

LANforge WiFi testing Roaming and HotSpot 2.0

Goal: Use automated script to reconnect stations to an AP and report results.

Requires LANforge 5.2.11 or later. Configure Stations to use HotSpot 2.0 (802.1x, 802.1u, etc) and associate them with a HotSpot 2.0 AP. Use the 'WiFi Mobility' LANforge-GUI Plugin to automate re-connecting to the AP and querying ANQP. The plugin will create graphs and other reports that can be saved to HTML. This example uses a LANforge CT520 system but the procedure should work on all CT521, CT522, CT523, CT525 and similar systems. The AP in this test is another LANforge machine, but it could be any AP that supports HotSpot 2.0. A similar test could roam between multiple APs. If the APs are all on the same channel there are no restrictions, but if the APs are on different channels, then only a single station can be configured per LANforge radio. In that case, multiple 3-radio CT523 or other high-density systems may be a good choice.





- 1. Configure stations to connect to an AP configured for HotSpot 2.0.
 - A. Go to the Port Manager tab, select wiphy0 on proper resource, click Create, fill out appropriate information and create desired number of Station interfaces.

B. The new stations should appear in the Port-Mgr table. Double-click to modify one of them. Configure IP Address information, set SSID to [BLANK] and select WPA2:

	Current:	Port Status Informa LINK-UP GRO Autho Port Type: WIFI-STA	orized)	
		Port Configurable	es		
Standard Configu	ration Advanc	ed Configuration			
Enable ——		General Inte	erface Settings		1
🗹 Set IP Info	DHCP-IPv6	🖌 DHCP Release	Down	Aux-Mgt	
🗹 Set IP6 Info	☑ DHCP-IPv4	Secondary-IPs	DHCP Client ID:	None	-
Set IF Down	DNS Servers:	10.97.1.1	Peer IP:	NA	
Set MAC	IP Address:	9.9.9.2	Global IPv6:	AUTO	
Set TX Q Len	IP Mask:	255.255.255.0	Link IPv6:	AUTO	
Set MTU	Gateway IP:	0.0.0.0	IPv6 GW:	AUTO	
Set Offload	Alias:		MTU:	1500	
Set PROMISC	MAC Addr:	00:ab:cd:ef:01:02	TX Q Len	1000	
	Rpt Timer:	medium (8 s) 🔻	WiFi Bridge:	NONE	-
🔲 НТТР		WiFi	Settings		
FTP	SSID:	[BLANK] - A	AP:	DEFAULT	
,	Key/Phrase:	4	lode:	802.11abqn	-
Low Level	Freq/Channel:	5180/36 F	Rate:	OS Default	-
	RTS:	-1 T	x-Power:	17 dBm	
☐ TSO Enabled	AMPDU-Factor	: OS Default 🖵 🗚	MPDU-Density:	OS Default	-
GSO Enabled	Max-AMSDU:	OS Default 🖵 🛛	Bridge-IP:	0.0.0.0	
	Use WPA	Use WPA2 Use	Ч	HT40 🗌 Disabl	e SGI
GRO Enabled		en 🔲 Allow Migratio			
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C. Select the **Advanced Configuration** tab in the Port-Modify window and configure the Key Management, EAP Method, passwords, select **Use 802.1x**, **Enable 802.11u** and **HotSpot 2.0**. If you want to report on DHCP negotiation times, be sure to select the **Restart DHCP on Connect** checkbox. If you want to get packet-drop statistics during roam, Un-select **Restart DHCP on Connect**:

S	tal (ath9k-119	9) (Configure Settir	ngs	_		×
	Por	t S	tatus Informati	on			- 1
	Current: LIN	K-U	P GRO Authent	icated			
	Driver Info: Por	t Ty	ype:WIFI-STA	Parent: wiphy0			
	F	or	t Configurables				
Standard Configuration	on Advanced	Cor	figuration				
	Adv	/an	ced WiFi Settin	gs	1		
Select 'WPA2' on the and enable 802.1x to				o enable 802.1x 802.11u enables others.			
Key Management:	WPA-EAP	•	HESSID:	00:00:00:00:00			
Pairwise Ciphers:	CCMP TKIP	-	Realm:	lanforge.org			
Group Ciphers:	All	-	Client Cert:				
WPA PSK:			IMSI:				
EAP Methods:	EAP-TTLS	-	Milenage:				
EAP Identity:	testuser		Domain:	lanforge.org			
EAP Anon Identity:			Consortium:				
EAP Password:	testpasswd		Phase-1:				
EAP Pin:			Phase-2:	auth=MSCHAPV2			
Private Key:			PK Password:				
CA Cert File:			PAC File:				
Network Auth:							
🔽 Use 802.1x 🗌 P	C/SC & SIM/USIM	[☑ Enable 802.11	Lu 🗹 HotSpot 2.0 🗌 Enable PKC			
Custom WPA Cfg	WPA Cfg:						
✓ Restart DHCP on	Connect						
		_					
Print View Details	Probe D	isp	lay Scan S	Apply OK	Ca	ance	el I

D. Once the single station is connecting properly, use Batch-Modify to configure the rest of the stations to match the first.

