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TECHNOLOGIES
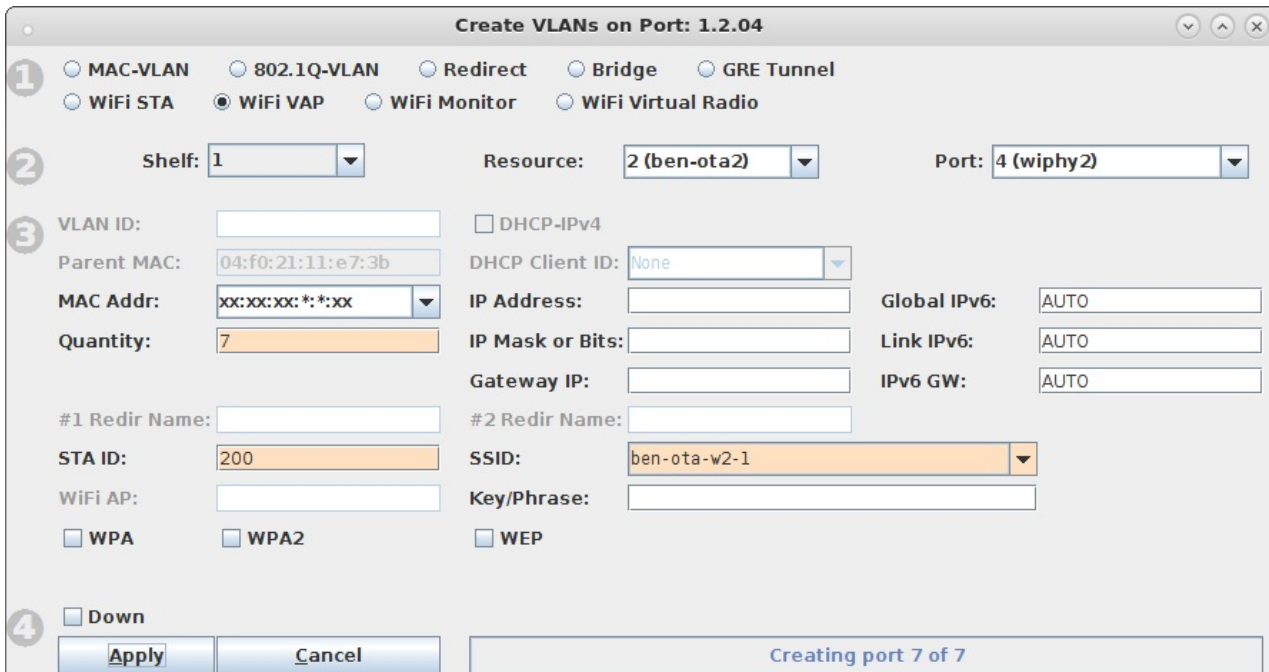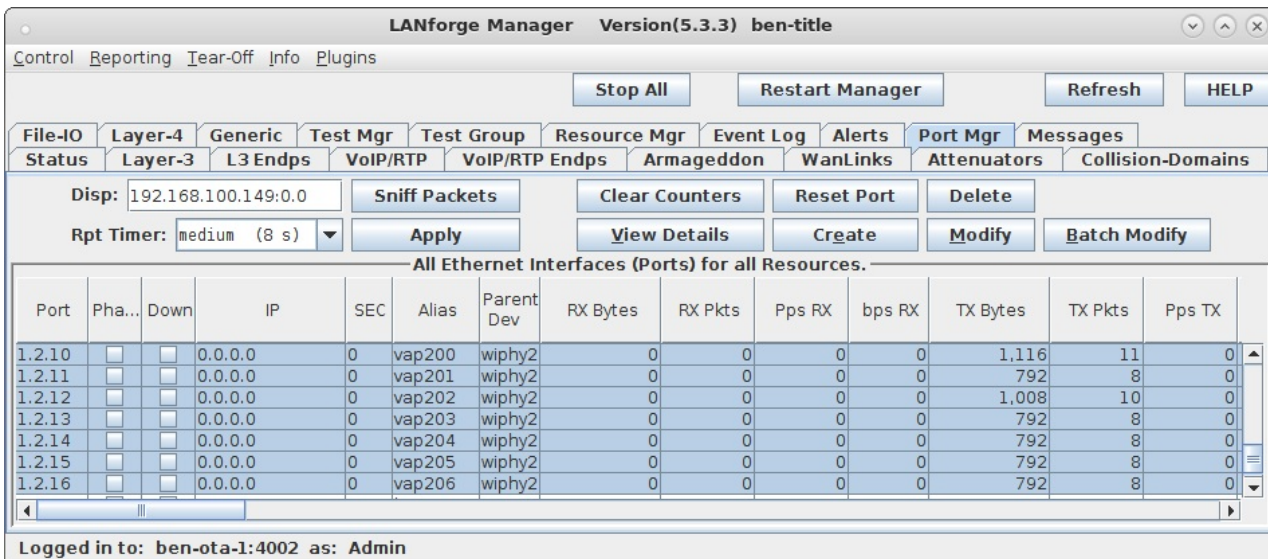Network Testing and Emulation Solutions

