

## LANforge WiFi Capacity Testing

**Goal**: Use the WiFi Capacity plugin to emulate traffic from hundreds of virtual stations across an access point and report the results.

Requires LANforge 5.2.11 or later. Configure 128 stations and assign them an SSID. Use the 'WiFi Capacity' LANforge-GUI plugin to emulate:

- Station download traffic through the AP
- Station-to-station traffic

The **eth1** port of our LANforge in this example is connected to the upstream network of the AP.

This example uses a LANforge CT523 system but the procedure should work on all CT520, CT523, CT525 and similar systems.





1. In the **Port Mgr** tab, select the radio wiphy0 and click **Create**.

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<u>C</u> ontrol	<u>C</u> ontrol <u>R</u> eporting <u>T</u> ear-Off <u>I</u> nfo <u>P</u> lugins												
	Stop All Restart Manager Refresh HELP												
File-IO	Laye	r-4   (	Generic		gr   I		Resource	Mgr   Ever		rts Port	Mgr Mes	sages	ine
Status	Laye	er-3	L3 Endp	S VOIP	/RIP	VOIP/RTP	Endps A	mageddon	wantinks	Attenu	ators   Co	lision-Doma	ans
Disp: 1	0.1.0.	14:0.0		Sn	niff Pac	kets	Clear	Counters	Reset Po	ort De	elete		
Rpt Tim	ner: me	dium	(8 s)	-	Appl	у	View	Details	Create	e M	odify E	Batch Modif	y
						thernet Int	erfaces (Po	ts) for all Re	sources -				
	1	1			1								
Port	Pha	Down	I	IP	SEC	Alias	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	
1.1.0			192.168	3.100.26	0	p33p1	148,643	. 268,227	75	347,472	284,765	291,864	
1.1.1			0.0.0.0		0	wiphy0	0	0	0	0	0	0	
1.1.2	1.1.2 0.0.0.0		0	wiphy1	(	0	0	0	0	0			
1.1.3			10.26.1	.2	0	plpl	27,822	2 🔧 89	0	103	0	0	
1.1.4		~	0.0.0.0		0	wlan0	0	0 0	0	0	0	0	
1.1.5		~	0.0.0.0		0	wlan1	0	0 0	0	0	0	0	-
													Þ
Logged	Logged in to: 192.168.100.26:4002 as: Admin												

2. The Create VLANs window appears. Set the values below.

٤		c	reate VLANs on	Port: 1.1.002		
0	<ul><li>○ MAC-VLAN</li><li>● WiFi STA</li></ul>	○ 802.1Q-VLAN ○ Rec ○ WiFi VAP ○ WiFi Moni	lirect ○ Bridge tor	○ GRE Tunnel		
2	Shelf:	1	Resource:	1 (jedtest) 💌	Port: 2 (	wiphy0) 🔻
B	VLAN ID:		DHCP-IPv4			
	Parent MAC:	00:0e:8e:63:2e:4d	DHCP Client ID:	-	•	
	MAC Addr:	00:18:c4:c8:27:59 💌	IP Address:		Global IPv6:	AUTO
	Quantity:	128	IP Mask or Bits:		Link IPv6:	AUTO
			Gateway IP:		IPv6 GW:	AUTO
	#1 Redir Name:		#2 Redir Name:			
	STA ID:	0	SSID:	test-AP	•	-
	WiFi AP:		Key/Phrase:			
	Use WPA	Use WPA2	Use WEP			
	Down					
	Apply	<u>C</u> ancel		- <b></b>		

- A. Check WiFi STA.
- B. In the MAC Addr dropdown, choose RANDOM.
- C. Select DHCP-IPv4.
- D. Specify 128 for Quantity.
- E. Set STA ID at 0.
- F. Our AP for this example is using SSID testAP with Keyphrase test-AP1. (no dashes allowed)
- G. Click the **Apply** button.
- H. And then close the window by pressing the **Cancel** button.

