LANforge WiFi testing HotSpot 2.0 Release 2

Goal: Setup HotSpot 2.0 Release 2 Example Requires LANforge 5.4.2 or later on Fedora 20 or later (this example is using Fedora 27). VRF must be enabled (it is enabled by default). One LANforge system will be used as the AP side, and a second LANforge machine will be the WiFi station.

- Run LANforge install script to begin setup of HotSpot 2.0 R2 related servers and certificates.
- Configure the OSU Server-only authenticated layer-2 Encryption Network (OSEN) AP and Passpoint AP.
- Initiate Online Sign-Up (OSU) procedure, select a provider and obtain an IP address from the Passpoint AP.
- Send traffic through the Service Provider Network.





For more information see:

WiFi Alliance Passpoint Release 2 Deployment Guidelines https://www.wi-fi.org/file/passpoint-release-2-deploymentguidelines

- 1. Run LANforge installation script to begin hostapd RADIUS, certificates and HotSpot 2.0 setup, as root user: cd /home/lanforge ./lf kinstall.pl --do radius --do hs20 --force new certs
- 2. Make two copies of the ca.pem certificate to different directories: cp /home/lanforge/hs20/ca/ca.pem /home/lanforge/osu-ca.pem cp /home/lanforge/hs20/ca/ca.pem /home/lanforge/ota-ca.pem #On station machine, if different from AP machine cp /home/lanforge/hs20/ca/ca.pem /home/lanforge/wifi/osu_wlan2/osu-ca.pem ota-ca.pem is used by the client for Over-The-Air authentication to the OSEN AP

osu-ca.pem is used by the client for the Online-Sign-Up server authentication before connecting to the Passpoint AP

Copy the ca.pem from the LANforge AP system to the LANforge Station system. And, if you are using a thirdparty client, then you will need to somehow install the ca.pem on it.

3. Create two MAC-VLANs for two hostapd RADIUS server instances.

A. Go to the Port Manager tab, select eth1, select Create, select MAC-VLAN, quantity 2 then Apply.

0			Create VLANs on Port: 1.1.01	\odot \sim \otimes
0	MAC-VLAN WiFi STA	○ 802.1Q-VLAN ○ ○ WiFi VAP ○ WiFi	Redirect 🛛 Bridge 🔾 GRE Tunnel Aonitor 🔿 WiFi Virtual Radio	
0	Shelf:	1 💌	Resource: 1 (ct523-3n-f20) ▼	Port: 1 (eth1)
a	VLAN ID:		DHCP-IPv4	
	Parent MAC:	00:1e:a6:6e:db:6c	DHCP Client ID: None	
	MAC Addr:	XX:XX:XX:*:*:XX	IP Address:	Global IPv6: AUTO
	Quantity:	2	IP Mask or Bits:	Link IPv6: AUTO
			Gateway IP:	IPv6 GW: AUTO
	#1 Redir Name:		#2 Redir Name:	
	STA ID:		SSID:	-
	WiFi AP:		Key/Phrase:	
	WPA	WPA2	WEP	
A	Down			
	Apply	<u>C</u> ancel		

B. Double-click each new MAC-VLAN interface in the Port-Mgr tab to modify. Select the RADIUS checkbox which will allow a hostapd based RADIUS server on the interfaces using the config files: /home/lanforge/wifi/hostapd_eth1#0.conf and /home/lanforge/wifi/hostapd_eth1#1.conf

In an all-in-one example, the hostapd RADIUS servers will be referenced by localhost and each MAC-VLAN interface will not need an IP address assigned. If the hostapd RADIUS servers were on different systems or networks, or need to be accessed from outside the LANforge system, the appropriate IP address would be assigned here.