For more information see LANforge User's Guide: Ports (Interfaces), WiFi Station Cookbook, WiFi HotSPot 2.0 Cookbook

2. Start the WiFi Migration script.

A. Go to the Port Manager tab, select the stations you wish to roam, right-click and choose the **WiFi Mobility** menu option.

Refresh Interval (ms): 5000						
Pause Batween Commands (ms): 50 ▼ Pause after Show-Port (ms): 1000 ▼ Auto-Verify timer (ms): 1000 ▼ Maximum roam-time in graphs (ms): 250 ▼ Skip Roam to current AP ✔ Run Script in Loop Clear Counters on Start 1.1.4 wanO 1.1.4 wanO 1.3.5 sta2 1.3.5 sta2 1.3.4 sta1 1.3.9 sta6 1.3.1 sta8 1.3.1 sta1 1.3.10 sta7 ■ 1.3.1 sta1 Before roaming, you should first scan the proper frequencies. WiFI Stations 1.3.1 sta1 Ot is can 1 Resource Stat Mi * trigger freq FI F2; To raan to a ne the stat on ream 'sta1 3 sta1 80:01:02:03:04:05 Toream to ane the station soft he stat one and the stat or ream 'sta0; * * • Free Ports # * * 1.3.10 sta7 * # * * Pace comming, you should first scan the proper frequencies. * * * Ot is can 1 Resource Stat Mi * trigger freq FI F2; To ream to a ne the station or ream 'sta1 * * * * or and the station or and 'sta1' * * * * *	WiFi Mobil	ity _ 🗆	×			
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Before roaming, you should first scan the proper frequencies. Otherwise, the supplicant process may do an internal scan which may significantly affect the connection time: d_cli scan 1 Resource STA NA 'trigger freq FI F2' To roam to a new Access Point, add a line in the text area with the following format: roam Resource STA BSSID Resource: Station's resource ID number, often '1' STA: name of the station to roam: 'stal1' BSSID. the BSSID address of the AP: 00:01:02:03:04:05 F1: the first frequency to scan: 5180 F2: Optional second frequency to scan: 5180 F2: Optional second, floating-point allowed): sleep 20 To issue a generic LANforge CLI command, begin command with: d_cli scan 1 1 stal NA 'trigger freq 5180 5300' sleep 1 roam 1 stal dc:a5:f4:ff:4f;ae sleep 20 d_cli scan 1 1 stal NA 'trigger freq 5180 5300' sleep 1 roam 1 stal dc:a5:f4:ff:4f;ae sleep 20 d_cli wifi_cli_cmd 1 3 sta7 'fetch_anqp' roam 3 sta6 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta6 'fetch_anqp' roam 3 sta6 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta6 'fetch_anqp' roam 3 sta6 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta7 80:01:02:03:04:05 sleep 20 To am 3 sta6 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta7 80:01:02:03:04:05 sleep 20 F1 stal dc:a5:f4:ff:4f;3c:c:9e						
Otherwise, the supplicant process may do an internal scan which may significantly affect the connection time: do_cli scan 1 Resource STA NA 'trigger freq F1 F2' To roam to a new Access Point, add a line in the text area with the following format: roam Resource STA BSSID# so this script forces an ANQP query so that we # get some ANQP query report times to display.do_cli scan 1 Resource STA BSSID						
	Otherwise, the supplicant process may do an internal scan which may significantly affect the connection time: do_cli scan 1 Resource STA NA 'trigger freq F1 F2' To roam to a new Access Point, add a line in the text area with the following format: roam Resource STA BSSID • Resource: Station's resource ID number, often '1' • STA: name of the station to roam: 'sta11' • BSSID: the BSSID address of the AP: 00:01:02:03:04:05 • F1: the first frequency to scan: 5180 • F2: Optional second frequency to scan: 5300 After issuing ROAM commands, a pause should be added to let the stations adjust (in seconds, floating-point allowed): sleep 20 To issue a generic LANforge CLI command, begin command with: do_cli scan 1 1 stal NA 'trigger freq 5180 5300' sleep 1 roam 1 stal dc:a5:f4:ff:4f:ae sleep 20 do_cli scan 1 1 stal NA 'trigger freq 5180 5300' sleep 1 roam 1 stal dc:a5:f4:f3:ce:9e	<pre># so this script forces an ANQP query so that we # get some ANQP query report times to display. do_cli scan 1 3 sta1 NA 'trigger freq 5180 5300' sleep 1 do_cli wifi_cli_cmd 1 3 sta1 'fetch_anqp' roam 3 sta1 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta2 'fetch_anqp' roam 3 sta2 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta3 'fetch_anqp' roam 3 sta3 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta4 'fetch_anqp' roam 3 sta4 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta5 'fetch_anqp' roam 3 sta5 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta5 'fetch_anqp' roam 3 sta5 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta6 'fetch_anqp' roam 3 sta6 80:01:02:03:04:05 do_cli wifi_cli_cmd 1 3 sta7 'fetch_anqp' roam 3 sta7 80:01:02:03:04:05 sleep 20</pre>				