I. In the Port Mgr tab you will see the new WiFi stations:

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:   10.1.0.14:0.0   Sniff Packets   Clear Counters   Reset Port   Delete     Rpt Timer:   faster   (1 s)   Apply   View Details   Create   Modify   Batch Modify						
Stop All   Restart Manager   Refresh   HELP     File-10   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:   10.1.0.14:0.0   Sniff Packets   Clear Counters   Reset Port   Delete     Rpt Timer:   faster   (1 s)   Apply   View Details   Create   Modify   Batch Modify						
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:   10.1.0.14:0.0   Sniff Packets   Clear Counters   Reset Port   Delete     Rpt Timer:   faster   (1 s)   Apply   View Details   Create   Modify   Batch Modify						
File-10   Layer-4   Generic   Test Mgr   Test Group   Resource Mgr   Event Log   Alerts   Port Mgr   Messages     Status   Layer-3   L3 Endps   VolP/RTP   VolP/RTP Endps   Armageddon   WanLinks   Attenuators   Collision-Domains     Disp:   10.1.0.14:0.0   Sniff Packets   Clear Counters   Reset Port   Delete     Rpt Timer:   faster   (1 s)   Apply   View Details   Create   Modify   Batch Modify						
Status   Layer-3   L3 Endps   VoIP/RTP   VoIP/RTP Endps   Armageddon   WanLinks   Attenuators   Collision-Domains     Disp:   10.1.0.14:0.0   Sniff Packets   Clear Counters   Reset Port   Delete     Rpt Timer:   faster   (1 s)   Apply   View Details   Create   Modify   Batch Modify						
Disp: 10.1.0.14:0.0 Sniff Packets Clear Counters Reset Port Delete   Rpt Timer: faster (1 s) Apply View Details Create Modify Batch Modify						
Rpt Timer: faster (1 s) Apply View Details Create Modify   All Ethernet Interfaces (Ports) for all Resources.						
Rpt Timer: faster (1 s) Apply View Details Create Modify Batch Modify   All Ethernet Interfaces (Ports) for all Resources.						
All Ethernet Interfaces (Ports) for all Resources.						
Port Pha Down IP SEC Alias RX Bytes RX Pkts Pps RX bps RX TX Bytes TX Pkts P						
11.1.000 112.108.100.26 0 p33p1 51.695 60,897 112 407,049 57,672 60,371						
1.1.002 0 0.00.0 0 Wpny0 343,142 558,158 4 4,788 7,659,3 245,012						
1.1.003 0 0 0,848 30 1.1.003 0 0 0 0 0 0,848 30 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
1.1.004 0 0 0,596 30						
1.1.005 0 0 5,400 26						
1.1.006 0 5,364 26						
1.1.007 1 10.26.2.166 0 stab 371,362 2,577 0 0 4,396 24						
1.1.008 1 10.26.2.168 0 sta6 388,362 2,669 0 0 5,038 25						
1.1.009 I 10.26.2.84 0 sta7 385,616 2,524 0 0 5,762 27						
1.1.010 🔄 🔄 10.26.2.87 0 sta8 385,106 2,513 0 0 5,454 27						
1.1.011 🔄 🗋 10.26.2.114 0 sta9 445,840 2,928 0 0 5,364 26						
1.1.012 🗌 🔄 10.26.2.116 0 sta10 287,894 2,045 0 0 5,002 25						
1.1.013 🔄 🖸 10.26.2.107 0 stall 340,708 2,320 0 0 6,234 29						
1.1.014 🗌 🔲 10.26.2.111 0 stal2 376,872 2,558 0 0 6,234 29						
1.1.015 🔄 🖸 10.26.2.118 0 sta13 337,682 2,351 0 0 5,734 27						
1.1.016 I 10.26.2.167 0 stal4 301,682 2,203 0 0 3,916 22						
1.1.017 I 10.26.2.120 0 sta15 360,972 2,504 0 0 5,762 27						
1.1.018 10.26.2.82 0 stal6 331,172 2,168 0 0 4.640 24						
1.1.019 10.26.2.100 0 sta17 399.290 2.609 0 0 5.872 28						
1.1.020 10.26.2.123 0 sta18 384.792 2.614 0 0 4.530 23						
11 021 0 10 26 2126 0 stal9 410 700 2 750 0 0 5 872 28						

