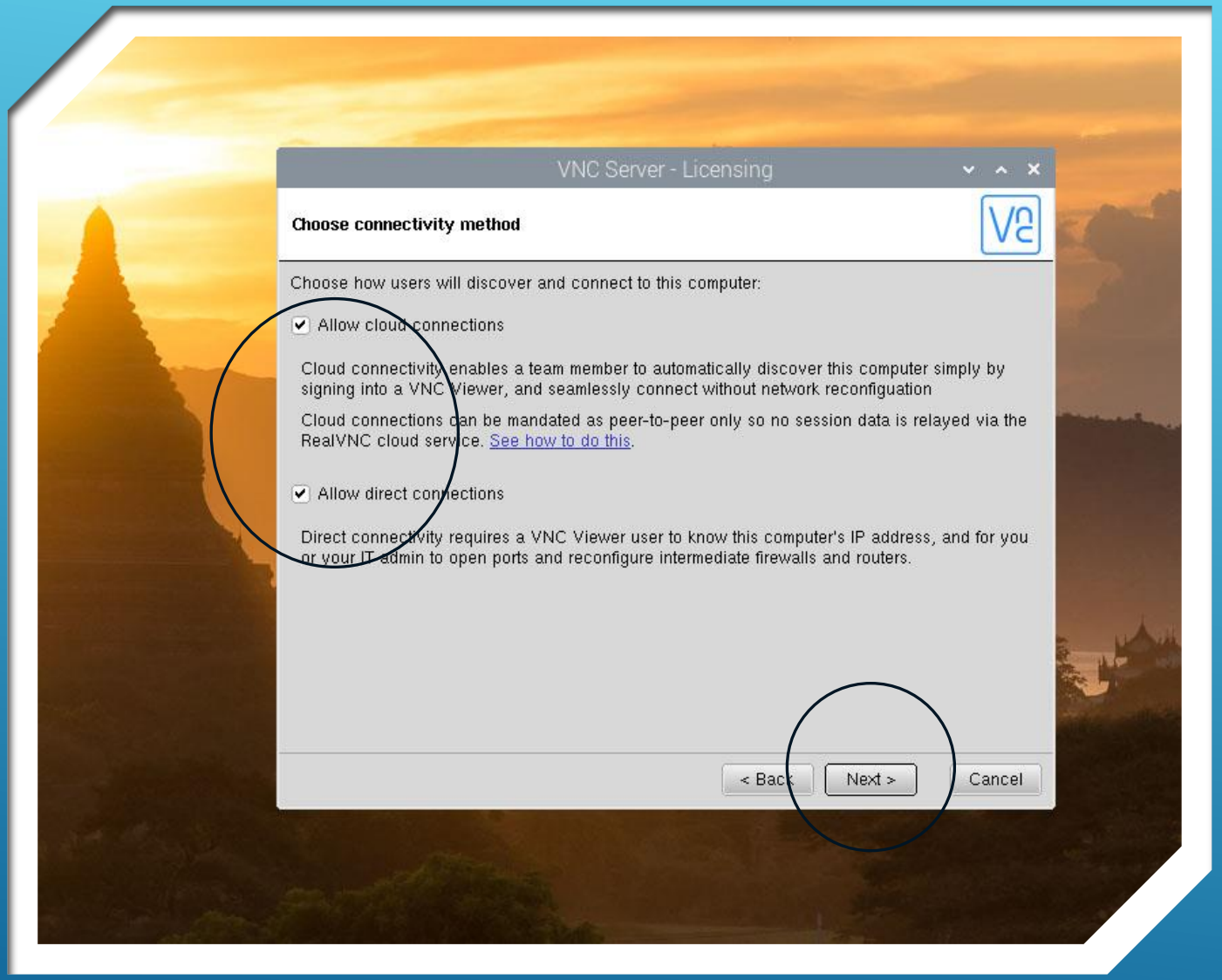
CONFIGURE THE RASPBERRY PI-4 FOR INTERNET "CLOUD" CONNECTIVITY

- **Click on "Licensing"**



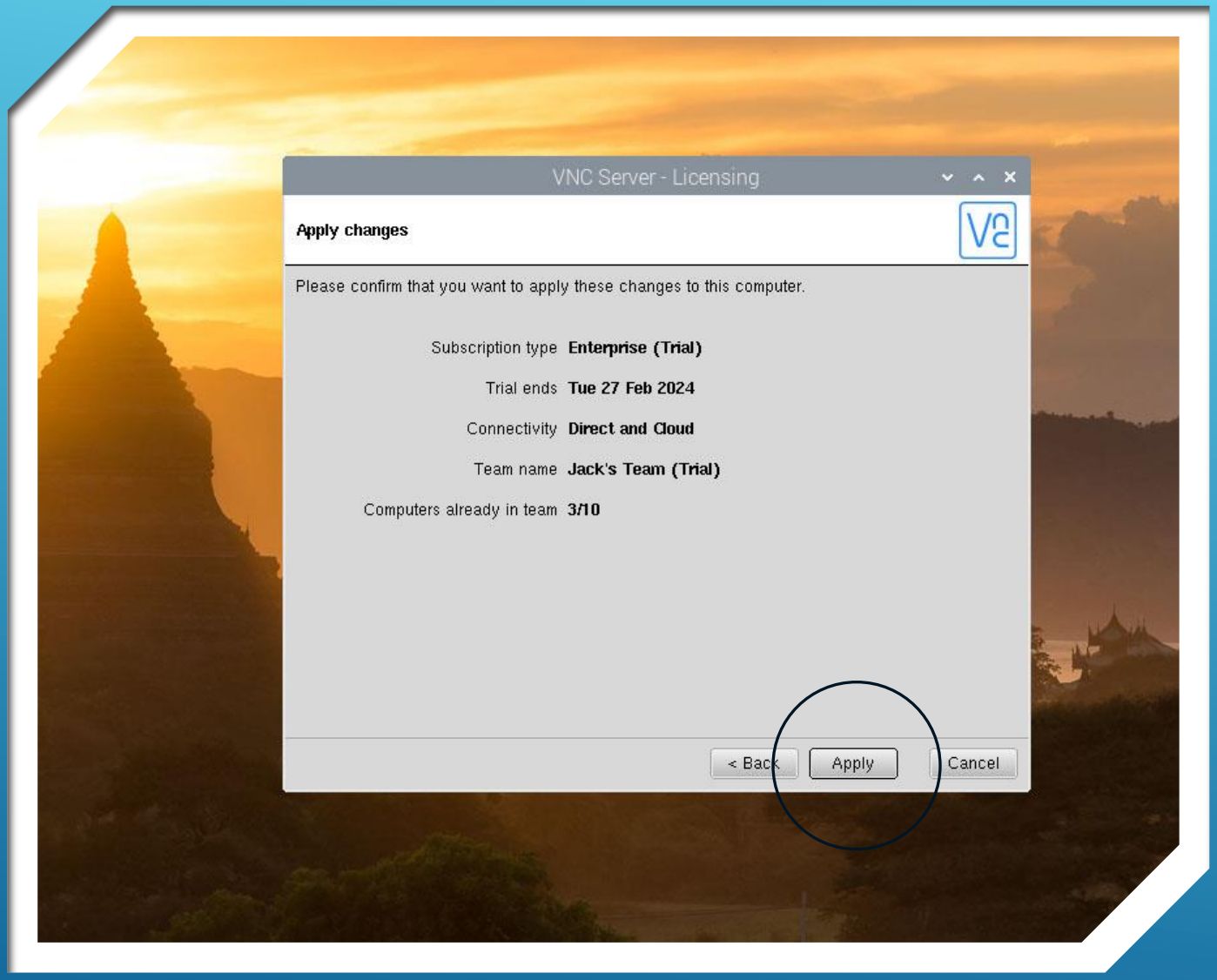
CONFIGURE THE RASPBERRY PI-4 FOR INTERNET "CLOUD" CONNECTIVITY

- **Sign in to your RealVNC account.**