•		eth1#0 (c	t523-3n-f20) Con	figure Settings			$\mathbf{v} \diamond \mathbf{x}$		
	Port Status Information								
	Current: LINK-DOWN PROBE-ERROR TSO UFO GSO GRO								
	Driver info: Port Type: MAC-VLAN Parent: eth1								
	Port Configurables								
Enable —		General Int	erface Settings			O 10bt-HD	Advert Rates		
Set IF Down						0 10bt-FD	V TODE-HD		
Set TX OL on	Down	Aux-Mgt				0 100bt-FD	V 100L-FD		
Set MTU	DHCP-IPv6	DHCP Release	DHCP Vendor ID:	None	-	0 1000-FD 0 10G-FD	100bt-FD		
Set Offload	DHCP-IPv4	Secondary-IPs	DHCP Client ID:	None	-	0 40G-FD	1000-ED		
Set PROMISC	DNS Servers:	BLANK	Peer IP:	NA		@ Autonegotiate	10G-FD		
Set Rx-All/FCS	IP Address:	0.0.0.0	Global IPv6:	AUTO		Renegotiate	40G-FD		
Set Bridge Info	IP Mask:	0.0.0.0	Link IPv6:	AUTO		Restart Xcvr	Flow-Control		
]	Gateway IP:	0.0.0.0	IPv6 GW:	AUTO		PROMISC PROMISC]—		
Fordicas	Alias:		MTU:	1500		RX-ALL	Offload		
HTTP	MAC Addr:	00:1e:a6:be:c8:6c	TX Q Len	0		RX-FCS	ISO Enabled		
ETP	Br Cost:	Ignore 💌	Priority:	Ignore	-	Bypass NOW!	UFO Enabled		
RADIUS	Rpt Timer:	medium (8 s) 🔻	WiFi Bridge:	NONE	-	Bypass Power-UP	GSU Enabled		
	·					Bypass Power-DOWN	GRO Enabled		
						Bypass Disconnect			
	Print V	iew Details	Probe Syne	Apply		OK Cancel			
•		eth1#1 (c	t523-3n-f20) Con	figure Settings			\odot \sim \times		
			Port Status Info	ormation					
		Current: LIN	NK-DOWN PROBE-E	RROR TSO UFO GS	60 G	RO			
		Driver Info: Po	rt Type: MAC-VLA	N Parent: eth1					
			Port Configu	ables					
Enable ——		General Int	erface Settings			Port Rates	-Advert Rates-		
Set IF Down			-			O 10bt-HD	🗹 10bt-HD		
Set MAC	Down	Aux-Mat				0 100t-HD	🗹 10bt-FD		
🔲 Set TX Q Len			DHCP Vendor ID:	None	-	0 100bt-FD 0 1000-FD	🗹 100bt-HD		
Set MTU					-	0 10G-FD 0 40G-ED	🗹 100bt-FD		
Set Offload	DHCP-IPV4	Secondary-IPs	DHCP Client ID:	None		Autonegotiate	🗹 1000-FD		
Set PROMISC	DNS Servers:	BLANK	Peer IP:	NA		Renegotiate	10G-FD		
Set Rx-All/FCS	IP Address:	0.0.0.0	Global IPv6:	AUTO	_	Restart Xcvr	40G-FD		
Set Bridge Info	IP Mask:	0.0.0.0	LINK IPVO:	AUTO	=		Flow-Control		
	Aliac:	0.0.0.0	MTU:	1500	=	RX-ALL	Offload		
Services —	MAC Addr:	00:1e:a6:67:96:6c	TX OL en	0		RX-FCS	✓ TSO Enabled		
HTTP	Pr Cost	Ignoro	Driositu	lanoro		Bypass NOW!	✓ UFO Enabled		
FTP	bi cost:		interiority:	Ignore	H	Bypass Power-UP	GSO Enabled		
RADIUS	Rpt Timer:	meaium (8 s)	WiFi Bridge:	NONE		Bypass Power-DOWN	LRO Enabled		
						Bypass Disconnect	GRO Enabled		

C. Create config file. You will need to change the server_id to match your hostname.

/home/lanforge/wifi/hostapd_eth1#0.conf for the hostapd RADIUS server on eth1#0.

NOTE: The eap_user_file, eap_sim_db and radius_server_auth_port are unique for each RADIUS server.

interface=eth1#0 driver=wired logger_syslog=-1 logger_syslog_level=2
logger_stdout=-1 logger_stdout_level=2 dump_file=/home/lanforge/wifi/hostapd_eth1#0.dump ctrl interface=/var/run/hostapd ctrl_interface_group=0 ieee8021x=1 eapol_key_index_workaround=0 eap_server=1 eap user file=/home/lanforge/hs20/AS/hostapd-osen.eap user server_id=ct523-3n-f20 eap sim db=unix:/tmp/hlr auc gw.sock radius_server_auth_port=1820 radius_server_clients=/home/lanforge/hs20/AS/hostap.radius_clients ca cert=/home/lanforge/hs20/ca/ca.pem server cert=/home/lanforge/hs20/ca/server.pem private_key=/home/lanforge/hs20/ca/server.key private_key_passwd=lanforge ocsp_stapling_response=/home/lanforge/hs20/ca/ocsp-server-cache.der

D. Create config file. You will need to change the server_id to match your hostname.

/home/lanforge/wifi/hostapd_eth1#1.conf for the hostapd RADIUS server on eth1#1.