## 3. Discussion of Capacity Test

A. Computing Intervals and Duration: The WiFi Capacity Test is intended to run in multiple intervals. How many intervals is a product of the number stations in the test divided by the interval increment: Intervals = (num stations / station increment). The duration of the test is the product of the number of intervals times the sum of the interval duration plus setup timeout between intervals. Given the setup time between intervals is J seconds, a test of 128 stations with a station increment of 8 and an interval duration of 30 seconds, the entire test duration is: (128 / 8) \* (30 + J) = 480 + 16J seconds. The actual setup time depends on two factors: a) If Seek Lower Rates is enabled, which will attempt to test each rate to try and even out connection rates, and b) DHCP performance. Adding piles of DHCP assignments for every increment can take several seconds, and actual performance depends on your test environment.

B. Configuring Routes: the upstream port of your LANforge system should be able to ping the virtual stations. You can use a command from the LANforge command prompt to test this out: ping -I eth1 10.26.2.100 where eth1 is your upstream port on the same switch as the AP, and 10.26.2.100 is the IP of the virtual station. In the eth1 Port Properties window, you will probably want to set the gateway address for the port to the IP of the AP. In this case it is 10.26.1.2. Without this routing configured, the only test performed will be the stationto-station test.

<u>\$</u>		plpl (jedtest.car	idelatech.com)	Configure Setting	s	↑ _ □ ×		
Port Status Information								
	Current: LINK-UP 1000bt-FD AUTO-NEGOTIATE Flow-Control TSO GSO GRO							
	Driver Info: Port Type: Ethernet Driver: e1000e(2.2.14-k) Bus: 0000:04:00.0							
Port Configurables								
Enable ————————————————————————————————————								
✓ Set IP Info ✓ Set IP6 Info					○ 10bt-HD ○ 10bt-FD ○ 100bt-HD	Advertise Rat		
Set IF Down	DHCP-IPv6	DHCP Release	Down	Aux-Mgt	0 100bt-FD	🗹 10bt-FD		
Set MAC	DHCP-IPv4	Secondary-IPs	DHCP Client ID:	None	0 1000-FD	🗹 100bt-HD		
Set TX Q Len	DNS Servers:	192.168.100.1	Peer IP:	NA	Autonegotiate	🗹 100bt-FD		
Set MIU	IP Address:	10.26.1.2	Global IPv6:	AUTO	]   -	🗹 1000-FD		
Set Omload	IP Mask:	255.255.255.0	Link IPv6:	AUTO	Renegotiate	🔲 10G-FD		
Set Rate Info	Gateway IP:	10.26.1.3	IPv6 GW:	AUTO	Restart Xcvr	Flow-Control		
Set PROMISC	Alias:		MTU:	1500	PROMISC	Offload		
Set Rypass	MAC Addr:	00:90:0b:29:06:f9	TX Q Len	1000	RX-ALL	✓ TSO Enabled		
Set Bypass	Br Cost:	Ignore 🗸 🗸	Priority:	Ignore 🗸	RX-FCS	UFO Enabled		
Set CPU Mask	Rpt Timer:	faster (1 s) 🔻	Watchdog:	0	Bypass NOW!	🕑 GSO Enabled		
Services -	CPU Mask:	NO-SET	WiFi Bridge:	NONE	Bypass Power-UP	LRO Enabled		
HTTP		·			Bypass Power-DOWN	🖌 GRO Enabled		
FTP					Bypass Disconnect	,		
[	Print View Details Probe Sync Apply OK Cancel							