- **Supply your sign-in credentials and click the "Sign in" button**



CONFIGURE THE RASPBERRY PI-4 FOR INTERNET "CLOUD" CONNECTIVITY

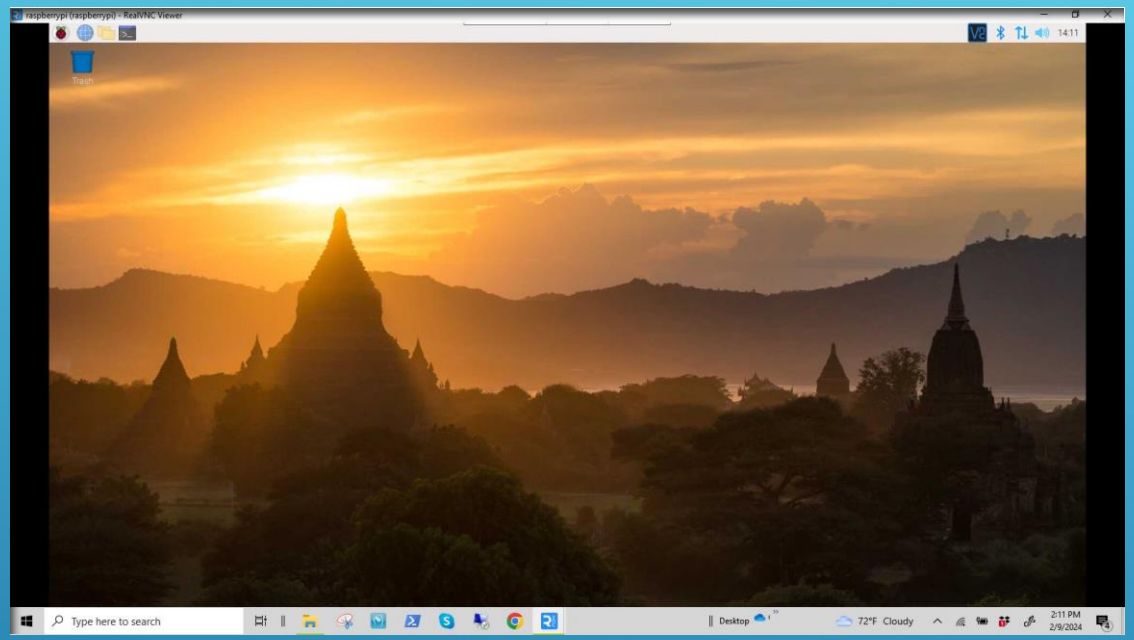
- **Choose desired connectivity method(s)**
- **Click "Next >"**



