Using Raspberry Pi For Network Commissioning

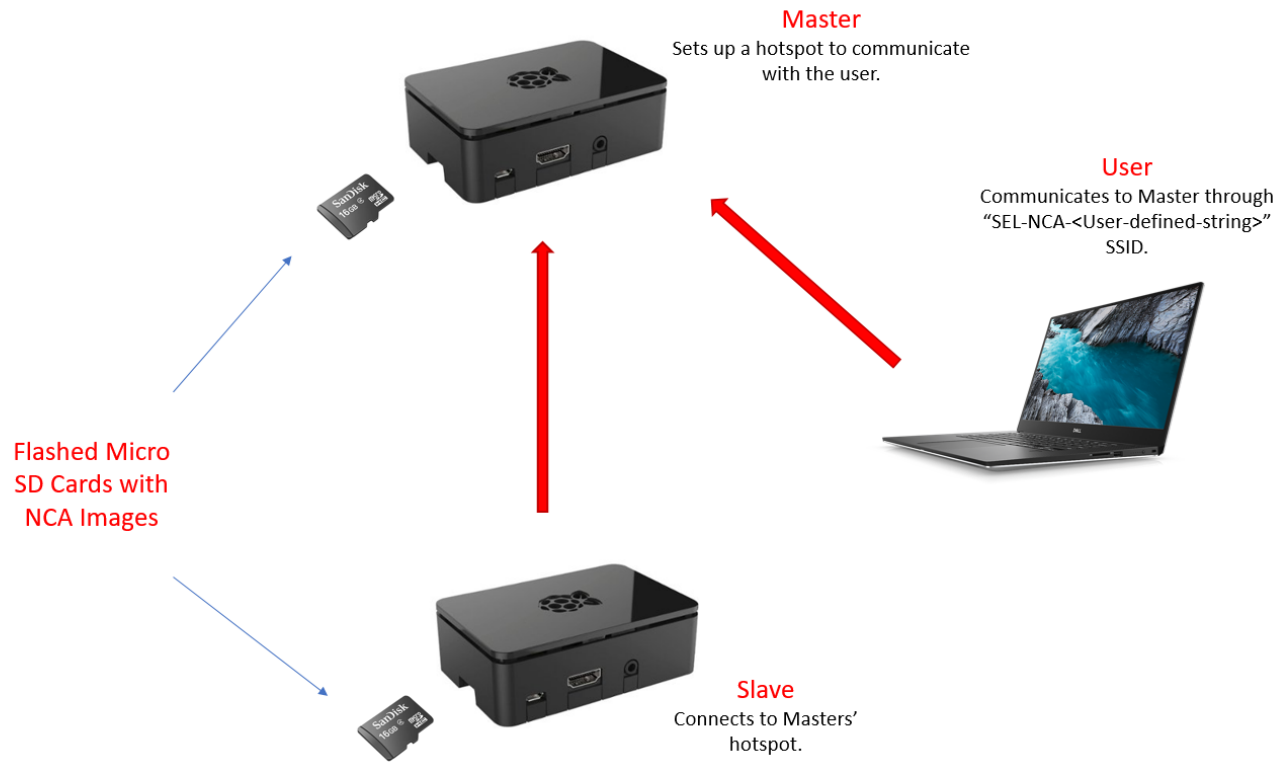
Overview

The Network Commissioning Assistant (NCA) is a tool suite for testing, monitoring and debugging Software Defined Networks (SDN). It is an inexpensive solution consisting of two Raspberry Pi's running a pre-existing Rasbian Lite version. The tool's setup is documented as follows:

- For a list of materials you will need, see Raspberry Pi Tester BOM.
- To set up the NCA tool, you must have the appropriate images flashed onto SD cards. See Image Flashing Guide for instructions on flashing pre-existing images onto SD cards.
- For building up images from scratch, do development and/or make a release, see Development and Release Procedure (NCA) OLD.

Quickstart

The only difference between the "Master" and "Slave" NCA's is that the slave connects to the other's wireless hot spot. That's how they, and you, communicate with the network. Make sure to configure both pi's in an order that allows you to connect to that hot spot. Essentially, always ensure you have a "Master" pi.

