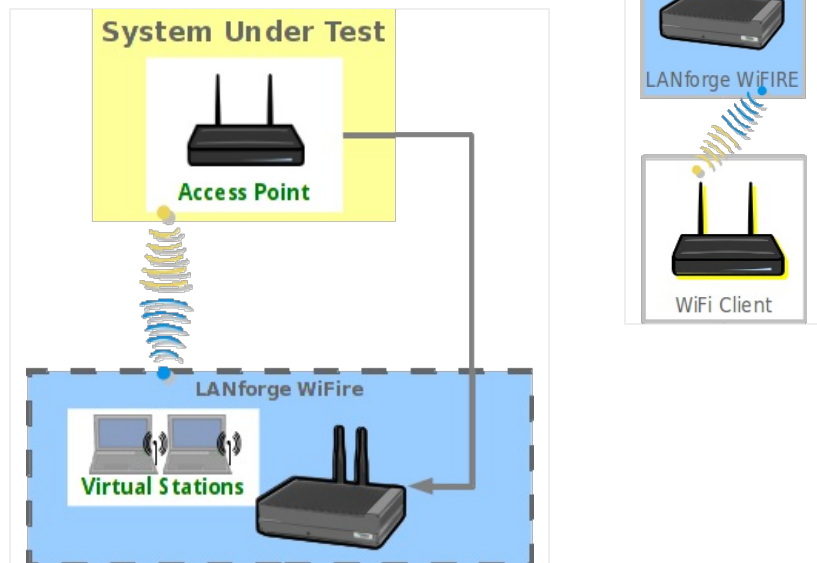


WiFi Capacity Test with Layer 4-7

Goal: Use the WiFi Capacity Test plugin to emulate layer 4-7 traffic from ten virtual stations across an access point and report the results.

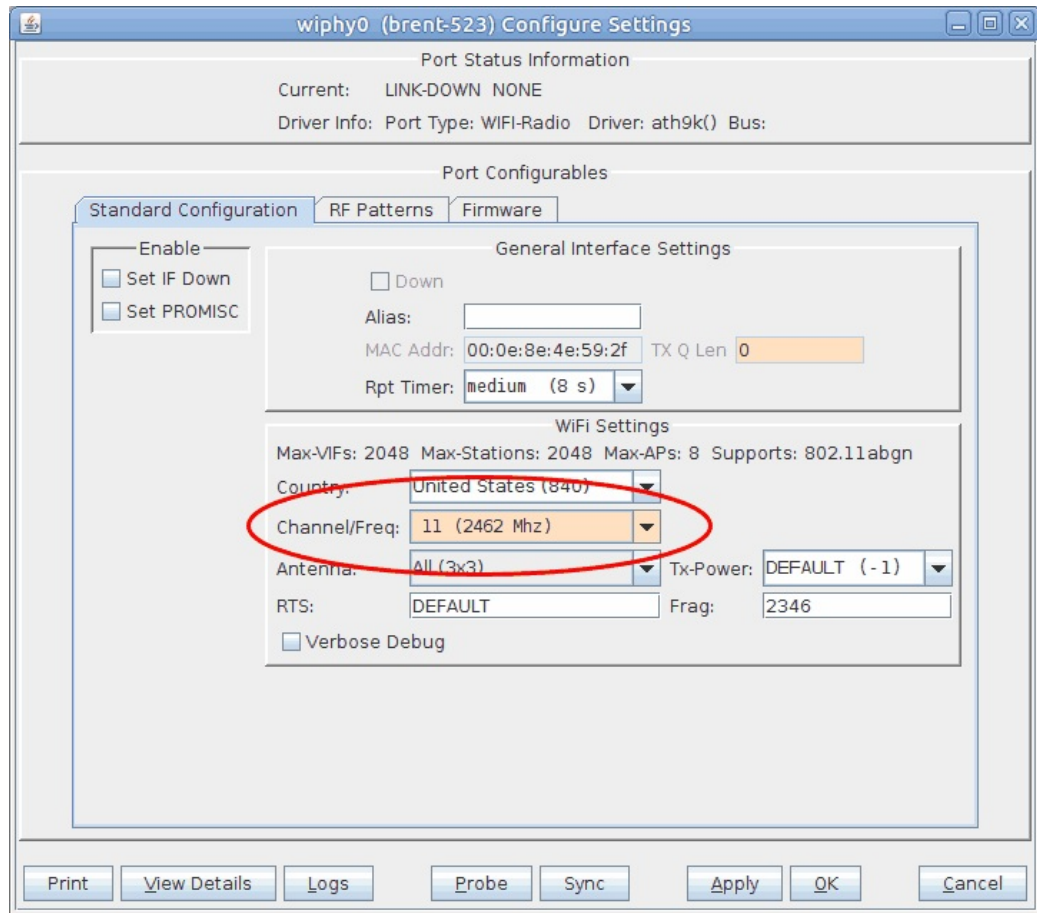
Requires 5.2.13 or later. This cookbook will go through setting up a VAP (Virtual Access Point) as an HTTP server, and creating/configuring 10 virtual stations to communicate with the VAP. It will also go through the setup of the WiFi Capacity Test LANforge-GUI plugin to have the virtual stations emulate downloading a file using Layer 4-7 endpoints in LANforge.

This example uses a **LANforge CT523** system but the procedure should also work on a CT521, CT522, CT525 or similar system.