LANforge WiFi Many vAP Testing

Goal: Create 7 vAP on a single a/b/g/n/AC radio to emulate a busy environment and test that station devices associate to the proper AP.

Requires LANforge 5.3.3 or later. Configure 7 vAP, add the vAP to a bridge and set up DHCP. The Device Under Test (DUT) in this case is a mobile handset or other wifi station device. Verify that station can handle many APs and select an appropriate AP from the available scan results. This example uses a LANforge CT523 system but the procedure should work on all CT520, CT523, CT524 and CT525 systems.
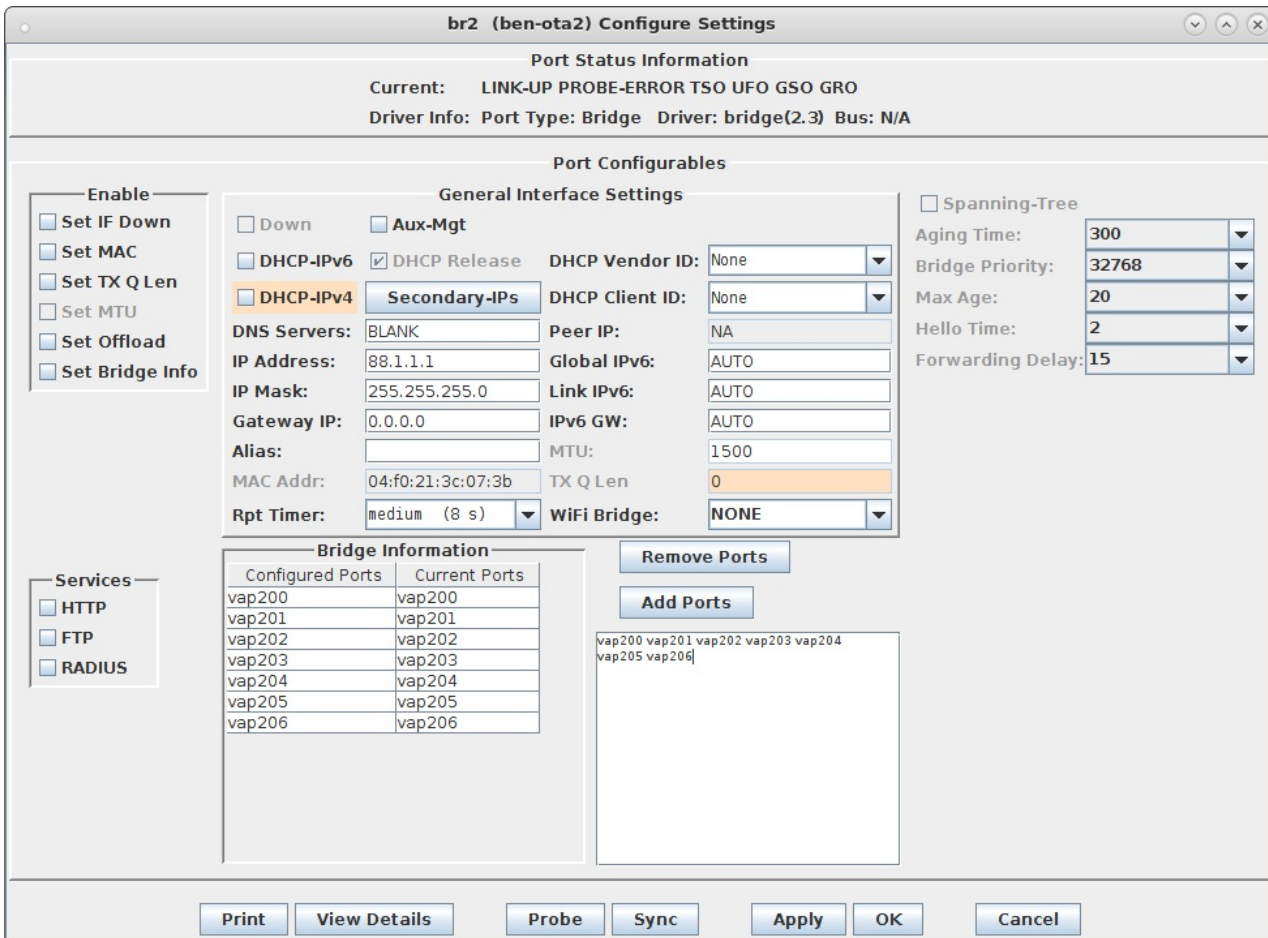
1. In the **Ports** tab, select the radio `wiphy2` and click **Create.** Configure the values appropriately and click create.
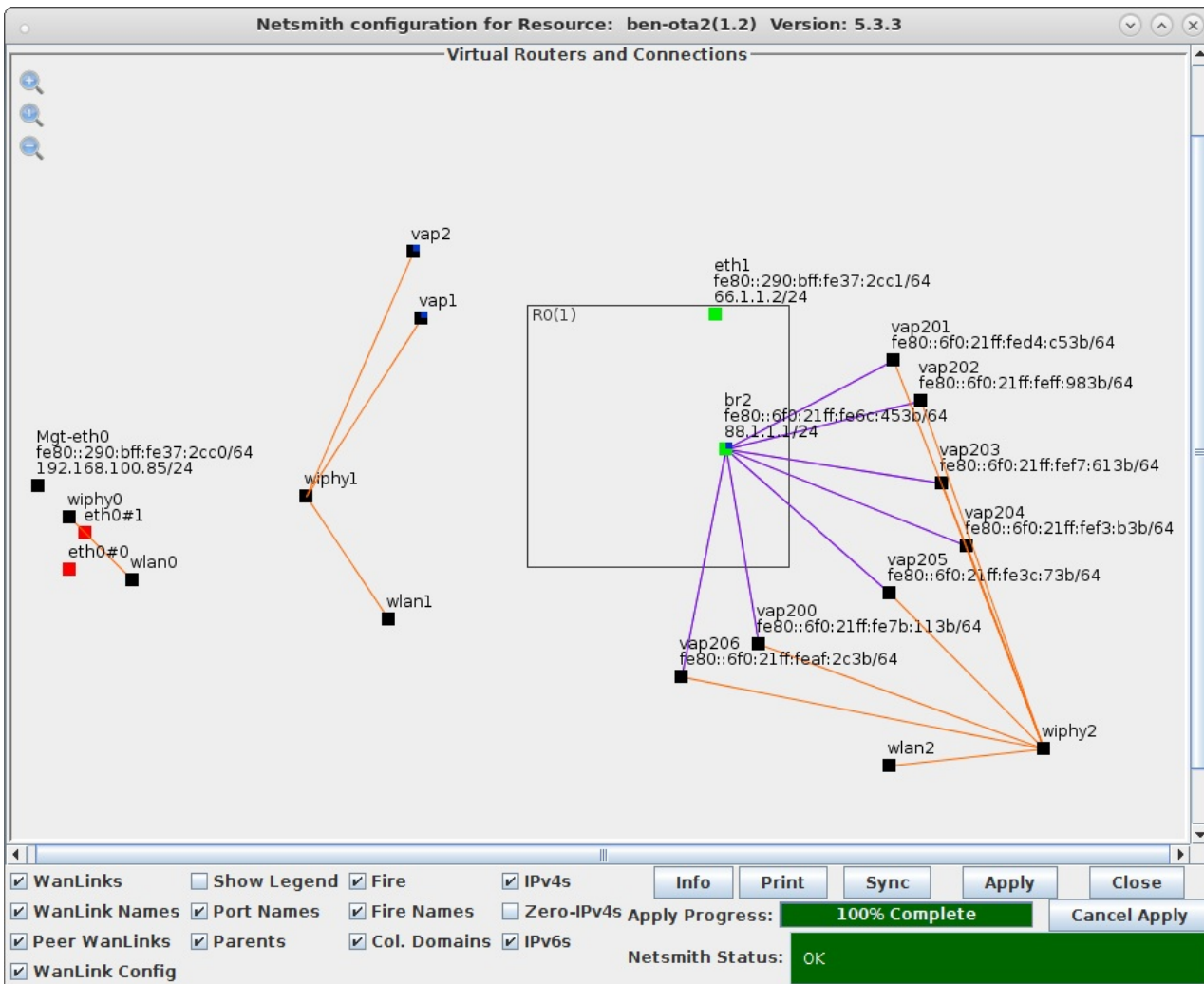