4. Downloading via 128 Virtual Stations

A. In the Plugins dropdown menu, select WiFi Capacity Test, then begin to configure ports for the test.

<u>s</u>	🛃 LANforge Manager Version(5.2.11) 🔶 🕈 🗖								
<u>Control</u> <u>Reporting</u> <u>Tear-Off</u> <u>Info</u>	<u>P</u> lugins		_						
	G <u>r</u> oovy Sc	ripting	top All	Rest	art Manage	r	Refr	esh	HELP
File-10 Layer-4 Generic Te	Create Simple VolP Enforce Fairness		Resource	Mgr Ever	nt Log Ale	erts Port	Mgr Mes	sages	nains
Disp: 10.1.0.14:0.0	VoIP Repo	rting	Clear	Counters	Reset F	ort D	elete		
Rpt Timer: faster (1 s) 💌	WiFi Mobility		View	Details	Creat	e M	1odify	Batch Mod	ify
All Etherne Interfaces (Ports) for all Resources.									
Port Pha Down IP	SEC	Alias	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	P
1.1.000 🔲 🔲 192.168.100	.26 0	p33p1	51,707,	60,923,	112	405,206	57,713,	60,406,	
1.1.001 10.26.2.165	0	sta0	290,172	2,116	0	0	10,254	67	-

A. Highlight free ports that you want to add to the test, this includes the upstream porteth1 and the virtual stations sta0 - sta127.

<u></u>			WiFi Capacity	Test		_ 0 ×
Select Ports	Settings	Advanced Settings	Select Outp	ut		
	Stat	ion Increment:		8	<b>•</b>	
	Loop Iterations:			Single (1)	-	
	Dura	ation:		30000	-	
	Prot	ocol:		UDP-IPv4	-	
	Lay	er-4 Endpoint:		NONE	-	
	Pay	oad Size:		24000 (24,000 B)	-	
	Tota	al Download Rate:	-	330 Mbps	•	
	Tota	al Upload Rate:	-	Zero (0 bps)	-	
	Perc	centage TCP Rate:		10% (10%)	•	
			Start	Close		

- B. Set Station Increment to 8. This will run 16 intervals with 8 stations added each time going up to 128 total.
- C. Set the increment **Duration** to thirty seconds (in milliseconds) so 30000.
- D. Select UDP-IPv4 for the Protocol.
- E. For the **Payload** size select **24,000 B**.
- F. Configure the **Download Rate** at 330 Mbps. The theoretical maximum for AP throughput on one radio is about 340 Mbps with perfect conditions. Even 330 Mbps might not be achieved. This download rate is the rate requested of the AP by all the virtual stations. With eight virtual stations, the target download rate per station is 41.25 Mbps.
- G. In Advanced Settings, set a Socket Buffer of 1MB.
- H. Deselect Try Lower Rates. This will reduce interval setup time.
- B. Click the **Start** button to begin the test.

C. You will see a Graphical Test Results window appear. It will update every test interval.



For more information see LANforge GUI User Guide: Plugins:WiFi Capacity Test.

- 5. Emulating station-to-station traffic with 128 virtual stations:
  - A. Go to the WiFi Capacity Test window.

B. This test is very similar. We remove the upstream port **eth1** from the **Ports in Use** list (in the **Select Ports** tab). We then configure the traffic to use smaller TCP packets.

🕌 WiFi Capaci	ity Test
Select Ports Settings Advanced Settings Select Ou	ıtput
Station Increment:	8
Loop Iterations:	Single (1)
Duration:	30000
Protocol:	UDP-IPv4
Layer-4 Endpoint:	NONE
Payload Size:	4000 (4,000 B)
Total Download Rate: 💌	60 Mbps
Total Upload Rate: 💌	60 Mbps
Percentage TCP Rate:	10% (10%)
Start	Close

- A. In the settings tab, set Protocol and Payload to TCP-IPv4 and  $4000\ B$  .
- B. Change **Total Download** and **Total Upload** rate to **60 Mbps** and **60 Mbps**. These settings should allow up to 120 Mbps between two stations, which will clearly saturate an AP.
- C. Click **Start** to begin the test.
- D. You will see a Graphical Test Results window appear. It will upon each test interval.





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