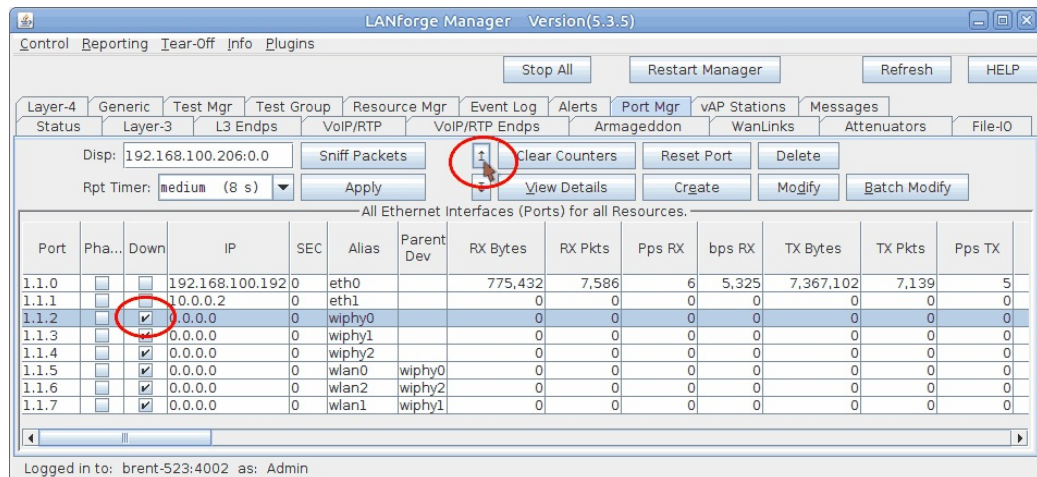
1. Create a VAP.
 - A. Verify the wiphy device used for the VAP is on your preferred channel (this test will use channel 11).

- A. In the **Port Mgr** tab of the LANforge Manager, modify the wiphy device that'll be used for the VAP (wiphy0 in this test).



- I. Select your preferred channel here.

- B. Make sure the wiphy device is up.



- I. If the device is down like in the above screenshot, select it and click the **Admin UP** button (also indicated in the above screenshot).

- B. In the **Port Mgr** tab, select a wiphy device (wiphy0 in this test) and click **Create**.

1 ☐ MAC-VLAN ☐ 802.1Q-VLAN ☐ Redirect ☐ Bridge ☐ GRE Tunnel
☐ WiFi STA ☒ WiFi VAP ☐ WiFi Monitor ☐ WiFi Virtual Radio

2 Shelf: 1 Resource: 1 (brent-523) Port: 2 (wiphy0)

3 VLAN ID: ☐ DHCP-IPv4
Parent MAC: 00:0e:8e:4e:59:2f DHCP Client ID: None
MAC Addr: xx:xx:xx:*:*:xx IP Address: 10.0.0.1/24 Global IPv6: AUTO
Quantity: 1 IP Mask or Bits: Link IPv6: AUTO
Gateway IP: IPv6 GW: AUTO
#1 Redir Name: #2 Redir Name:
STA ID: 0 SSID: layer4test
WiFi AP: Key/Phrase:
☐ WPA ☐ WPA2 ☐ WEP

4 ☐ Down
Apply Cancel Ready

- A. Select the **WiFi VAP** radio button.
- B. Set **Quantity** to **1**.
- C. Set **STA ID** to **0**.
- D. Set **IP Address** to **10.0.0.1/24**.
- E. Set the **SSID** to **layer4test**.
- F. Click **Apply** and close the create port window.

- C. Configure the VAP.

- A. Open **Netsmith** from the **Status** tab.

, Load Behavior: Overwrite, buttons: Load, Delete, Save, Download DB, Show Progress). Below this is a 'Virtual Shelf 1' section with 'Resource 1' containing a 'Netsmith' button circled in red. The bottom status bar shows 'Logged in to: brent-523:4002 as: Admin'."/>

LANforge Manager Version(5.3.5)

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr vAP Stations Messages

Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Attenuators File-IO

License Info
Licenses expire in: 53 days.
Support expires in: 53 days.

Current Users
* Admin from: 192.168.100.206
gnuserver from: 127.0.0.1

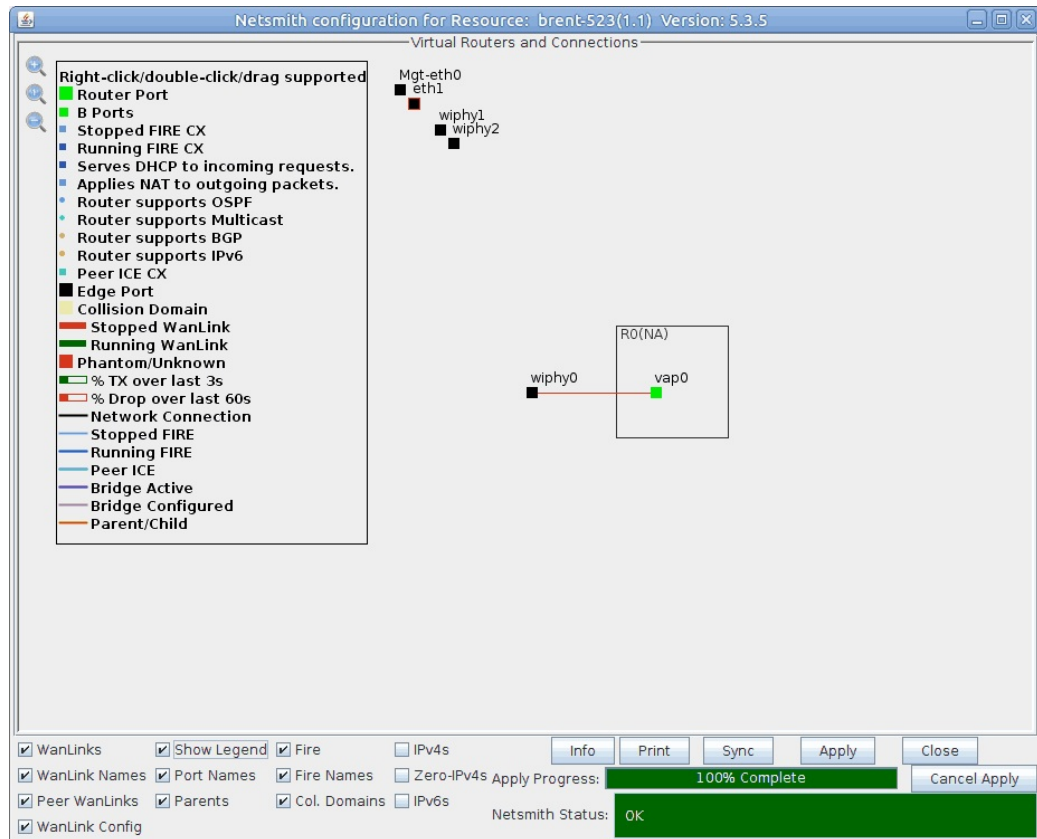
Test Configuration Database
List: BLANK Load
Name: Delete
Load Behavior: Overwrite Save
Download DB Show Progress

Virtual Shelf 1
Resource 1
Netsmith

Logged in to: brent-523:4002 as: Admin

- B. In Netsmith, right click and select **New Router**.
- C. Click **OK**.