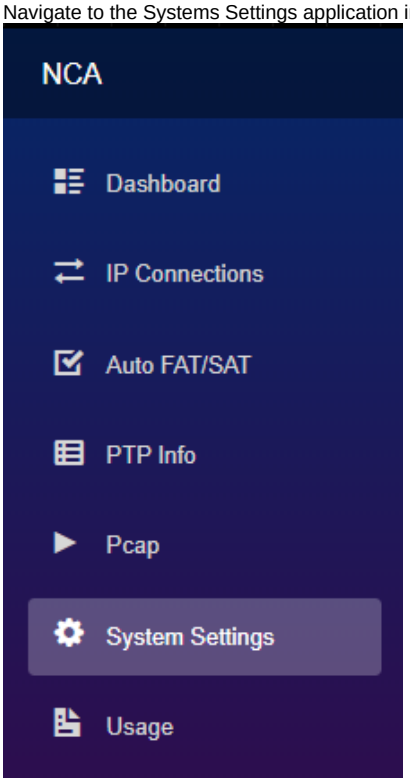


To setup the pi's for the first time:

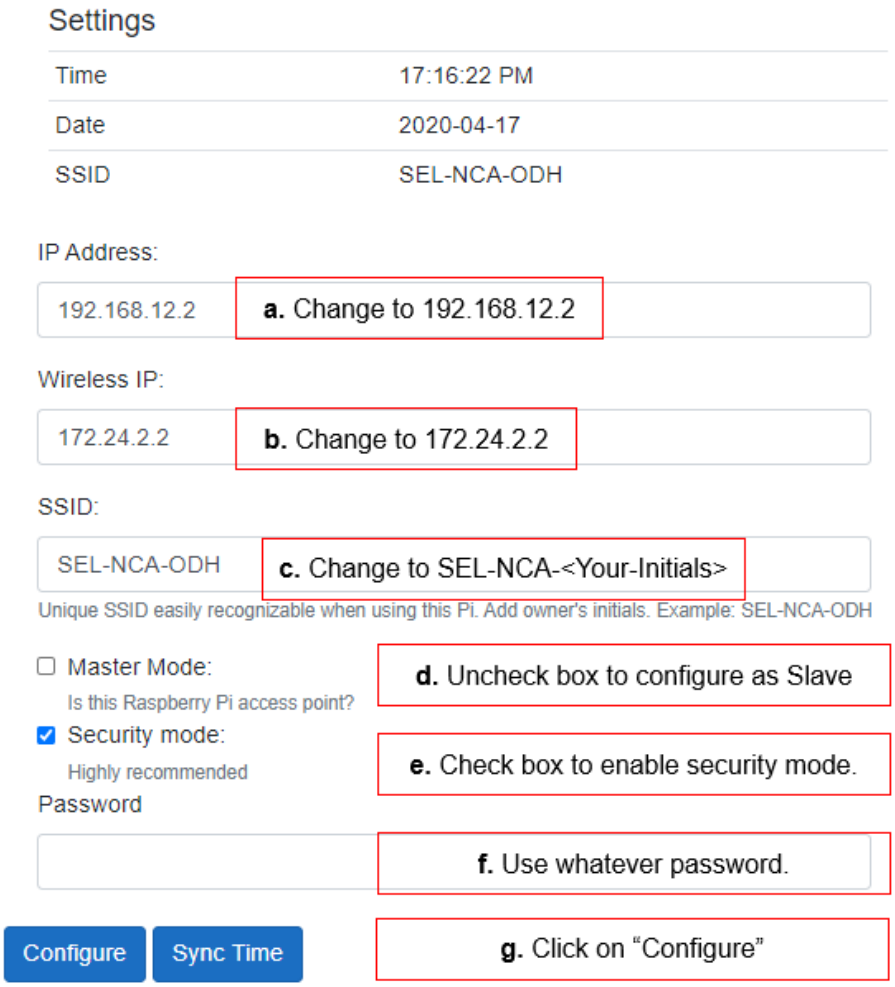
1. Flash two of the NCA images (latest version) onto the micro-SD cards, and insert them in both pi's.
2. Power on the first pi which will be configured as **Slave.**
3. Connect to the default SSID ("SEL-NCA-CHANGE-ME"). The network will not have internet access necessarily. If asked whether you want your PC to be discoverable on that network, either option will work.

4. Use a browser to access the default website 172.24.2.1

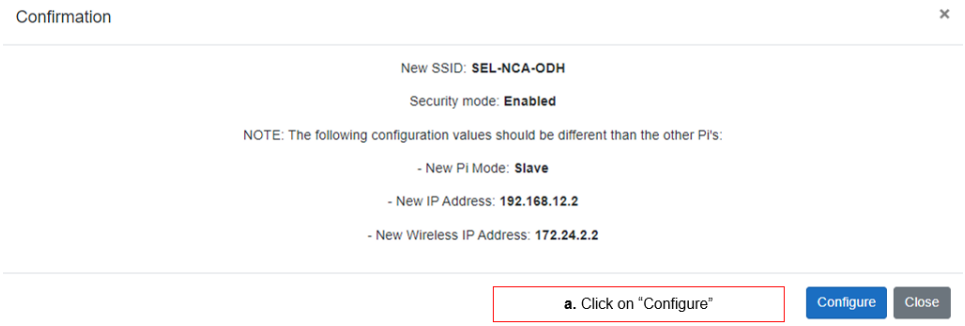
5. Navigate to the Systems Settings application in the sidebar.