NOTE: The eap_user_file, eap_sim_db and radius_server_auth_port are unique for each RADIUS server.

```
interface=eth1#1
driver=wired
logger syslog=-1
logger_syslog_level=2
logger_stdout=-1
logger_stdout_level=2
dump_file=/home/lanforge/wifi/hostapd_eth1#1.dump
ctrl_interface=/var/run/hostapd
ctrl_interface_group=0
ieee8021x=1
eapol_key_index_workaround=0
eap_server=1
eap user file=sqlite:/home/lanforge/hs20/AS/DB/eap user.db
server_id=ct523-3n-f20
eap_sim_db=unix:/tmp/hlr_auc_gw.sock db=/home/lanforge/hs20/AS/DB/eap_sim.db
radius_server_auth_port=1821
radius_server_clients=/home/lanforge/hs20/AS/hostap.radius_clients
ca_cert=/home/lanforge/hs20/ca/ca.pem
server_cert=/home/lanforge/hs20/ca/server.pem
private_key=/home/lanforge/hs20/ca/server.key
private_key_passwd=lanforge
ocsp_stapling_response=/home/lanforge/hs20/ca/ocsp-server-cache.der
```

E. Start the hlr_auc_gw tool:

```
cd /home/lanforge
```

```
. lanforge.profile
```

```
hlr_auc_gw -m /etc/hlr_auc_gw.milenage_db > /tmp/hlr_auc_gw.log &
```

NOTE: If the hlr_auc_gw does not start, you may have to remove the file /tmp/hlr_auc_gw.sock first.

F. Reset the MAC-VLAN interfaces on the Port Mgr tab so that the new hostapd RADIUS servers are started. Check that they are running with the command: ps_auxwww_lgrep_hostapd_eth

If they are not running, check the log files for problems: cat /home/lanforge/wifi/hostapd_log_eth1#0.txt cat /home/lanforge/wifi/hostapd_log_eth1#1.txt

- 4. Create two VAPs for the HotSpot 2.0 Release 2 Network. Skip this section if you are using third-party APs in this test.
 - A. Go to the Port Mgr tab and create one VAP on wiphy0 and one VAP on wiphy1.

B. Modify the first VAP on wiphy0 to be the **OSEN** AP. Configure IP Address and SSID.

		Port Status Inform	nation		
	Current:	LINK-UP GRO NOM	NE .		
	Driver In	nfo: Port Type: WIFI-A	P Parent: wiphy0		
		Port Configurat	oles		
Standard Configur	ation Advanced	d Configuration Mise	c Configuration	Custom WiFi	
Enable		General Ir	nterface Settings		1
🔲 Set IF Down	Down	Aux-Mgt			
Set MAC	DHCP-IP	Pv6 ☑ DHCP Release	DHCP Vendor ID	: None	-
Set TX Q Len	DHCP-IP	Secondary-IPs	DHCP Client ID:	None	-
Set Offload	DNS Serve	rs: BLANK	Peer IP:	NA	
Set PROMISC	IP Address	: 10.88.1.1	Global IPv6:	AUTO	5
Jer Pholise	IP Mask:	255.255.255.0	Link IPv6:	AUTO	
	Gateway II	P: 0.0.0.0	IPv6 GW:	AUTO	
	Alias:		MTU:	1500	
🔲 НТТР	MAC Addr:	00:0e:8e:5d:5a:71	TX Q Len	1000	
FTP	Rpt Timer:	faster (1 s)	 WiFi Bridge: 	NONE	-
		Wil	Fi Settings		
l ow Level	SSID: AE	BCD-1234	▼ AP:	DEFAULT	
	Key/Phrase:		Mode:	802.11abgn	-
TSO Enabled	Freq/Channel: 5	5180/36	Rate:	OS Default	•
UFO Enabled	DTIM-Period: 2		Max-STA:	2007	
GSO Enabled	Beacon: 24	40			
LRO Enabled	🗌 WPA 🔲 WPA	2 🗹 OSEN 🗌 WEP 📃	Disable HT40 📃 Di	sable HT80 📃 Disa	ble SGI
GRO Enabled	Verbose Deb	bug			
,					

C. Select the **Advanced Configuration** tab in the Port-Modify window to configure 802.1x and RADIUS server information.