D. Drag vap0 into the virtual router.



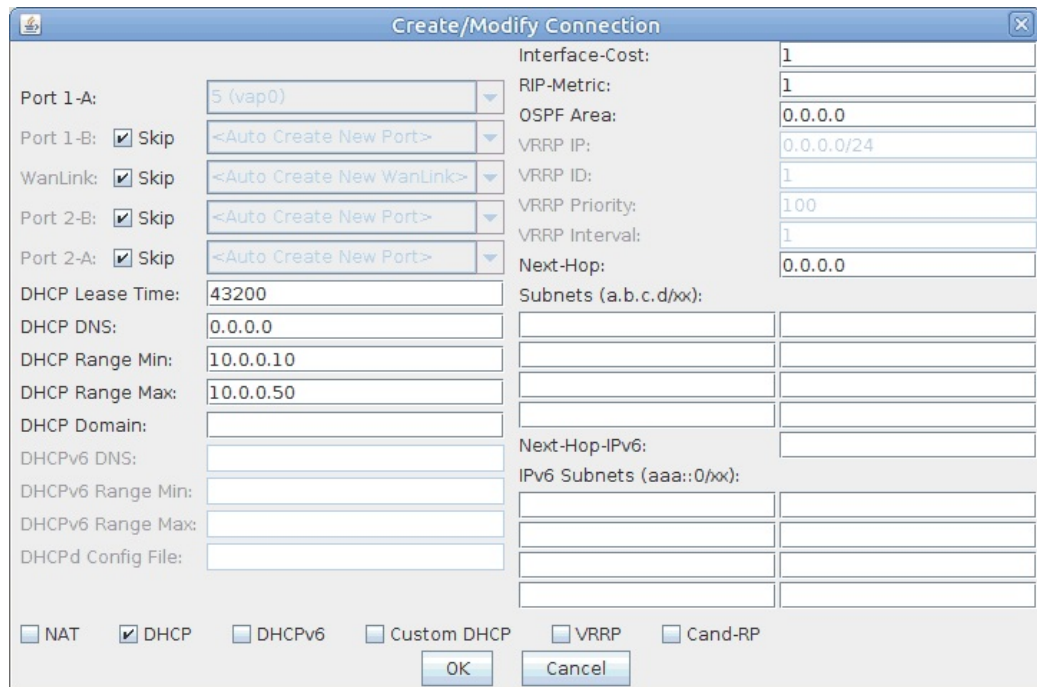
E. Right click vap0 and select **Modify**.

F. Check **DHCP**.

G. Change **DHCP Range Min** to **10.0.0.10**

H. Change **DHCP Range Max** to **10.0.0.50**

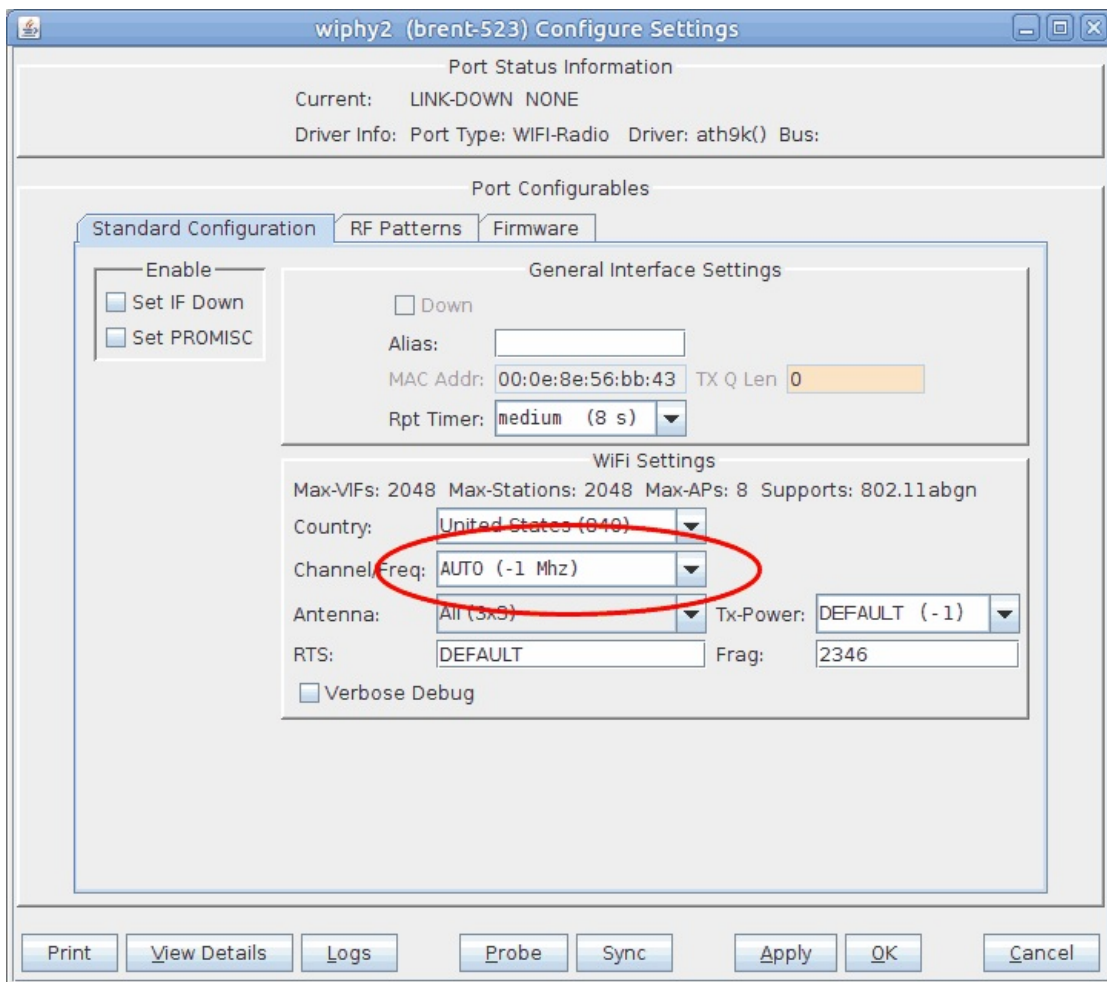
I. Click **OK**.