2. In the **Ports** tab you will see the new WiFi vAP:

Control Reporting Tear-Off Info Plugins

Stop All   Restart Manager   Refresh   HELP

File-IO   Layer-4   Generic   Test Mgr   Test Group   Resource Mgr   Event Log   Alerts   Port Mgr   Messages
Status   Layer-3   L3 Endps   VoIP/RTP   VoIP/RTP Endps   Armageddon   WanLinks   Attenuators   Collision-Domains

Disp: 192.168.100.149:0.0   Sniff Packets   Clear Counters   Reset Port   Delete
Rpt Timer: medium (8 s) ▼   Apply   View Details   Create   Modify   Batch Modify

All Ethernet Interfaces (Ports) for all Resources.

Port	Pha...	Down	IP	SEC	Alias	Parent Dev	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	Pps TX
1.2.10	☐	☐	0.0.0.0	0	vap200	wiphy2	0	0	0	0	1,116	11	0
1.2.11	☐	☐	0.0.0.0	0	vap201	wiphy2	0	0	0	0	792	8	0
1.2.12	☐	☐	0.0.0.0	0	vap202	wiphy2	0	0	0	0	1,008	10	0
1.2.13	☐	☐	0.0.0.0	0	vap203	wiphy2	0	0	0	0	792	8	0
1.2.14	☐	☐	0.0.0.0	0	vap204	wiphy2	0	0	0	0	792	8	0
1.2.15	☐	☐	0.0.0.0	0	vap205	wiphy2	0	0	0	0	792	8	0
1.2.16	☐	☐	0.0.0.0	0	vap206	wiphy2	0	0	0	0	792	8	0

Logged in to: ben-ota-1:4002 as: Admin

3. Select the **Status** panel in the LANforge GUI, and click the Netsmith button for the appropriate resource. Right-click and select the 'New Bridge' option. In this example, I selected 'br2' as the bridge name. After creating the bridge, click Sync to show the new bridge device. Right-click on it and select Modify Port. Add each of the vAP you just created to the bridge and then apply:

br2 (ben-ota2) Configure Settings

Port Status Information
Current: LINK-UP PROBE-ERROR TSO UFO GSO GRO
Driver Info: Port Type: Bridge Driver: bridge(2.3) Bus: N/A

Port Configurables

— Enable —
☐ Set IF Down
☐ Set MAC
☐ Set TX Q Len
☐ Set MTU
☐ Set Offload
☐ Set Bridge Info