Current: LINK-UP GRO NONE Driver Info: Port Type: Port Configurables Standard Configuration Advanced Configuration Masc Configuration Custom WiFi Advanced WiFi Settings Select 'WPA2' on the Standard Configuration screen to enable Advanced/802.1x and enable Advanced/802.1x to enable most of these. Enabling 802.11u enables others. Ignore Probes: Zero (%) Zero (%) HESSID: O0:00:00:00:00:00 Ignore Auth-Assoc: Zero (%) Zero (%) Milenage: Ignore Re-Assoc: Zero (%) Zero (%) Milenage: Corrupt GTK: Zero (%) Pot Cass RADIUS IP H520 Capabilities Consortium: H520 Oper Class RADIUS Port H520 Oper Class RADIUS Port H520 Oper Class RADIUS Secret Iene80211w: Disabled (0) RADIUS Secret Network Type: Private (0) Address Types: Not Available (0) Network Auth: 3GPP Cell Net: Use 802111 Use 802111 Use 802111 Short-Preamble		Port S	tat	us Information		
Driver Info: Port Type: WIFI-AP Parent: wiphy0 Port Configurables Standard Configuration Advanced Configuration Misc Configuration Custom WiFi Advanced WiFi Settings Select 'WPA2' on the Standard Configuration screen to enable Advanced/802.1x and enable Advanced/802.1x to enable most of these. Enabling 802.11u enables others. Ignore Probes: zero (%) ♥ HESSID: 00:00:00:00:00 Ignore Auth-Assoc: zero (%) ♥ HESSID: 00:00:00:00:00 Ignore Assoc: zero (%) ♥ HISS: Ignore Re-Assoc: zero (%) ♥ Milenage: Corrupt GTK: zero (%) ♥ Domain: HS20 Capabilities Consortium: HS20 Oper Class RADIUS Port 1820 Ieee80211w: Disabled (0) ♥ Renue Type: Dispecified (0) ♥ Venue Type: Venue Group: Disabled (0) ♥ RaDIUS Secret Ianforge Venue Group: Dispecified (0) ♥ Venue Type: Dispecified (0) ♥ Venue Type: Dispecified (0) ♥ Venue Type: Viste (0) ♥ Address Types: Vot Available (0) ♥ Venue Type: Dispecified (0) ♥ Venue Type: Dispecified (0) ♥ Venue Type: Viste (0) ♥ Address Types: Vot Available (0) ♥ Vetwork Auth: 3GPP Cell Net: Use 80211d Use 80211h Short-Preamble Ø Advanced/802.1x HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u USEA 802.11u USEA 802.11u USEA		Current: LINK-	JP (GRO NONE		
Port Configuration Misc Configuration Custom WiFi Standard Configuration Misc Configuration Custom WiFi Advanced WiFi Settings Select 'WPA2' on the Standard Configuration screen to enable Advanced/802.1x and enable Advanced/802.1x to enable most of these. Enabling 802.11u enables others. Ignore Probes: 2ero (0%) • HESSID: 00:00:00:00:00:00:00 Ignore Auth-Assoc: 2ero (0%) • HESSID: 00:00:00:00:00:00 Ignore Assoc: 2ero (0%) • HISI:		Driver Info: Port 1	уре	e: WIFI-AP Paren	t: wiphy0	
Standard Configuration Misc Configuration Custom WiFi Advanced WiFi Settings Select 'WPA2' on the Standard Configuration screen to enable Advanced/802.1x and enable Advanced/802.1x to enable most of these. Enabling 802.11u enables others. Ignore Probes: Zero (0%) HESSID: 00:00:00:00:00:00 Ignore Auth-Assoc: Zero (0%) Realm: Image: Corrupt GTK: Zero (0%) Milenage: Corrupt GTK: Zero (0%) Domain: Image: Corrupt GTK: Zero (0%) RADIUS SP Cort 1820 Image: Corrupt GIK: Image: Corrupt GIK: Image: Corrupt GIK: <th></th> <th>Por</th> <th>t Co</th> <th>onfigurables</th> <th></th> <th></th>		Por	t Co	onfigurables		