J. Click **Apply** in Netsmith then close the window.

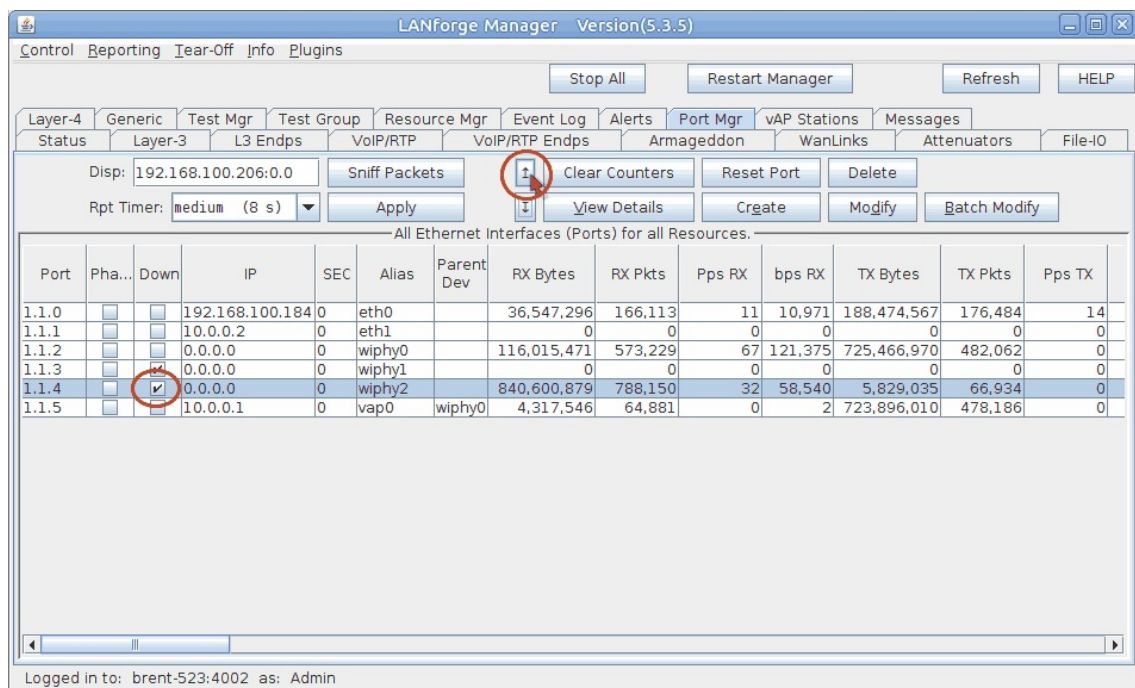
2. Create 10 virtual stations.

- A. Verify the wiphy device used for the stations (wiphy 2 in this test) is on the **AUTO** channel.



The image shows the 'wiphy2 (brent-523) Configure Settings' dialog box. It has a 'Port Status Information' section at the top showing 'Current: LINK-DOWN NONE' and 'Driver Info: Port Type: WIFI-Radio Driver: ath9k() Bus:'. Below this is the 'Port Configurables' section with three tabs: 'Standard Configuration', 'RF Patterns', and 'Firmware'. The 'Standard Configuration' tab is active. It contains a 'General Interface Settings' section with 'Enable' checked, 'Set IF Down' and 'Set PROMISC' unchecked, 'Down' unchecked, 'Alias' empty, 'MAC Addr: 00:0e:8e:56:bb:43', 'TX Q Len: 0', and 'Rpt Timer: medium (8 s)'. Below this is the 'WiFi Settings' section with 'Max-VIFs: 2048', 'Max-Stations: 2048', 'Max-APs: 8', and 'Supports: 802.11abgn'. It also has 'Country: United States (840)', 'Channel Freq: AUTO (-1 Mhz)' (circled in red), 'Antenna: All (5x3)' (circled in red), 'Tx-Power: DEFAULT (-1)', 'RTS: DEFAULT', 'Frag: 2346', and 'Verbose Debug' unchecked. At the bottom are buttons for 'Print', 'View Details', 'Logs', 'Probe', 'Sync', 'Apply', 'OK', and 'Cancel'.

- B. Make sure wiphy2 is up.



The image shows the LANforge Manager Version(5.3.5) interface. It has a top menu bar with 'Control', 'Reporting', 'Tear-Off', 'Info', and 'Plugins'. Below this is a toolbar with 'Stop All', 'Restart Manager', 'Refresh', and 'HELP'. The main area has a tabbed interface with 'Layer-4', 'Generic', 'Test Mgr', 'Test Group', 'Resource Mgr', 'Event Log', 'Alerts', 'Port Mgr', 'vAP Stations', and 'Messages'. The 'Port Mgr' tab is active, showing a table of 'All Ethernet interfaces (Ports) for all Resources.' The table has columns: Port, Pha..., Down, IP, SEC, Alias, Parent Dev, RX Bytes, RX Pkts, Pps RX, bps RX, TX Bytes, TX Pkts, and Pps TX. The 'wiphy2' interface is highlighted in blue, and its 'Down' checkbox is checked (circled in red). The 'Clear Counters' button is also circled in red. At the bottom, it says 'Logged in to: brent-523:4002 as: Admin'.