CONFIGURE THE RASPBERRY PI-4 FOR INTERNET "CLOUD" CONNECTIVITY

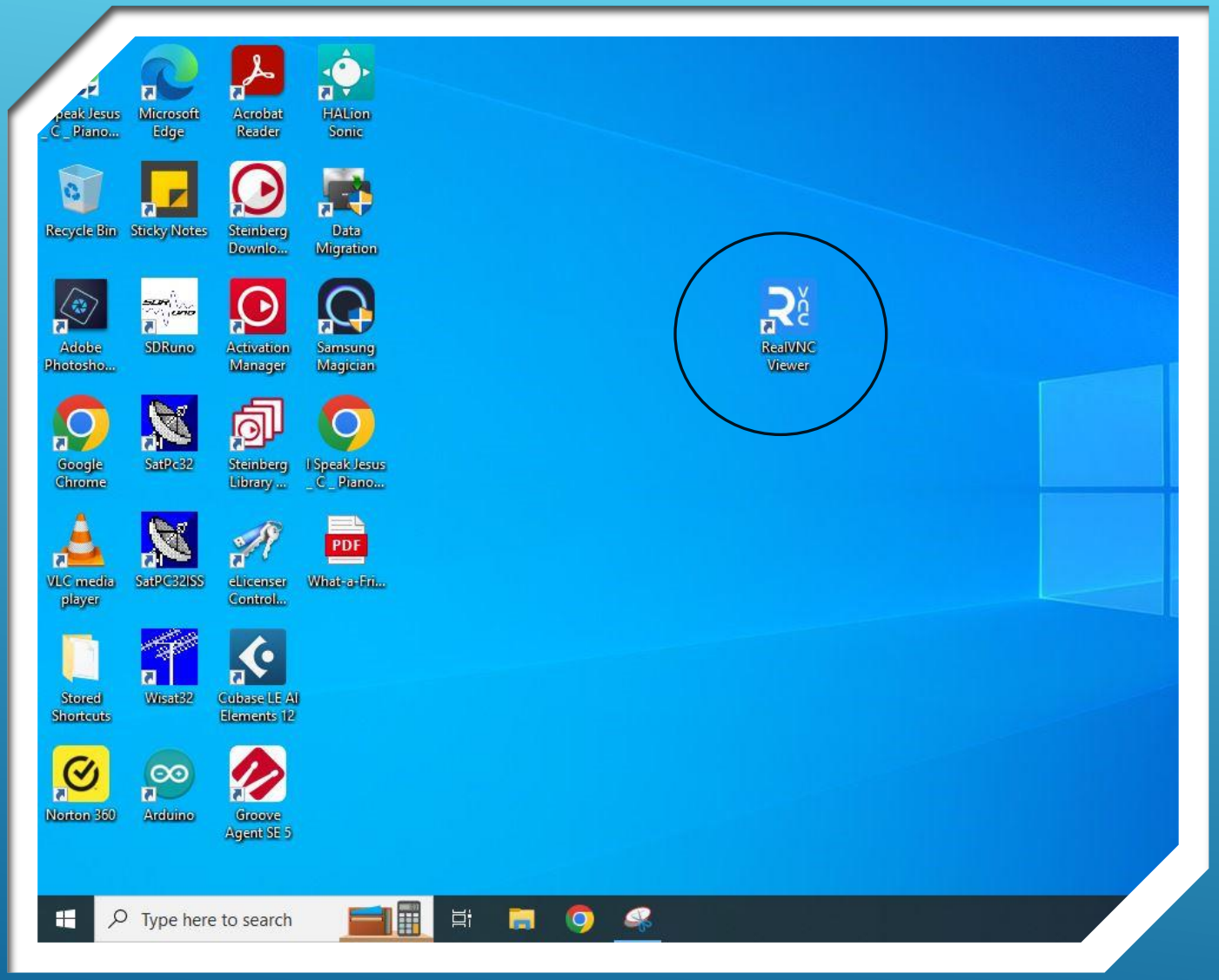
- **Review screen information**
- **Click "Apply"**
- **Next screen should confirm changes are in effect.**
- **Return to your home screen**
- **You are now ready to connect to your Pi-4 from any location via the internet**