B. The options at the top default to common values and most do not need to be changed. For this example, you must unselect Skip Roam to current AP because the script is requesting exactly that. The ports will be automatically configured based on the selection on the Port Manager tab, and may be adjusted before starting the script. The Ports in Use should normally include all stations used in the script. The configuration requiring the most work from the user is the roaming script itself. There is a help section on the left, and a script-entry field on the right. Once the script is written, it should be saved in a text file on the user's PC so that it can easily be pasted into future WiFi Mobility scripts. Some key points are that you must scan about 1 second before roaming or the roam logic in the supplicant process will either fail or do its own roaming. Either way, the results may be worse than if you do the roam properly in the script. It can take a bit of time for LANforge to get all of the data it needs to report on the roam attempt, so it is suggested that stations not roam more often that about once every 10-20 seconds. If reporting is less important, then the stations can roam more often.

C. Once the script is properly configured, click Start to start the roaming. A window will pop up that has liveupdating graphs of various reports. A text log is at the bottom for more detailed analysis, and the whole thing can be saved as HTML. The graphs can be scaled and configured through right-click menus if desired. It will take 1-2 complete roam attempts before the graphs are able to show any useful information.



D. ANQP and 4-Way Authentication graphs.



E. DHCP Negotiation and Migration Totals graphs.



F. Text log with timestamps. Can be coorelated with wpa_supplicant logs and other log files to debug specific roam attempts.