General Interface Settings
☐ Down   ☐ Aux-Mgt
☐ DHCP-IPv6   ☑ DHCP Release   DHCP Vendor ID: None ▼
☐ DHCP-IPv4   Secondary-IPs   DHCP Client ID: None ▼
DNS Servers: BLANK   Peer IP: NA
IP Address: 88.1.1.1   Global IPv6: AUTO
IP Mask: 255.255.255.0   Link IPv6:   AUTO
Gateway IP: 0.0.0.0   IPv6 GW: AUTO
Alias: MTU: 1500
MAC Addr: 04:f0:21:3c:07:3b TX Q Len   0
Rpt Timer: medium (8 s) ▼   WiFi Bridge: NONE ▼

☐ Spanning-Tree
Aging Time: 300 ▼
Bridge Priority: 32768 ▼
Max Age: 20 ▼
Hello Time: 2 ▼
Forwarding Delay: 15 ▼

— Bridge Information —
Configured Ports	Current Ports
vap200	vap200
vap201	vap201
vap202	vap202
vap203	vap203
vap204	vap204
vap205	vap205
vap206	vap206

Remove Ports
Add Ports
vap200 vap201 vap202 vap203 vap204 vap205 vap206

— Services —
☐ HTTP
☐ FTP
☐ RADIUS

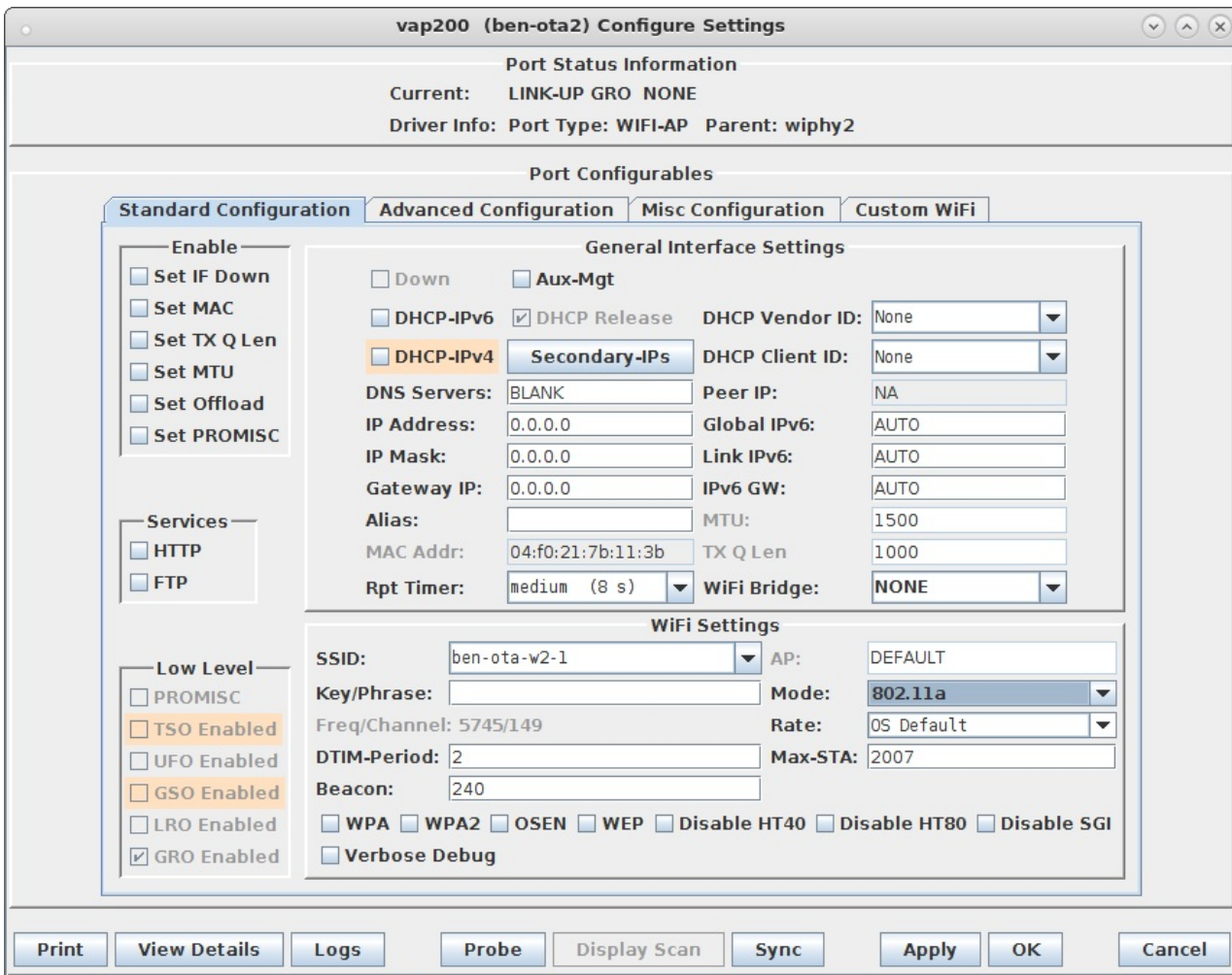Print   View Details   Probe   Sync   Apply   OK   Cancel