Port	Pha...	Down	IP	SEC	Alias	Parent Dev	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	Pps TX
1.1.0			192.168.100.184	0	eth0		36,547,296	166,113	11	10,971	188,474,567	176,484	14
1.1.1			10.0.0.2	0	eth1		0	0	0	0	0	0	0
1.1.2			0.0.0.0	0	wiphy0		116,015,471	573,229	67	121,375	725,466,970	482,062	0
1.1.3			0.0.0.0	0	wiphy1		0	0	0	0	0	0	0
1.1.4		☒	0.0.0.0	0	wiphy2		840,600,879	788,150	32	58,540	5,829,035	66,934	0
1.1.5			10.0.0.1	0	vap0	wiphy0	4,317,546	64,881	0	2	723,896,010	478,186	0

C. In the **Port Mgr** tab, select a wiphy device (wiphy2 in this test) and click **Create**.

- Select the **WiFi STA** radio button.
- Set **Quantity** to **10**.
- Set **STA ID** to **0**.
- Select **DHCP-IPv4**.
- Set the **SSID** to **layer4test**.
- Click **Apply** and close the create port window.

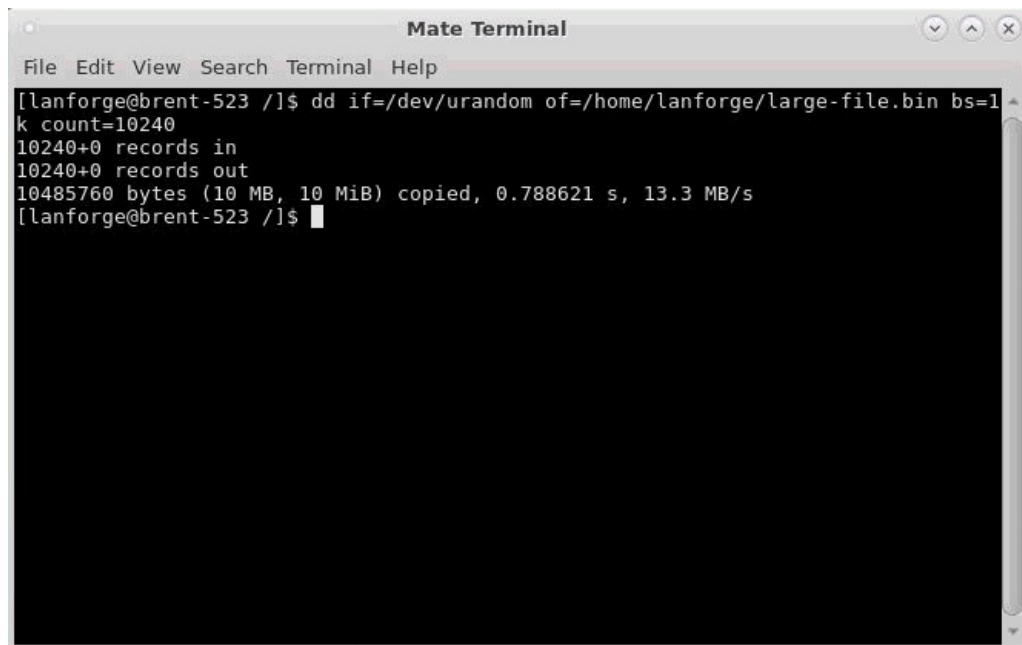
D. Make sure the 10 staX ports get IPs.

Port	Pha...	Down	IP	SEC	Alias	Parent Dev	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	Pps TX
1.1.00			192.168.100.192	0	eth0		46,812,745	95,852	8	7,049	64,012,518	76,741	14
1.1.01			0.0.0.0	0	eth1		0	0	0	0	0	0	0
1.1.02			0.0.0.0	0	wiphy0		85,790,508	400,112	83	144,894	237,614	1,490	0
1.1.03			0.0.0.0	0	wiphy1		0	0	0	0	0	0	0
1.1.04			0.0.0.0	0	wiphy2		2,315,229	10,998	78	133,398	19,313	214	0
1.1.05			10.0.0.1	0	vap0	wiphy0	11,030	73	0	0	27,134	140	0
1.1.06			10.0.0.13	0	sta0	wiphy2	9,944	64	0	0	1,622	9	0
1.1.07			10.0.0.16	0	sta1	wiphy2	10,622	71	0	0	1,198	7	0
1.1.08			10.0.0.14	0	sta2	wiphy2	10,532	70	0	0	1,198	7	0
1.1.09			10.0.0.10	0	sta3	wiphy2	10,532	70	0	0	1,198	7	0
1.1.10			10.0.0.17	0	sta4	wiphy2	10,364	68	0	0	1,296	8	0
1.1.11			10.0.0.19	0	sta5	wiphy2	10,694	69	0	0	1,560	8	0
1.1.12			10.0.0.12	0	sta6	wiphy2	10,352	68	0	0	1,198	7	0
1.1.13			10.0.0.15	0	sta7	wiphy2	10,172	66	0	0	1,198	7	0
1.1.14			10.0.0.18	0	sta8	wiphy2	10,082	65	0	0	1,198	7	0
1.1.15			10.0.0.11	0	sta9	wiphy2	9,914	63	0	0	1,296	8	0

3. Create a file for the layer 4-7 endpoint to use.

- A. In a terminal on the LANforge system, run the below command to generate a 10MB file in **/home/lanforge**.
Note: The smaller a file is, the harder it is to reach higher rates. Therefore it is recommended to use a larger file for these tests.

```
dd if=/dev/urandom of=/home/lanforge/large-file.bin bs=1k count=10240
```