6. Change the following settings and click on "Configure."

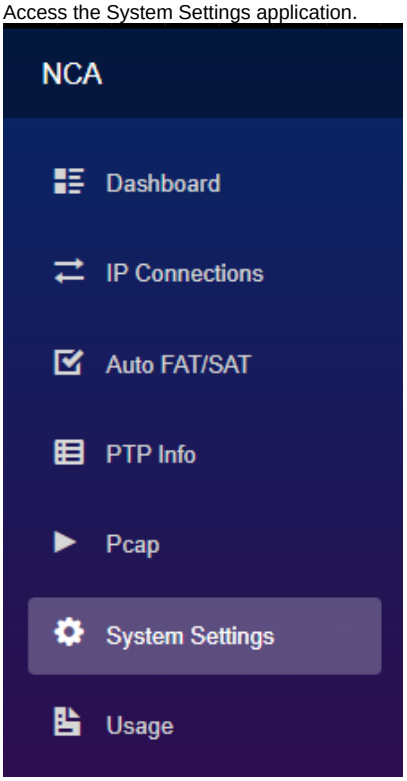


7. A confirmation modal will pop up. After confirming the changes and clicking on "Configure," the pi should restart.

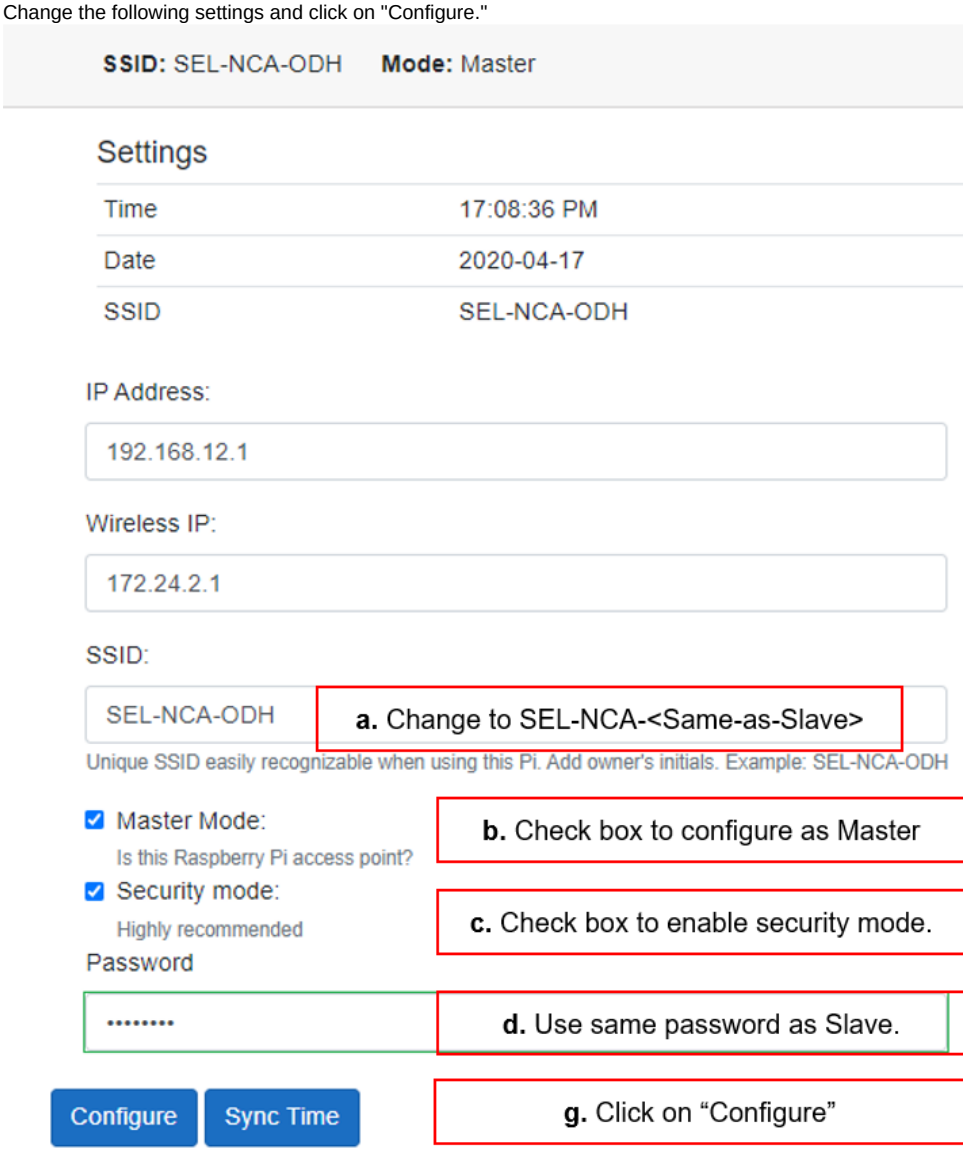


8. Power on the other pi which will be configured as **Master.**
9. Connect to the default SSID ("SEL-NCA-CHANGE-ME"), and navigate to the 172.24.2.1 page. The network will not have internet access necessarily. If asked whether you want your PC to be discoverable on that network, either option will work.