4. Create a virtual router in Netsmith and add br2, and optionally a wired port (eth1) to the router. Double-click the br2 port and configure DHCP to match its IP address. When complete, Netsmith should look something like this:

─Virtual Routers and Connections─

vap2

vap1

eth1
fe80::290:bff:fe37:2cc1/64
66.1.1.2/24

R0(1)

vap201
fe80::6f0:21ff:fed4:c53b/64

vap202
fe80::6f0:21ff:feff:983b/64

br2
fe80::6f0:21ff:fe6c:453b/64
88.1.1.1/24

Mgt-eth0
fe80::290:bff:fe37:2cc0/64
192.168.100.85/24

wiphy1

vap203
fe80::6f0:21ff:fef7:613b/64

wiphy0
eth0#1

vap204
fe80::6f0:21ff:fef3:b3b/64

eth0#0
wlan0

vap205
fe80::6f0:21ff:fe3c:73b/64

wlan1

vap200
fe80::6f0:21ff:fe7b:113b/64

vap206
fe80::6f0:21ff:feaf:2c3b/64

wiphy2

wlan2

☑ WanLinks ☐ Show Legend ☑ Fire ☑ IPv4s [Info] [Print] [Sync] [Apply] [Close]
☑ WanLink Names ☑ Port Names ☑ Fire Names ☐ Zero-IPv4s **Apply Progress:** [100% Complete] [Cancel Apply]
☑ Peer WanLinks ☑ Parents ☑ Col. Domains ☑ IPv6s
☑ WanLink Config **Netsmith Status:** OK

5. Now, we should have 7 vAP able to accept stations and give out DHCP addresses. Depending on the DUT, the user may wish to run iperf on LANforge, or on an upstream device connected to the LANforge eth1 port. For an initial test, make sure the DUT can connect to one of the vAP and get an IP address. The DUT should also see each of the vAP in its listing of available APs. This example will use LANforge WiFi Station on a different radio as the DUT. Here is a listing of the scan results:

wiphy0 Scan Results

SSID	Channel	Info	Auth	BSS	Signal	Frequency	Beacon	Age
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:7b:11:3b	-18.0	5745	240	2.83 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:d4:c5:3b	-20.0	5745	240	2.83 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:af:2c:3b	-18.0	5745	240	2.83 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:ff:98:3b	-19.0	5745	240	2.83 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:f7:61:3b	-21.0	5745	240	2.83 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:3c:07:3b	-18.0	5745	240	2.83 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:f3:0b:3b	-21.0	5745	240	2.83 m

☐ Pause [Scan] [Sync] [Close]

6. To make it a bit more interesting, we will now set the operating modes for one AP to be 802.11a, a second to be 802.11n, and the rest will remain 802.11AC. These APs are running on channel 149, so b and g mode are not available on this radio. To set the mode, double-click the vap200 row and set the Mode to be 802.11a and click OK to apply. Use similar procedure to set vap201's mode to 802.11an:

vap200 (ben-ota2) Configure Settings

Port Status Information

Current: LINK-UP GRO NONE

Driver Info: Port Type: WIFI-AP Parent: wiphy2

Port Configurables

Standard Configuration | Advanced Configuration | Misc Configuration | Custom WiFi