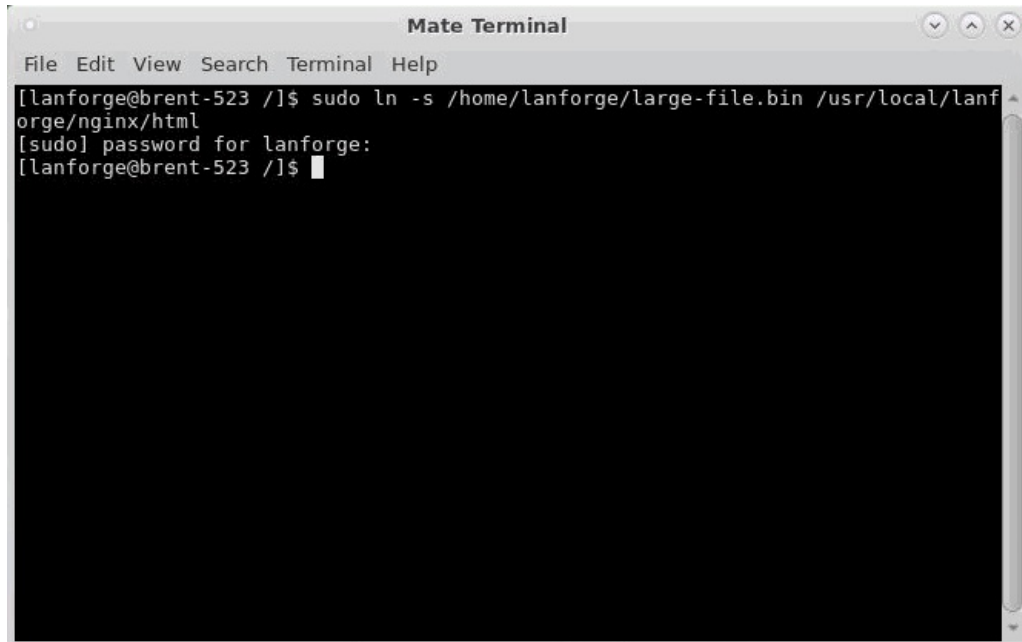


The screenshot shows a terminal window titled "Mate Terminal" with a menu bar (File, Edit, View, Search, Terminal, Help). The terminal output shows the command `dd if=/dev/urandom of=/home/lanforge/large-file.bin bs=1k count=10240` being executed. The output indicates that 10240+0 records were written, totaling 10485760 bytes (10 MB, 10 MiB) copied in 0.788621 seconds at a rate of 13.3 MB/s.

```
[lanforge@brent-523 ~]$ dd if=/dev/urandom of=/home/lanforge/large-file.bin bs=1k count=10240
10240+0 records in
10240+0 records out
10485760 bytes (10 MB, 10 MiB) copied, 0.788621 s, 13.3 MB/s
[lanforge@brent-523 ~]$
```

- B. For the webserver to serve the file we created, it needs to know where to find it. Run the below command in a terminal on the LANforge system to link the file.

```
ln -s /home/lanforge/large-file.bin /usr/local/lanforge/nginx/html
```



The screenshot shows a terminal window titled "Mate Terminal" with a menu bar (File, Edit, View, Search, Terminal, Help). The terminal output shows the command `ln -s /home/lanforge/large-file.bin /usr/local/lanforge/nginx/html` being executed. It prompts for a password for the user 'lanforge', which is entered, and the command completes successfully.

```
[lanforge@brent-523 ~]$ sudo ln -s /home/lanforge/large-file.bin /usr/local/lanforge/nginx/html
[sudo] password for lanforge:
[lanforge@brent-523 ~]$
```

4. Set up the HTTP server on **vap0**.

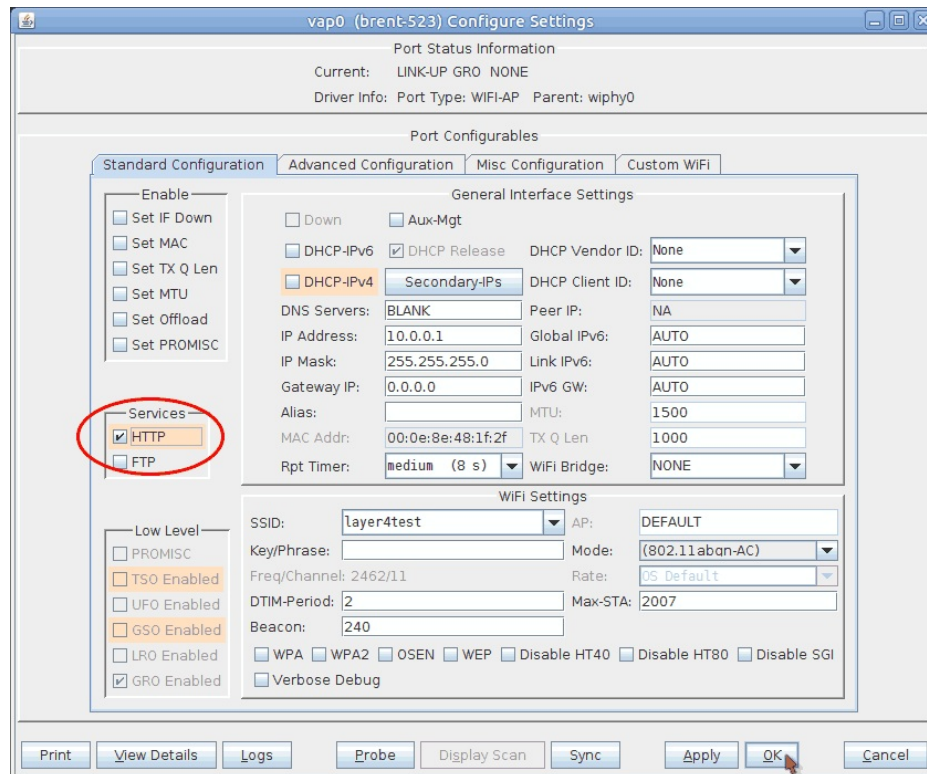
A. Before starting HTTP on vap0, the Apache service may need to be disabled.

