**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;
C. Select the **Advanced Configuration** tab in the Port-Modify window and configure the Key Management, EAP Method, passwords, select **Use 802.1x**, **Enable 802.11i** 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**.

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.
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.

```
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:

```
room Resource STA BSSID
```

- **Resource** - Station's resource ID number, often '1'
- **STA** - name of the station to roam 'sta1'
- **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 the `ROOM` command, a pause should be added to let the stations adjust (in seconds, default value 20):

```
sleep 20
```

To issue a generic LANforge CLI command, begin command with `do_cli`:

```
do_cli scan 1 1 sta1 NA 'trigger freq 5180 5300'
sleep 1
```

# When roaming to self, anAP is not normally done
# 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'`
- `room 3 sta1 80:01:02:03:04:05`
- `do-cli wifi_cli_cmd 1 3 sta2 'fetch_anqp'`
- `room 3 sta2 80:01:02:03:04:05`
- `do-cli wifi_cli_cmd 1 3 sta3 'fetch_anqp'`
- `room 3 sta3 80:01:02:03:04:05`
- `do-cli wifi_cli_cmd 1 3 sta4 'fetch_anqp'`
- `room 3 sta4 80:01:02:03:04:05`
- `do-cli wifi_cli_cmd 1 3 sta5 'fetch_anqp'`
- `room 3 sta5 80:01:02:03:04:05`
- `do-cli wifi_cli_cmd 1 3 sta6 'fetch_anqp'`
- `room 3 sta6 80:01:02:03:04:05`
- `do-cli wifi_cli_cmd 1 3 sta7 'fetch_anqp'`
- `room 3 sta7 80:01:02:03:04:05`

```
sleep 20
```

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 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 than 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 live-updating 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.

Stations are configured for Hot-Spot 2.0 (EAPOL key management, EAP-TTLS). Stations are configured to re-negotiate DHCP on each station reconnect. The script forces DHCP query before each roam attempt to provide DHCP query reports (without this, roaming to the same AP will not cause a new DHCP query). Re-negotiating DHCP on each roam is not normally how user-endpoints would act, and it disturbs any network traffic. So, no traffic is configured on these interfaces and the packet-loss graphs will not show any useful data.
D. ANQP and 4-Way Authentication graphs.

WiFi Mobility Report

Station ANQP Times

ANQP per AP Times

Station 4-Way Auth Times

4-Way Auth per AP Times
E. DHCP Negotiation and Migration Totals graphs.

Station DHCP Times

DHCP per AP Times

The migration is verified after the Auto-Verify timer has expired. If the migration has not completed in that time, it will be counted as failed.

Migration Totals

Migration Totals per AP
Migration Script Contents:
# When moving to self, wnp is not normally done
# so this script forces an ANQP query so that we
# get some ANQP query report times to display.

do_cli scan 3 sta tl 'trigger freq 5199.5300'
sleep 1

do_cli wifi cli cmd 3 sta tl 'fetch_wnq'
scan 3 sta 00:01:02:03:04:05

do_cli wifi cli cmd 3 sta tl 'fetch_wnq'
scan 3 sta 00:01:02:03:04:05

do_cli wifi cli cmd 3 sta tl 'fetch_wnq'
scan 3 sta 00:01:02:03:04:05

do_cli wifi cli cmd 3 sta tl 'fetch_wnq'
scan 3 sta 00:01:02:03:04:05

do_cli wifi cli cmd 3 sta tl 'fetch_wnq'
scan 3 sta 00:01:02:03:04:05

do_cli wifi cli cmd 3 sta tl 'fetch_wnq'
scan 3 sta 00:01:02:03:04:05

Log Messages:
1385157744:652 Cl: scan 3 sta tl 'trigger freq 5199.5300'
1385157744:754 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:857 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:958 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1060 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1162 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1264 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1355 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1458 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1550 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1652 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1754 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1856 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:1958 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'
1385157744:2060 Cl: wifi cli cmd 3 sta tl 'fetch_wnq'

For more information see Complete report for this test case
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