General Interface Settings

Enable
- ☐ Set IF Down
- ☐ Set MAC
- ☐ Set TX Q Len
- ☐ Set MTU
- ☐ Set Offload
- ☐ Set PROMISC

Services
- ☐ HTTP
- ☐ FTP

Low Level
- ☐ PROMISC
- ☐ TSO Enabled
- ☐ UFO Enabled
- ☐ GSO Enabled
- ☐ LRO Enabled
- ☑ GRO Enabled

☐ Down   ☐ Aux-Mgt

☐ DHCP-IPv6   ☑ DHCP Release   DHCP Vendor ID: None ▼

☐ DHCP-IPv4   Secondary-IPs   DHCP Client ID: None ▼

DNS Servers: BLANK   Peer IP: NA

IP Address: 0.0.0.0   Global IPv6: AUTO

IP Mask: 0.0.0.0   Link IPv6: AUTO

Gateway IP: 0.0.0.0   IPv6 GW: AUTO

Alias: MTU: 1500

MAC Addr: 04:f0:21:7b:11:3b   TX Q Len: 1000

Rpt Timer: medium (8 s) ▼   WiFi Bridge: NONE ▼

WiFi Settings

SSID: ben-ota-w2-1 ▼   AP: DEFAULT

Key/Phrase: Mode: 802.11a ▼

Freq/Channel: 5745/149   Rate: OS Default ▼

DTIM-Period: 2   Max-STA: 2007

Beacon: 240

☐ WPA ☐ WPA2 ☐ OSEN ☐ WEP ☐ Disable HT40 ☐ Disable HT80 ☐ Disable SGI

☐ Verbose Debug

Print | View Details | Logs | Probe | Display Scan | Sync | Apply | OK | Cancel

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7. Now, request the DUT to re-scan and re-associate to the network. There should now be one 802.11a, one 802.11n, and 5 802.11AC vAP in the scan results. A well behaved DUT should attempt to connect to the AP with the higest rate that the DUT supports. In this case, the LANforge Station properly selected the 802.11AC vAP:

wiphy0 Scan Results

SSID	Channel	Info	Auth	BSS	Signal	Frequency	Beacon	Age
ben-ota-w2-1	149	802.11a	Open	04:f0:21:9f:77:3b	-25.0	5745	240	1.83 h
ben-ota-w2-1	149	802.11a	Open	04:f0:21:7b:11:3b	-24.0	5745	240	3.42 m
ben-ota-w2-1	149+	3x3 MIMO	Open	04:f0:21:d4:c5:3b	-23.0	5745	240	3.42 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:af:2c:3b	-22.0	5745	240	3.42 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:ff:98:3b	-23.0	5745	240	3.42 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:f7:61:3b	-22.0	5745	240	3.42 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:3c:07:3b	-24.0	5745	240	3.42 m
ben-ota-w2-1	149+	3x3 MCS 0-9 AC	Open	04:f0:21:f3:0b:3b	-23.0	5745	240	3.42 m
ben-ota-w2-4	149+	3x3 MCS 0-9 AC	Open	04:f0:21:95:03:3b	-25.0	5745	240	1.83 h

☐ Pause | Scan | Sync | Close

8. For additional testing, you may wish to use additional LANforge radios to create more vAP, change the SSID and configure DUT to connect to a particular SSID, admin down vAP to make sure DUT will properly connect to a new AP, and much more. You may also run traffic on the different APs to ensure that if a DUT connects to a 802.11a AP, then it does not try to send any 802.11n (HT) encoded traffic. A LANforge radio configured for monitor mode could verify this, as could third-party sniffers.:

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: | wlan.addr == 04:f0:21:11:e7:3a | Expression... Clear Apply Save   bss-cross ibss-10k sta1000 vap50 wlan2-o1