A. Stop and disable httpd (Apache) in the LANforge terminal with the below commands.

```
sudo systemctl stop httpd.service
[sudo] password for lanforge:
[lanforge@brent-523 /]$
[lanforge@brent-523 /]$
[lanforge@brent-523 /]$ sudo systemctl disable httpd.service
Removed symlink /etc/systemd/system/multi-user.target.wants/httpd.service.
[lanforge@brent-523 /]$
[lanforge@brent-523 /]$
[lanforge@brent-523 /]$ sudo systemctl daemon-reload
[lanforge@brent-523 /]$
```

B. Modify **vap0** in the LANforge **Port Mgr** tab.

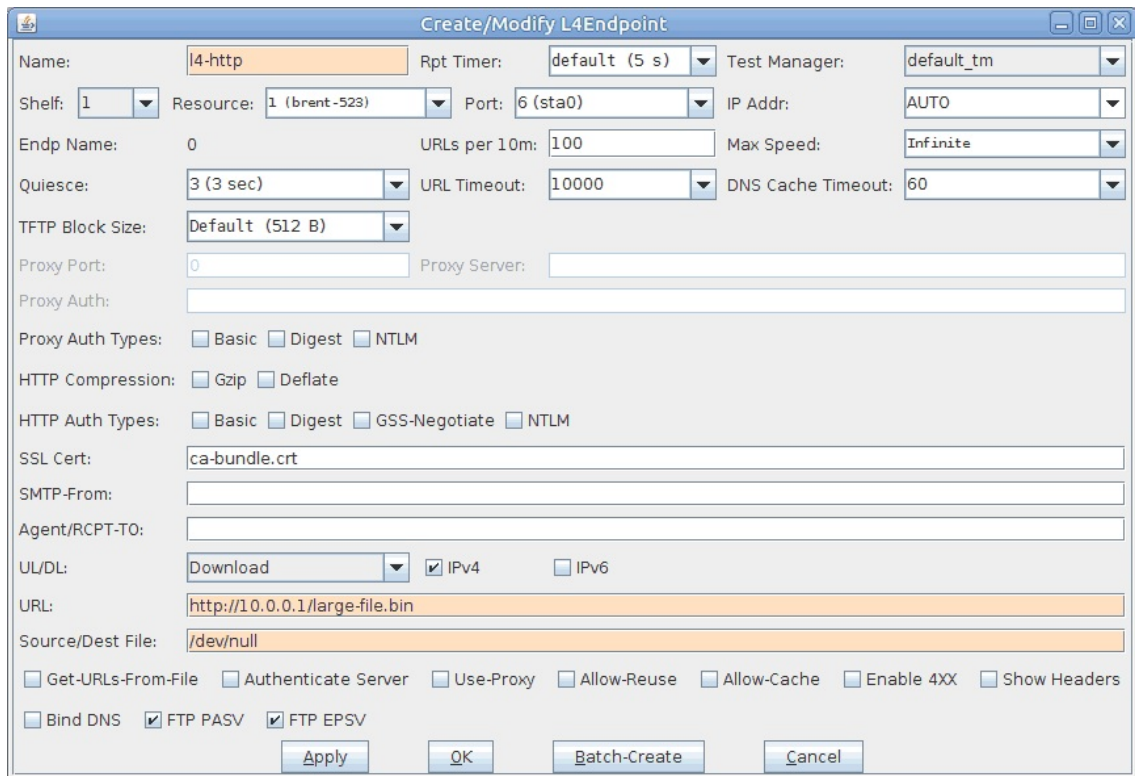
I. Enable the **HTTP** checkbox.



II. Click **OK**.

5. Create a layer 4-7 endpoint. WiFi Capacity will be using this as a template to copy from.

- A. In the Layer 4-7 tab, click **Create**.



The 'Create/Modify L4Endpoint' dialog box contains the following fields and options:

- Name:** l4-http
- Rpt Timer:** default (5 s)
- Test Manager:** default_tm
- Shelf:** 1
- Resource:** 1 (brent-523)
- Port:** 6 (sta0)
- IP Addr:** AUTO
- Endp Name:** 0
- URLs per 10m:** 100
- Max Speed:** Infinite
- Quiesce:** 3 (3 sec)
- URL Timeout:** 10000
- DNS Cache Timeout:** 60
- TFTP Block Size:** Default (512 B)
- Proxy Port:** 0
- Proxy Server:**
- Proxy Auth:**
- Proxy Auth Types:** ☐ Basic ☐ Digest ☐ NTLM
- HTTP Compression:** ☐ Gzip ☐ Deflate
- HTTP Auth Types:** ☐ Basic ☐ Digest ☐ GSS-Negotiate ☐ NTLM
- SSL Cert:** ca-bundle.crt
- SMTP-From:**
- Agent/RCPT-TO:**
- UL/DL:** Download ☒ IPv4 ☐ IPv6
- URL:** http://10.0.0.1/large-file.bin
- Source/Dest File:** /dev/null
- Options:**
 - ☐ Get-URLs-From-File
 - ☐ Authenticate Server
 - ☐ Use-Proxy
 - ☐ Allow-Reuse
 - ☐ Allow-Cache
 - ☐ Enable 4XX
 - ☐ Show Headers
 - ☐ Bind DNS
 - ☒ FTP PASV
 - ☒ FTP EPSV
- Buttons:** Apply, OK, Batch-Create, Cancel