STEP 3



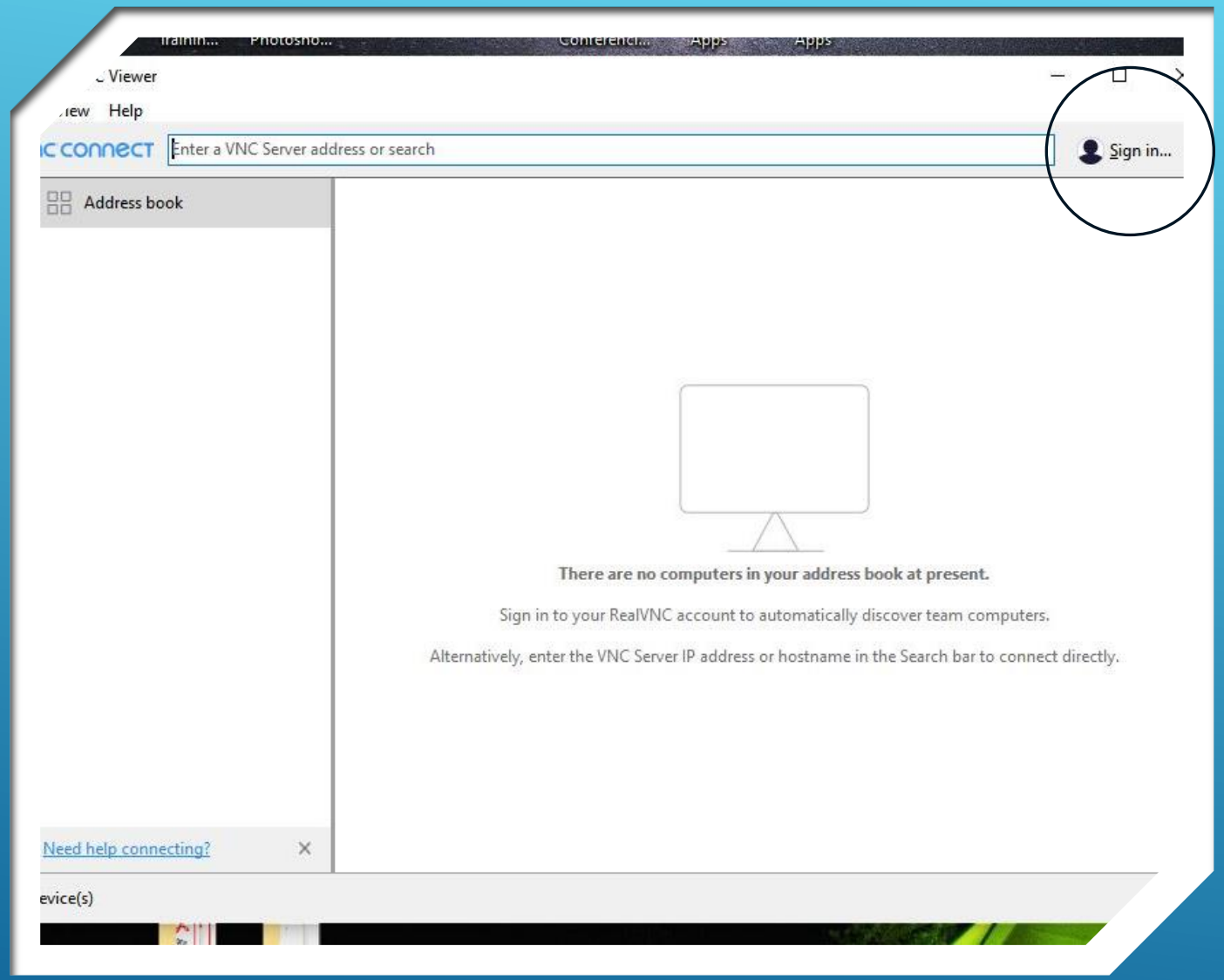
- Remember to have radio and interface powered up, connected to the Pi-4 and configured accordingly. (from Part 2 Presentation)
- Have the Pi-4 workstation powered up, displaying the Home Screen, and connected to the internet through your local router.