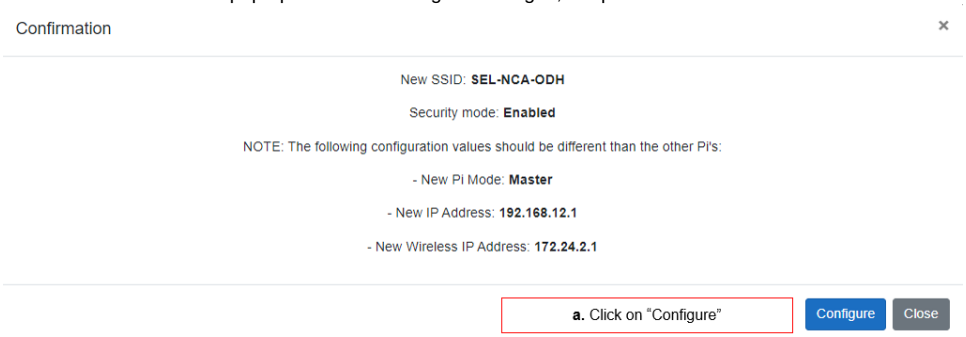
10. Access the System Settings application.



11. Change the following settings and click on "Configure."

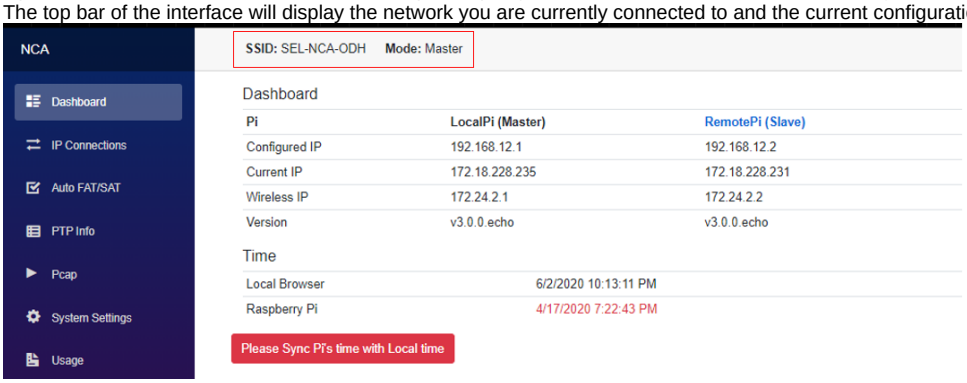


12. A confirmation modal will pop up. After confirming the changes, the pi should restart.



13. Make sure both pi's are powerded on and connect to the new SSID that you specified earlier.

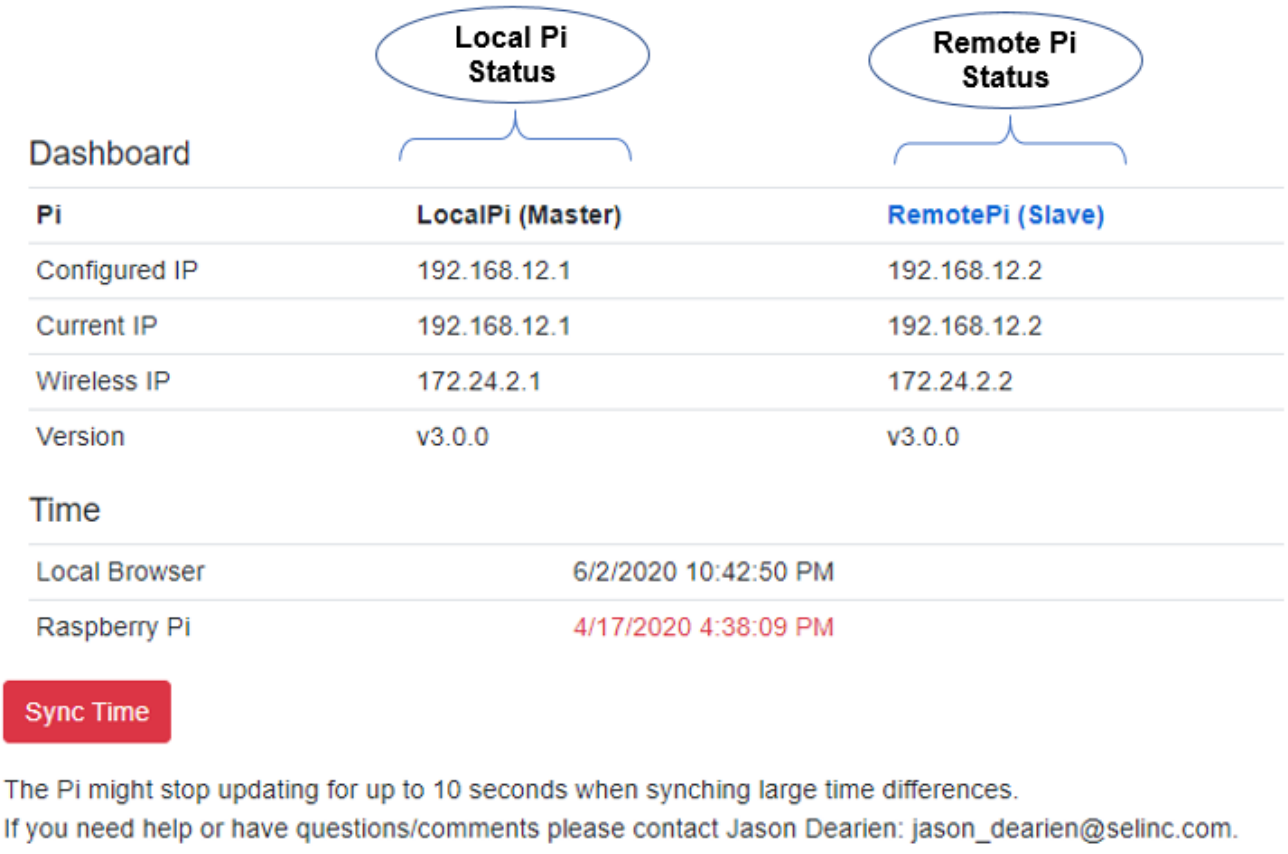
14. Open internet browser and access 172.24.2.1 (Master) to go to the NCA dashboard and make sure you can see the Remote Pi's info. NOTE: The top bar of the interface will display the network you are currently connected to and the current configuration of the pi (Master or Slave).



Dashboard

Gives small amount of information about local and remote pi.

NOTE: "Local Pi" refers to the interface of the current pi's server, while "Remote Pi" simply refers to the "other" pi, regardless of which pi is configured as Master or Slave.



Sync Time

There is a table that displays information about local time and the time on the Pi, and if these differ by more than 15 seconds, a button will pop up to sync the time. This is relevant for the Pcap application, so that the timestamps on any of files created by the pi will have a roughly correct time, but it is not required for the proper function of the application.

After pressing this button, if the time change betweent the pi and browser is significant, it may cause a slight interruption in the web-interface but it should recover.

IP Connections

The IP Connections is an application that simulates end-to-end protocols between the two devices. The possible test configurations are the following:

- Client/Server Mode
- UDP (It is good to try the Bi-directional setting on Unidirectional protocols, for negative testing).
    - Unidirectional
    - Bidirectional
- TCP/UDP Port Number.
- IP Address
- Remote IP Address
- Subnetwork Mask
- Default Gateway