Advanced WiFi Settings Select 'WPA2' on the Standard Configuration screen to enable Advanced/802.1x and enable Advanced/802.1x to enable most of these. Enabling 802.11u enables others. Ignore Arborner Standard Configuration screen to enable Advanced/802.1x to enable most of these. Enabling 802.11u enables others. Ignore Probes: 2ero (%) HESSID: 00:00:00:00:00 Ignore Auth-Assoc: 2ero (%) Realm:	Standard Configuration	Advanced Configur	atio	Misc Configu	ration Custom WiFi	_
Select 'WPA2' on the Standard Configuration screen to enable Advanced/802.1x and enable Advanced/802.1x to enable most of these. Enabling 802.11u enables others. Ignore Probes: 2ero (%) Ignore Auth-Assoc: 2ero (%) Ignore Assoc: 2ero (%) Ignore Re-Assoc:		Advan	ced	l WiFi Settings		1
Ignore Probes: 2ero (%) HESSID: 00:00:00:00:00:00 Ignore Auth-Assoc: 2ero (%) Realm: Ignore Assoc: 2ero (%) IMSI: Ignore Re-Assoc: 2ero (%) Milenage: Corrupt GTK: 2ero (%) Domain: HS20 Capabilities Consortium: HS20 Oper Class RADIUS IP 127.0.0.1 HS20 WAN Metrics RADIUS Port IB20 Ieee80211w: Disabled (0) RADIUS Secret Ianforge Venue Group: Uspecified (0) Address Types: Not Available (0) Bo2.11u UESA <	Select 'WPA2' on the and enable Advance	e Standard Configurat ed/802.1x to enable mo	ion st (screen to enable of these. Enabling	e Advanced/802.1x g 802.11u enables others.	
Ignore Auth-Assoc: Zero (0%) Realm: Ignore Assoc: Zero (0%) IMSI: Ignore Re-Assoc: Zero (0%) Milenage: Corrupt GTK: Zero (0%) Domain: HS20 Capabilities Consortium: HS20 Oper Class RADIUS IP I27.0.0.1 HS20 HS20 WAN Metrics RADIUS Port Ieee80211w: Disabled (0) Venue Group: Unspecified (0) Venue Group: Unspecified (0) Venue KType: Private (0) Venue Kuth: 3GPP Cell Net: Use 80211d Use 80211h Short-Preamble Verdvanced/802.1x HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u Internet	Ignore Probes:	zero (0%)	-	HESSID:		
Ignore Assoc: Zero (0%) VIMSI: Ignore Re-Assoc: Zero (0%) Milenage: Corrupt GTK: Zero (0%) Domain: HS20 Capabilities Consortium: HS20 Oper Class RADIUS IP HS20 WAN Metrics RADIUS Port Ieee80211w: Disabled (0) Venue Group: Uspecified (0) Venue Group: Inspecified (0) Venue Kauth: 3GPP Cell Net: Use 80211d Use 80211h HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u Internet	Ignore Auth-Assoc:	zero (0%)	-	Realm:		
Ignore Re-Assoc: Zero (0%) ✓ Milenage: Corrupt GTK: Zero (0%) ✓ Domain: HS20 Capabilities Consortium: HS20 Oper Class RADIUS IP 127.0.0.1 Itexe80211w: Disabled (0) ▼ RADIUS Secret Ieee80211w: Disabled (0) Venue Group: Inspecified (0) Venue Group: Inspecified (0) Venue Kauth: 3GPP Cell Net: Use 80211d Use 80211h Short-Preamble ✓ Advanced/802.1x HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u Internet	Ignore Assoc:	zero (0%)	-	IMSI:		
Corrupt GTK: Zero (%) Domain: HS20 Capabilities Consortium: HS20 Oper Class RADIUS IP 127.0.0.1 HS20 WAN Metrics RADIUS Port 1820 Ieee80211w: Disabled (0) RADIUS Secret Ianforge Venue Group: Unspecified (0) Venue Type: Inspecified (0) V Network Type: Private (0) Address Types: Not Available (0) V Network Auth: 3GPP Cell Net: Use 80211d Use 80211h Short-Preamble ✓ Advanced/802.1x HotSpot 2.0 Disable DGAF 802.11u UESA 802.11u UESA	Ignore Re-Assoc:	zero (O%)	-	Milenage:		
HS20 Capabilities Consortium: HS20 Oper Class RADIUS IP 127.0.0.1 HS20 WAN Metrics RADIUS Port 1820 Ieee80211w: Disabled (0) Disabled (0) RADIUS Secret Ianforge Venue Group: Unspecified (0) Venue Group: Unspecified (0) Venue Type: Inspecified (0) Network Type: Private (0) Address Types: Not Available (0) Network Auth: 3GPP Cell Net: Use 80211d Use 80211h HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u Internet 802.11u LSR 802.11u UESA	Corrupt GTK:	zero (0%)	-	Domain:		