GETTING ON THE AIR - REMOTE



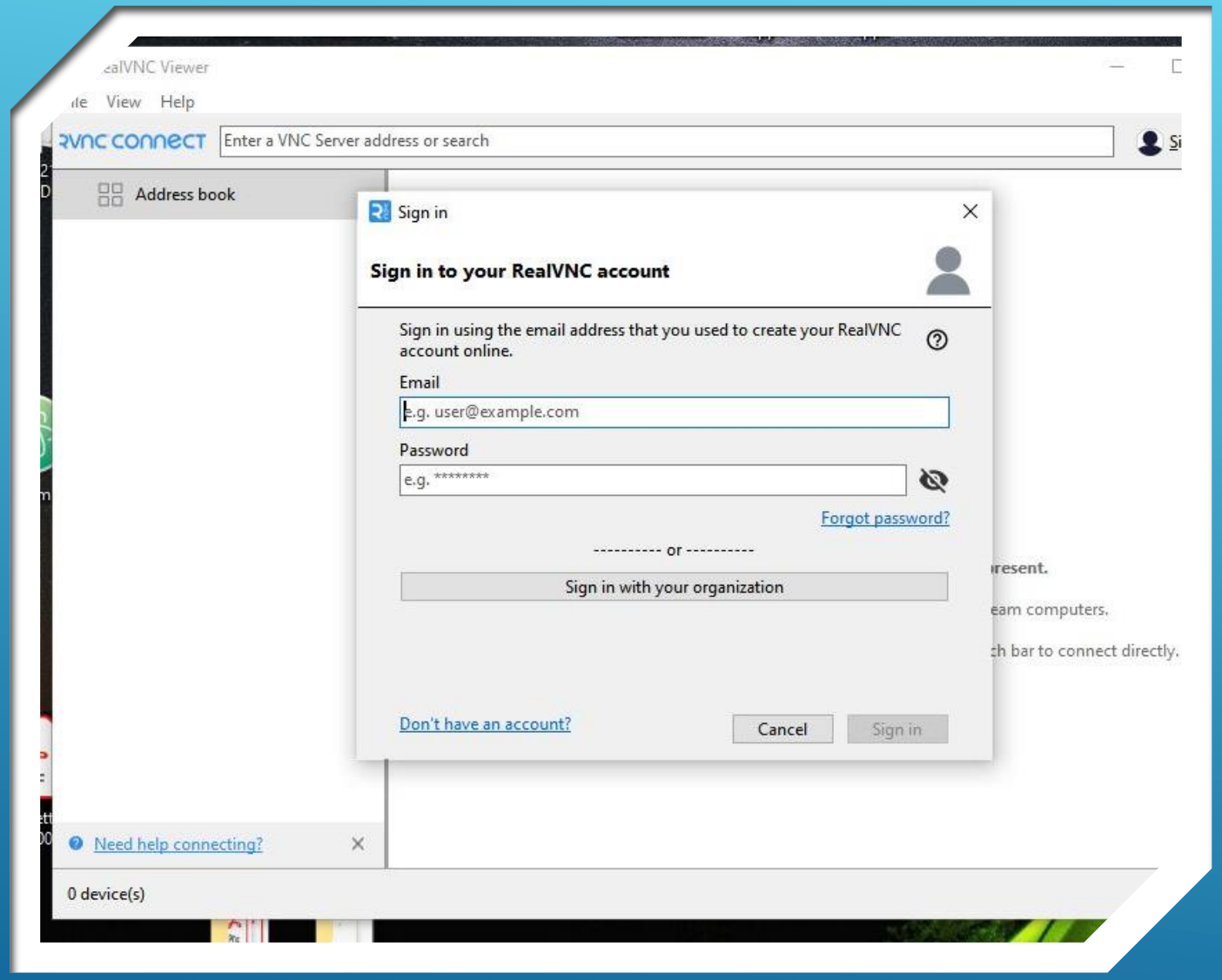
GETTING ON THE AIR – REMOTE

- **ON THE LAPTOP…**
- **Have the Laptop computer powered up, displaying the Home Screen, and connected to the internet through a remote router or a smartphone or tablet serving as a HOTSPOT .**
- **Double-click the RealVNC Viewer icon to open VNC Viewer on the laptop.**