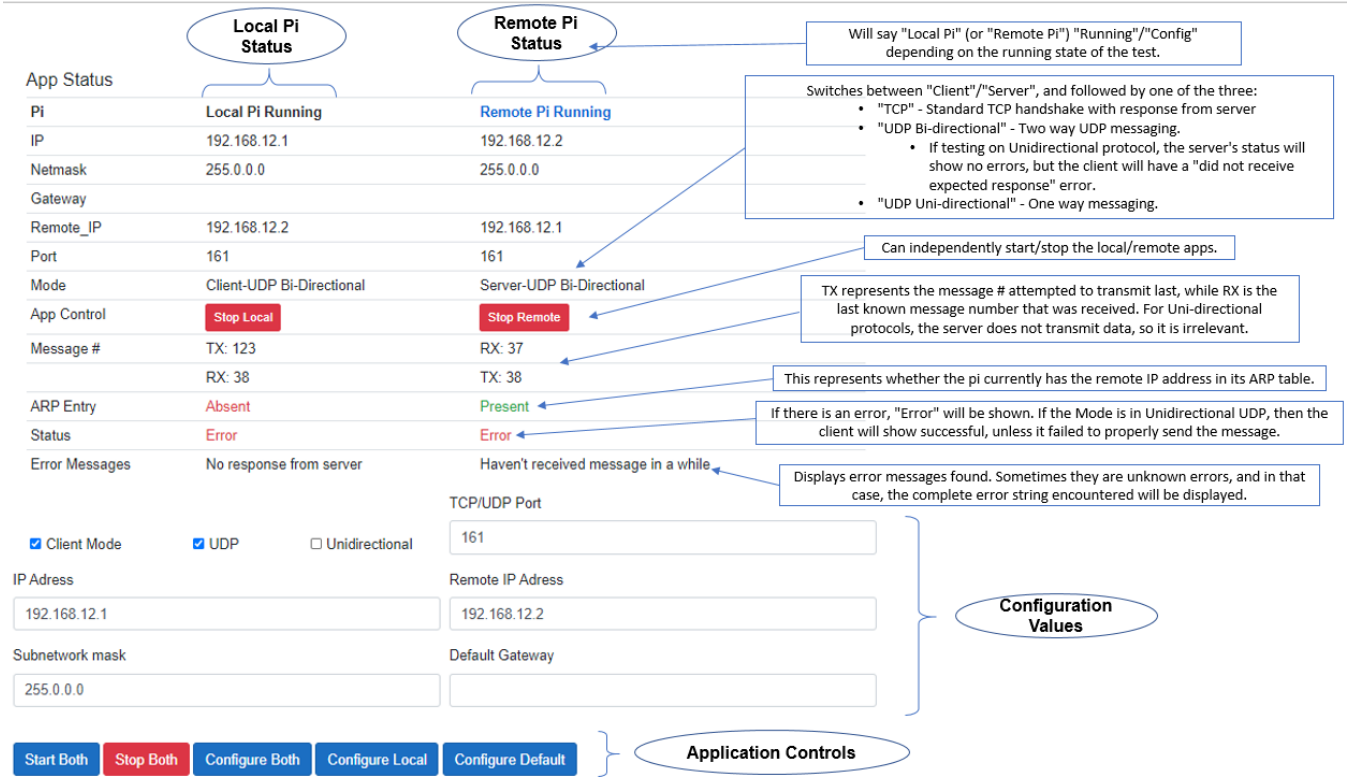
If configuration details are sent while running an active test, the test will be restarted with the new configuration.

NOTE: It is recommended that all the configuration changes be made from the Master pi. However, if you want to configure the Slave Pi, you will have to navigate to his page, whose link is located in the header of the Slave pi column, and configure its information locally. The differences between the Master and Slave IP Connections interface are as follows:

- IP and Remote IP address will be reversed.
- Client Mode will be inverted

Results