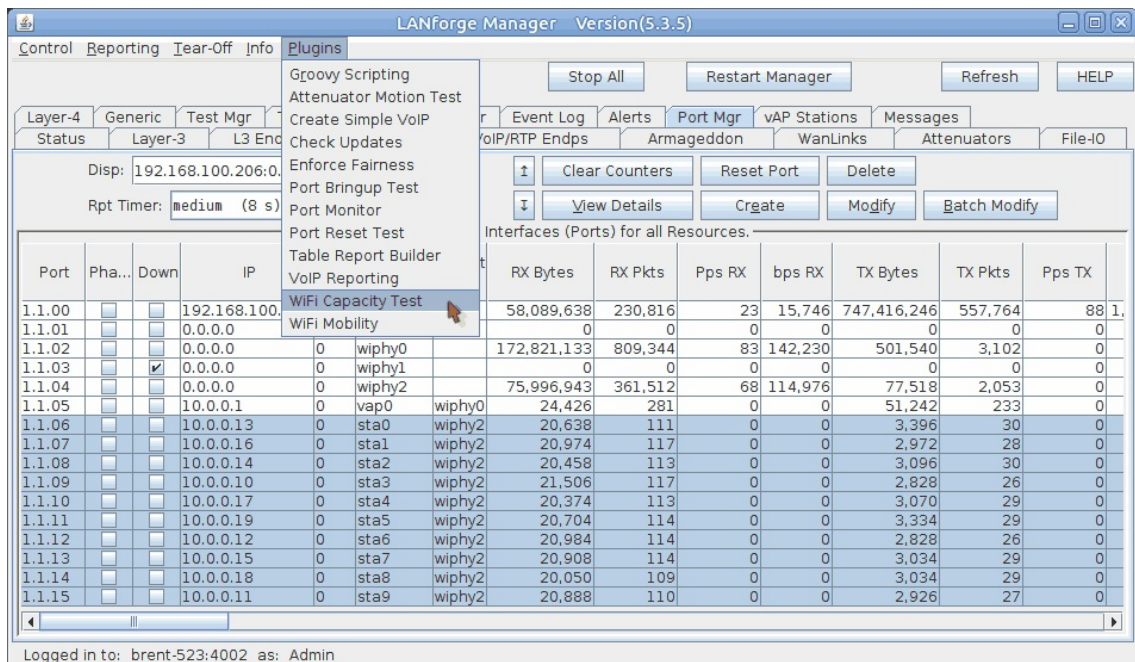
- A. Set the **Name** to **l4-http**
- B. Set the **Port** to **sta0**.
- C. The **URL** will point to the VAP's IP: **http://10.0.0.1/large-file.bin**

Note: This is where you can specify an IP of an AP you wish to test. LANforge also supports other layer 4-7 protocols, for more information you can view a tooltip by hovering over the URL text box.

- D. Set the **Source/Dest File** to **/dev/null**
- E. Click **OK**.

6. Set up and run a WiFi Capacity test.

- A. Select the 10 created stations, then open WiFi Capacity Test from the Plugins menu.



The LANforge Manager interface shows the 'Plugins' menu with 'WiFi Capacity Test' selected. The main window displays a table of interfaces (ports) for all resources, with columns for Port, Phase, Down, IP, and various performance metrics.

Port	Phase	Down	IP	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	Pps TX
1.1.00			192.168.100.0	58,089,638	230,816	23	15,746	747,416,246	557,764	88
1.1.01			0.0.0.0	0	0	0	0	0	0	0
1.1.02			0.0.0.0	172,821,133	809,344	83	142,230	501,540	3,102	0
1.1.03			0.0.0.0	0	0	0	0	0	0	0
1.1.04			0.0.0.0	75,996,943	361,512	68	114,976	77,518	2,053	0
1.1.05			10.0.0.1	24,426	281	0	0	51,242	233	0
1.1.06			10.0.0.13	20,638	111	0	0	3,396	30	0
1.1.07			10.0.0.16	20,974	117	0	0	2,972	28	0
1.1.08			10.0.0.14	20,458	113	0	0	3,096	30	0
1.1.09			10.0.0.10	21,506	117	0	0	2,828	26	0
1.1.10			10.0.0.17	20,374	113	0	0	3,070	29	0
1.1.11			10.0.0.19	20,704	114	0	0	3,334	29	0
1.1.12			10.0.0.12	20,984	114	0	0	2,828	26	0
1.1.13			10.0.0.15	20,908	114	0	0	3,034	29	0
1.1.14			10.0.0.18	20,050	109	0	0	3,034	29	0
1.1.15			10.0.0.11	20,888	110	0	0	2,926	27	0

Logged in to: brent-523:4002 as: Admin

B. Go to the Settings tab.

The screenshot shows the 'WiFi Capacity Test' application window with the 'Settings' tab selected. The window has a title bar with standard OS controls. Below the title bar are five tabs: 'Select Ports', 'Settings', 'PDU Mix Settings', 'Advanced Settings', and 'Select Output', with 'Settings' being the active tab. The main area contains several configuration options, each with a label and a dropdown menu. The settings are: 'Station Increment' set to 'Single (1)', 'Loop Iterations' set to 'Single (1)', 'Duration' set to '60000', 'Protocol' set to 'Layer-4', 'Layer-4 Endpoint' set to 'l4-http', 'Payload Size' set to 'AUTO', 'Total Rate' set to '10M (10 Mbps)', 'Total Upload Rate' set to 'Zero (0 bps)', and 'Percentage TCP Rate' set to '10% (10%)'. At the bottom of the window are two buttons: 'Start' and 'Close'.

Setting	Value
Station Increment:	Single (1)
Loop Iterations:	Single (1)
Duration:	60000
Protocol:	Layer-4
Layer-4 Endpoint:	l4-http
Payload Size:	AUTO
Total Rate:	10M (10 Mbps)
Total Upload Rate:	Zero (0 bps)
Percentage TCP Rate:	10% (10%)

A. Set **Station Increment** to **1**.

B. Set the Protocol to **Layer 4-7**. **Note:** This should automatically be set if you first select a Layer 4-7 Endpoint.

C. Select your Layer 4-7 Endpoint (**l4-http** in this test). The capacity test will use this as a template for each of the ten stations.

D. **Total Rate** can stay at 10Mbps. **Note:** This rate can represent either upload or download traffic depending on how you have your layer 4-7 endpoint configured.

C. Run the Capacity test by clicking **Start**.



- A. The test will now make a copy of the selected layer 4-7 endpoint for each station. **Note:** You may notice that URLs per 10m is set to a high rate, this is to ensure the maximum amount of URLs are processed as WiFi Capacity adjusts the Max Speed.