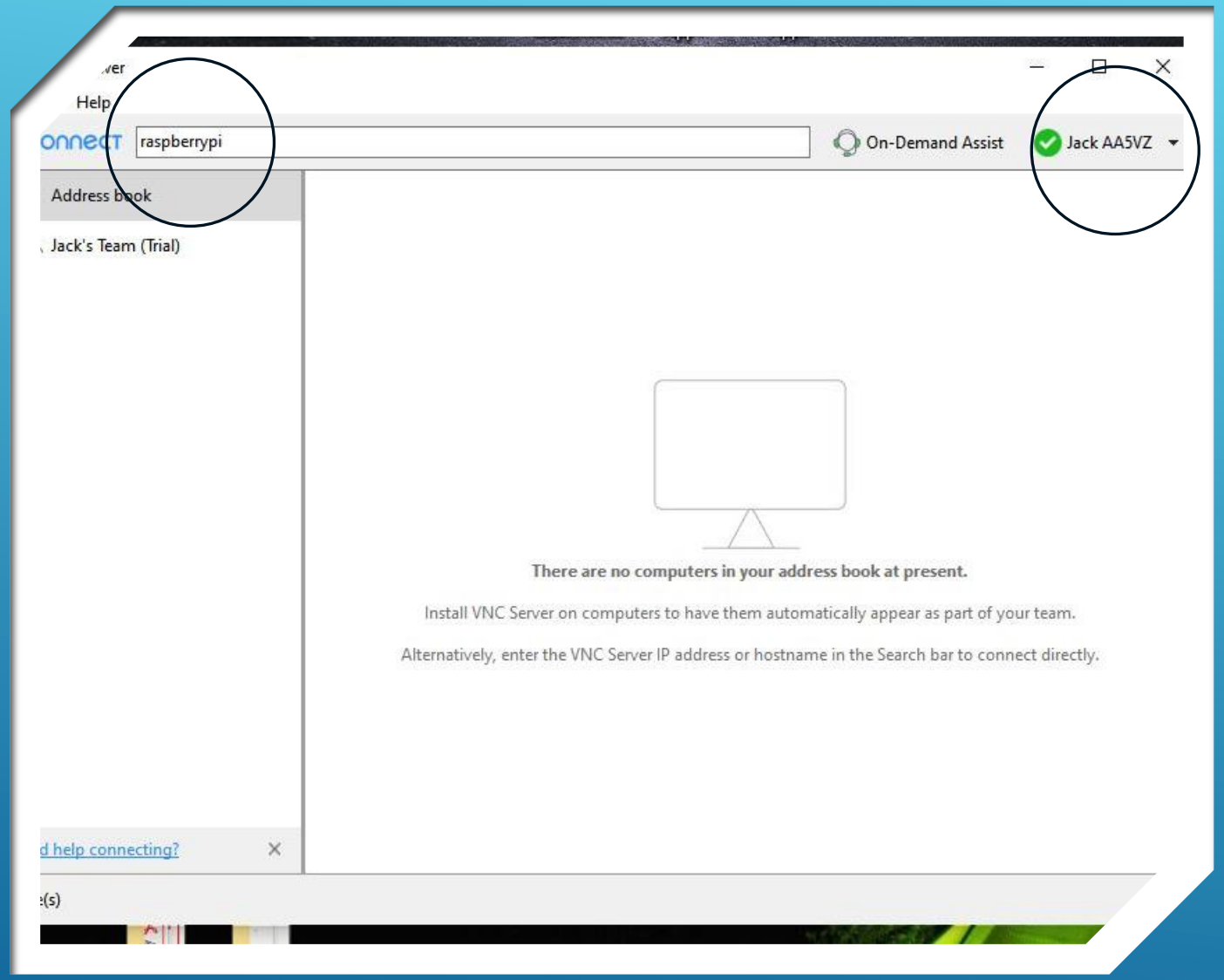
GETTING ON THE AIR – REMOTE

- **ON THE LAPTOP…**
- **To establish a remote connection via internet <u>YOU MUST</u> sign in to your Real VNC account.**
- **Click the "Sign in" button.**