There are several different pieces of information that appear in the App Status table. Most of these are simply reflections of the way that the pi was configured at the time of starting the current running test. Other reflect information about the status of the communication between the two pi's.



Auto FAT/SAT

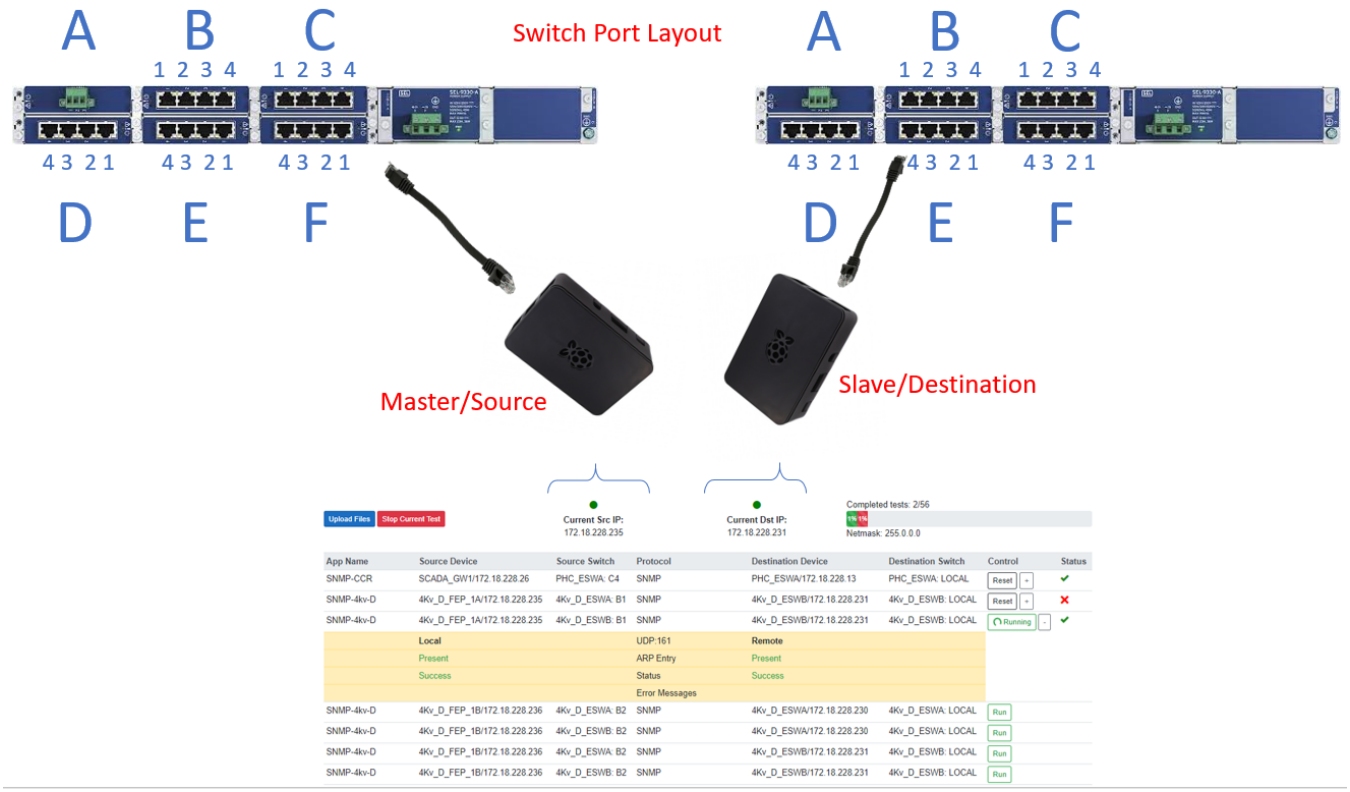
This is the automated version of the IP Connections application, which simulates end-to-end protocols between the two devices. On this application, instead of manually typing the port number, source and destination IP addresses, the user needs to upload two different files:

- **SAT file**. This file must contain at least the following headers:
    - AppName
    - SrcName
    - SrcPort
    - SrcIP
    - SrcSwitch
    - SrcSwitchPort
    - Protocol
    - DstName
    - DstPort
    - DstIP
    - DstSwitch

    - DstSwitchPort
- **Protocols file.** This file must contain at least the following headers:
    - Name
    - Unicast
    - Bidirectional
    - EthType
    - IpProto
    - TcpDst
    - UdpDst

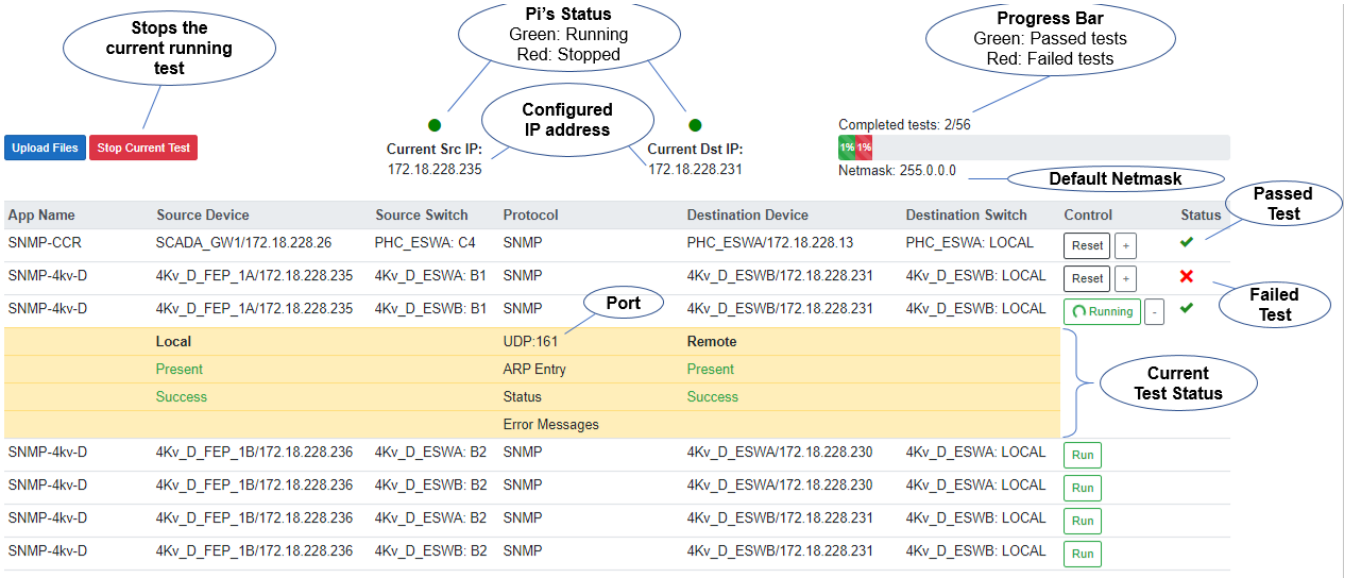
The application will left-join the SAT with Protocol files on "AppName" and "Name" fields, and a list of all the available tests will be displayed. The user can run individual tests by clicking on the "Run" button. When a test is run, the application will configure both Pi's and start the test accordingly. When a test is running, then stopped or a different test is started, the current running test will save the last state it was on. This allows the user to keep track of previous passed and/or failed tests.