WiFi Mobility Report _	1
ion Script Contents:	
rearing to calf any is not normally done	
roaming to self, anqp is not normally done his script forces an ANQP query so that we	
some ANQP query report times to display.	
scan 1 3 stal NA 'trigger freq 5180 5300' 1	
wifi cli cmd l 3 stal 'fetch angp'	
stal 80:01:02:03:04:05	
wifi_cli_cnd 1 3 sta2 'fetch_andp'	
sta2 80:01:02:03:04:05 wifi_cli_cmd l 3 sta3 'fetch_anqp'	
sta3 80:01:02:03:04:05	
wifi_cli_cmd_1_3 sta4_'fetch_anqp'	
sta4 80:01:02:03:04:05 wifi_cli_cmd l 3 sta5 'fetch_angp'	
sta5 80:01:02:03:04:05	
wifi_cli_cmd 1 3 sta6 'fetch_anqp'	
sta6 80:01:02:03:04:05	
wifi_cli_cmd l 3 sta7 'fetch_anqp' sta7 80:01:02:03:04:05	
20	
ssages:	
sages. 7743.662 CLI: scan 1 3 stal NA 'trigger freg 5180 5300'	
47444.764 CLL: wifi_cli_cmd 1 3 stal 'fetch_angp'	
77444.817 CLI:wifi_cli_end13 stal roam 80.01.02:03:04:05'	
47444.868 CLI: wifi_cli_cmd 1 3 sta2 'fetch_anqp' 47444.920 CLI: wifi cli_cmd 1 3 sta2 'roam 80:01:02:03:04:05'	
47444.970 CLI: wifi_cli_cmd 1 3 sta3 'fetch_anqp'	
47445.022 CLI: wifi_cli_cmd 1 3 sta3 'roam 80:01:02:03:04:05'	
47445.073 CLI: wifi_cli_cmd 1 3 sta4 'fetch_anqp' 47445.125 CLI: wifi_cli_cmd 1 3 sta4 'roam 80:01:02:03:04:05'	
7745.125 CL: wifi Cli cmd 1 3 sta4 Total 50.00.00.00.00	
47445.227 CLI: wifi_cli_cmd 1 3 sta5 'roam 80:01:02:03:04:05'	
17445.277 CLI: wifi_cli_cmd 1 3 sta6 'fetch_anqp'	
47445.328 CLI: wifi_cli_cmd 1 3 sta6 'roam 80:01:02:03:04:05' 47445.379 CLI: wifi_cli_cmd 1 3 sta7 'fetch_anqp'	
7/445.430 CLL: wif_cll_cmd 1 3 sta7 'roam 80:01:02:03:04:05'	
47445.820 Detected: 0 dropped (rx) packets during roam attempt, station: 1.3.4(sta1), BSSID: 80:01:02:03:04:05	
17445.921 Detected: 0 dropped (nx) packets during roam attempt, station: 1.3.5(sta2), BSSID: 80:01:02:03:04:05	
47446.023 Detected: 0 dropped (π/) packets during roam attempt, station: 1.3.6(sta3), BSSID: 80:01:02:03:04:05 47446.126 Detected: 0 dropped (π/) packets during roam attempt, station: 1.3.7(sta4), BSSID: 80:01:02:03:04:05	
17446.229 Detected: 0 dropped (rx) packets during roam attempt, station: 1.3.8(sta5), BSSID: 80:01:02:03:04:05	
47446.329 Detected: 0 dropped (nx) packets during roam attempt, station: 1.3.9(sta6), BSSID: 80:01:02:03:04:05	
47446.432 Detected: 0 dropped (rx) packets during roam attempt, station: 1.3.10(sta7), BSSID: 80:01:02:03:04:05	
47461.470 sta2: connected to: 80:01:02:03:04:05 in: 27,702 us 4-way-auth: 10,170 us ANQP: 5,582 us DHCP: 1,172 ms 47461.471 sta3: connected to: 80:01:02:03:04:05 in: 29,833 us 4-way-auth: 10,923 us ANQP: 6,113 us DHCP: 1,818 ms	
7461.472 sta4: connected to: 80:01:02:03:04:05 in: 35,841 us 4-way-auth: 10,264 us ANQP: 5,393 us DHCP: 1,879 ms	
47461.473 sta5: connected to: 80:01:02:03:04:05 in: 35,327 us 4-way-auth: 10,604 us ANQP: 5,952 us DHCP: 1,917 ms	
17461.475 sta6: connected to: 80:01:02:03:04:05 in: 25:100 us 4-way-auth: 13:226 us ANQP: 5,737 us DHCP: 1,860 ms	
47461.476 sta7: connected to: 80:01:02:03:04:05 in: 29,981 us 4-way-auth: 9,509 us ANQP: 5,661 us DHCP: 1,294 ms 47465.731 CLI: scan 1 3 sta1 NA 'trigger freq 5180 5300'	
7466.832 CL: wifi Cli cmd 1 3 stal fetch angp'	
47400.052 CLI. WIT CITCHT I S STAT TECCH AND	
47466.883 CLI: wifi_cli_cmd 1 3 sta1 'roam 80:01:02:03:04:05'	
47466.883 CLI: wifi_cli_cmd 1 3 sta1 'roam 80:01:02:03:04:05' 47466.934 CLI: wifi_cli_cmd 1 3 sta2 'fetch_anqp'	
47466.883 CLI: wifi_cli_cmd 1 3 stal 'roam 80:01:02:03:04:05' 47466.934 CLI: wifi_cli_cmd 1 3 sta2 'fetch_anqp' 47466.984 CLI: wifi_cli_cmd 1 3 sta2 'roam 80:01:02:03:04:05'	
47466.883 CLI: wifi_cli_cmd 1 3 sta1 'roam 80:01:02:03:04:05' 47466.934 CLI: wifi_cli_cmd 1 3 sta2 'fetch_anqp'	
47466.883 CLI: wifi_cli_cmd 1 3 stal 'roam 80:01:02:03:04:05' 47466.934 CLI: wifi_cli_cmd 1 3 sta2 'fetch_anqp' 47466.984 CLI: wifi_cli_cmd 1 3 sta2 'fetch_anqp' 47467.035 CLI: wifi_cli_cmd 1 3 sta3 'fetch_anqp'	

For more information see Complete report for this test case

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