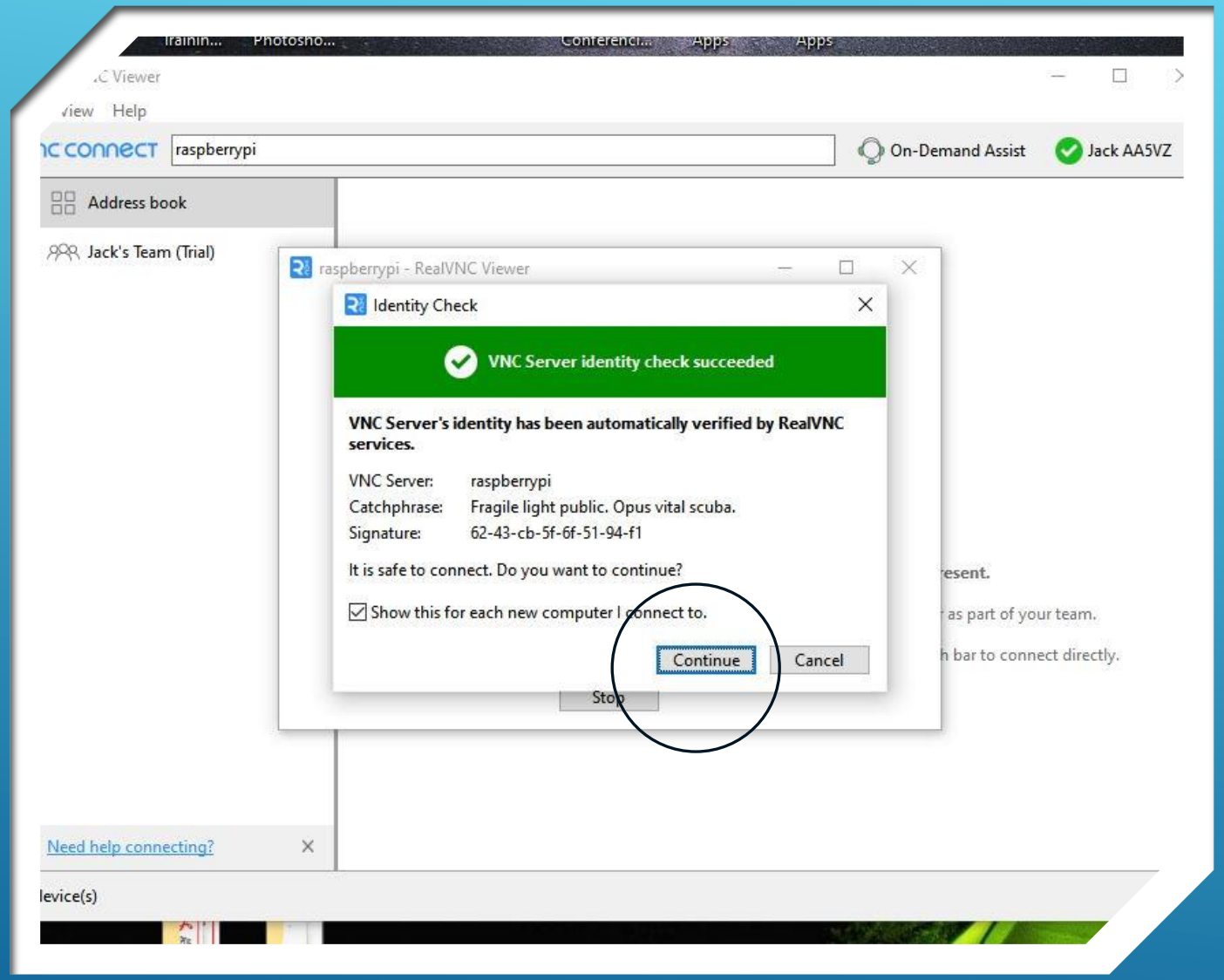
GETTING ON THE AIR – REMOTE

- **ON THE LAPTOP…**
- **Supply your RealVNC sign-in credentials on the form**



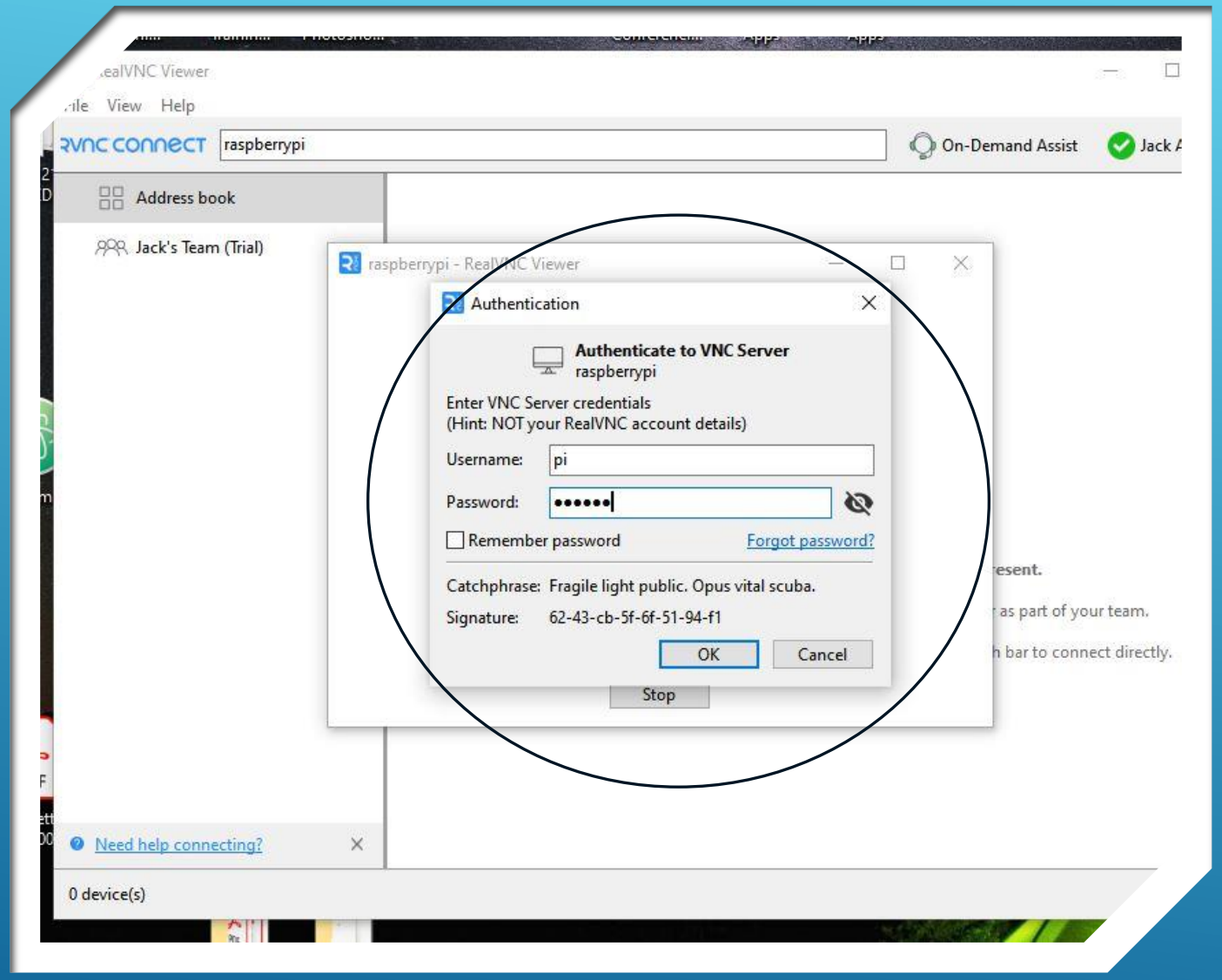
GETTING ON THE AIR – REMOTE

- **ON THE LAPTOP…**
- **Green Checkmark indicates you are properly signed in to VNC Connect.**
- **To connect to the Pi-4 enter the device hostname (“raspberrypi” in this case) in the Connect address line.**
- **Press “Enter” on the keyboard.**



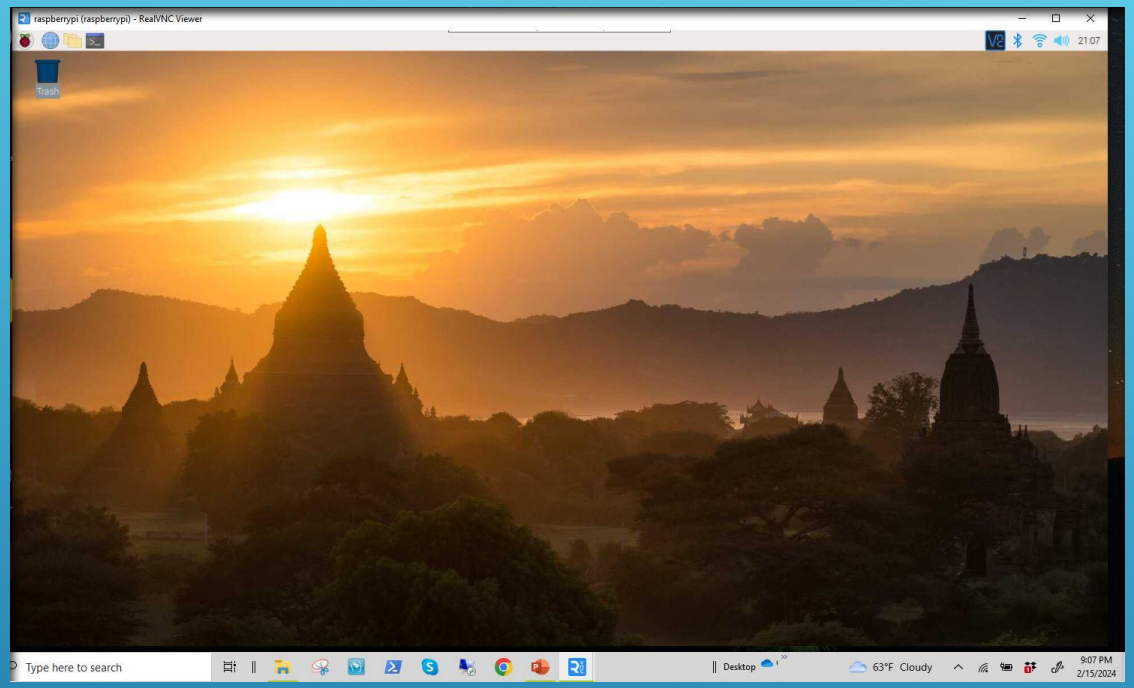
GETTING ON THE AIR – REMOTE

- **ON THE LAPTOP…**
- **Pop-up screen indicates the server device (raspberrypi) was identified and located.**
- **Click “Continue” on the screen**



GETTING ON THE AIR – REMOTE

- **ON THE LAPTOP…**
- **Fill in form using the Pi-4's logon credentials**
- **Click "OK" to connect**



- ON THE LAPTOP…
- SUCCESS!!!
- You are now connected to your Raspberry Pi compurer, remotely, via the world-wide-web.
- The rest you have already done.
- Now GET ON THE AIR!...and,
- Have fun!

GETTING ON THE AIR – REMOTE

DEMONSTRATION

QUESTIONS OR TESTIMONIALS?

REFERENCES

1. Link to configure WSJT-X for operation with Icom IC-7300
https://www.k0pir.us/icom-7300-wsjt-x-ft8-easy-way/

2. WSJT-X Home Page

3. https://www.tigertronics.com/slusbmain.htm

4. www.google.com

5. www.youtube.com

(PARTS 3A AND 3B)

RASPBERRY PI IN THE SHACK

GETTING STARTED WITH REMOTE STATION OPERATION

Jack Weaver – AA5VZ

RECOMMENDED READING

- WSJT-X User Guide – Available On-Line
- https://physics.princeton.edu/pulsar/k1jt/wsjtx-doc/wsjtx-main-2.3.1_en.html#NEW_FEATURES

- FL-Digi User Guide – Available On-Line
- http://www.w1hkj.com/FldigiHelp-3.21/html/index.html