Recommended steps



1. Run desired test.
2. Plug Source pi into Source Switch and Remote pi into Destination Switch.
3. Wait for a pass or fail state.
4. Stop current test or run a different one. NOTE: The application will save the last state the test was on; hence, do not unplug any of the pi's before stopping or starting a new test.
5. Repeat until all desired tests have been run.

Application Overview

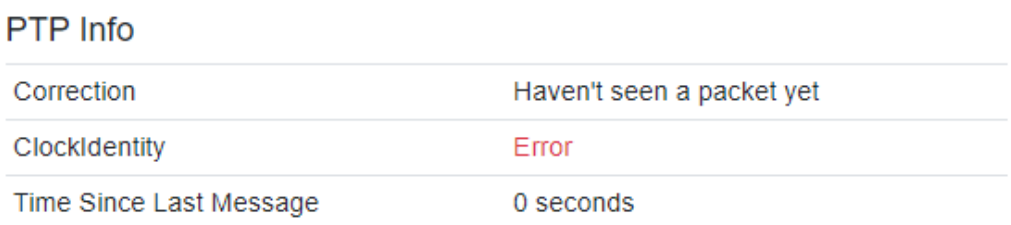


PTP Info

Straight forward Application. It just listens on physical address for any PTP packets. It grabs the correction, clock identity, and time since last PTP packet.

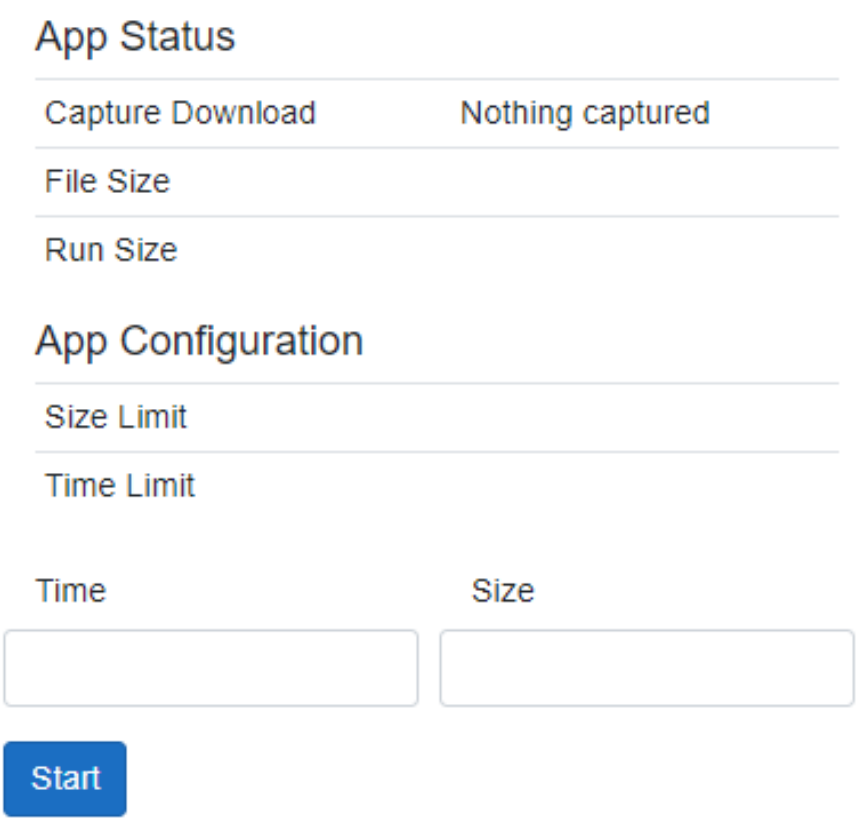
It only grabs correction values from the Sync message. This means that the application is accurate only for 1-step PTP. If you are using 2-step, the correction will be inaccurate. This is because we do not add together the correction values of the Sync and Follow-up messages.

Application Overview



Pcap

The Pcap application is used to create .pcap files for viewing in wireshark. The configuration settings are based on the time/max size of the file, whichever comes first. The user is allowed to start the application without a configuration. In which case, the maximum size will be used, and there won't be a limit to the time frame.



Limits

Time*: 5 seconds < time < 24 hours

Size: 1KB < size < 2 GB

*If no time value is given, the application will not stop until the size limit is reached.

Results

The result file can be downloaded at any time using the hyperlink "Capture Download" row. Files are deleted when a new test is run, or the raspberry pi turns off.