No.	Time	Source	Destination	Protocol	Length	Info
23130	2015-10-12 09:33:04.560572000	88.1.1.1	88.1.1.10	TCP	100	33002 > 12439 [RST] Seq=1 Win=0 Len=0
23132	2015-10-12 09:33:04.560919000	88.1.1.10	88.1.1.1	TCP	1560	10853 > 33002 [ACK] Seq=932513 Ack=1 Win=29696 Len=1448 TS
23133	2015-10-12 09:33:04.560971000		CompexPt_11:e7:3a (RA)	802.11	36	Acknowledgement, Flags=........
23134	2015-10-12 09:33:04.561092000	88.1.1.10	88.1.1.1	TCP	112	34187 > 33002 [ACK] Seq=942649 Ack=2 Win=29696 Len=0 TSval
23135	2015-10-12 09:33:04.561150000		CompexPt_11:e7:3a (RA)	802.11	36	Acknowledgement, Flags=........
23136	2015-10-12 09:33:04.561215000	88.1.1.1	88.1.1.10	TCP	100	33002 > 16029 [RST] Seq=1 Win=0 Len=0
23138	2015-10-12 09:33:04.561536000	CompexPt_11:e7:3a (TA)	CompexPt_9f:77:3b (RA)	802.11	34	Request-to-send, Flags=........
23139	2015-10-12 09:33:04.561553000	CompexPt_11:e7:3a (TA)	CompexPt_9f:77:3b (RA)	802.11	42	Request-to-send, Flags=........
23140	2015-10-12 09:33:04.561621000		CompexPt_11:e7:3a (RA)	802.11	36	Clear-to-send, Flags=........
23141	2015-10-12 09:33:04.561638000	88.1.1.10	88.1.1.1	TCP	112	21314 > 33002 [ACK] Seq=936857 Ack=2 Win=29696 Len=0 TSval
23142	2015-10-12 09:33:04.561694000		CompexPt_11:e7:3a (RA)	802.11	36	Acknowledgement, Flags=........
23143	2015-10-12 09:33:04.561818000	88.1.1.10	88.1.1.1	TCP	112	11352 > 33002 [ACK] Seq=939753 Ack=2 Win=29696 Len=0 TSval
23144	2015-10-12 09:33:04.561875000		CompexPt_11:e7:3a (RA)	802.11	36	Acknowledgement, Flags=........
23145	2015-10-12 09:33:04.562019000	CompexPt_9f:77:3b (TA)	CompexPt_11:e7:3a (RA)	802.11	34	Request-to-send, Flags=........
23146	2015-10-12 09:33:04.562036000	CompexPt_9f:77:3b (TA)	CompexPt_11:e7:3a (RA)	802.11	42	Request-to-send, Flags=........
23148	2015-10-12 09:33:04.562121000	88.1.1.1	88.1.1.10	TCP	100	33002 > 34187 [RST] Seq=1 Win=0 Len=0

▶ Frame 23143: 112 bytes on wire (896 bits), 112 bytes captured (896 bits) on interface 0
▼ Radiotap Header v0, Length 26
    Header revision: 0
    Header pad: 0
    Header length: 26
  ▶ Present flags
    MAC timestamp: 15435269
  ▶ Flags: 0x00
    Data Rate: 54.0 Mb/s
    Channel frequency: 5745 [A 149]
  ▶ Channel type: 802.11a (0x0140)
    SSI Signal: -13 dBm
    Antenna: 0
  ▶ RX flags: 0x0000

```
0010  00 6c 71 16 40 01 f3 00  00 00 88 01 2c 00 04 f0   .lq.@... ....,...
0020  21 9f 77 3b 04 f0 21 11  e7 3a 04 f0 21 6c 45 3b   !.w;..!. .:..!lE;
0030  70 98 00 00 aa aa 03 00  00 00 08 00 45 00 00 34   p....... ....E..4
0040  19 7f 40 00 40 06 6f 38  58 01 01 0a 58 01 01 01   ..@.@.o8 X...X...
0050  2c 58 80 ea b1 fe 03 43  16 f9 dc 94 80 10 00 1d   ,X.....C ........
0060  ad 81 00 00 01 01 08 0a  0e 08 c8 37 00 46 ea 79   ........ ...7.F.y
```

⬤ 📄 Speed this frame was sent/received... Packets: 252694 · Displaye... Profile: Default