HS20 Oper Class RADIUS IP 127.0.0.1 HS20 WAN Metrics RADIUS Port 1820 Ieee80211w: Disabled (0) RADIUS Secret Ianforge Venue Group: Unspecified (0) Venue Type: Inspecified (0) V Network Type: Private (0) Address Types: Not Available (0) V Network Auth: 3GPP Cell Net: Secret Secret Venue (0) Venu	HS20 Capabilities			Consortium:		
HS20 WAN Metrics RADIUS Port 1820 leee80211w: Disabled (0) RADIUS Secret Ianforge Venue Group: Unspecified (0) Venue Type: Unspecified (0) V Network Type: Private (0) Address Types: Not Available (0) V Network Auth: 3GPP Cell Net: SGPP Cell Net: Venue Type: Venue Type: Venue Type: Vse 80211d Use 80211h Short-Preamble Short-Preamble Venue Type: Venue Type: Venue Type: Enable 802.11u 802.11u Internet 802.11u ASRA 802.11u ESR 802.11u UESA	HS20 Oper Class			RADIUS IP	127.0.0.1	
Ieee80211w: Disabled (0) RADIUS Secret Ianforge Venue Group: Unspecified (0) Venue Type: Unspecified (0) Address Types: Not Available (0) Address Types: Not Available (0) Metwork Auth: 3GPP Cell Net: Use 80211d Use 80211h Short-Preamble Advanced/802.1x HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u Internet 802.11u ASRA 802.11u UESA 	HS20 WAN Metrics			RADIUS Port	1820	
Venue Group: Unspecified (0) Venue Type: Unspecified (0) Venue Type: Network Type: Private (0) Address Types: Not Available (0) Venue Type: Network Auth: 3GPP Cell Net: Venue Type: Venue Type: Venue Type: Use 80211d Use 80211h Short-Preamble Venue Type: Venue Type: Venue Type: Advanced/802.1x HotSpot 2.0 Disable DGAF 802.11u UESA 802.11u UESA	leee80211w:	Disabled (0)	-	RADIUS Secret	lanforge	
Network Type: Private (0) Address Types: Not Available (0) Network Auth: 3GPP Cell Net: Use 80211d Use 80211h Short-Preamble ✓ Advanced/802.1x HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u Internet 802.11u ASRA 802.11u ESR 802.11u UESA	Venue Group:	Unspecified (0)	-	Venue Type:	Unspecified (0) 🗸	
Network Auth: 3GPP Cell Net: Use 80211d Use 80211h Short-Preamble Advanced/802.1x HotSpot 2.0 Disable DGAF Enable 802.11u 802.11u Internet B02.11u ASRA 802.11u ESR	Network Type:	Private (0)	-	Address Types:	Not Available (0) 🗸	
□ Use 80211d □ Use 80211h □ Short-Preamble ✓ Advanced/802.1x □ HotSpot 2.0 □ Disable DGAF □ Enable 802.11u □ 802.11u Internet □ 802.11u ASRA □ 802.11u ESR □ 802.11u UESA	Network Auth:			3GPP Cell Net:		
Advanced/802.1x HotSpot 2.0 Disable DGAF	Use 80211d	Use 80211h 🔲 Short-	Pre	amble		
Enable 802.11u 802.11u Internet 802.11u ASRA 802.11u ESR 802.11u UESA	Advanced/802.1x	HotSpot 2.0	Disa	ble DGAF		
	Enable 802.11u	802.11u Internet		302.11u ASRA	802.11u ESR 802.11u UESA	
	_	_				

D. Select the **Custom WiFi** tab to add the following lines for HotSpot 2.0 Release 2.

ocsp_stapling_response=/home/lanforge/hs20/ca/ocsp-server-cache.der



E. Modify the second VAP on wiphy1 to be the **Passpoint** AP. Configure IP Address and SSID.

•	vap2 (ct523-3n-f20) Co	onfigure Setti	ngs		\odot	
	Current Driver li	Port Status : LINK-UP GRC nfo: Port Type: V	Information) NONE VIFI-AP Paren	ıt: wiphyl			
		Port Confi	gurables				
Standard Configurati	on Advanced	Configuration	Misc Configura	ation Cu	stom WiFi		
Enable —		Gen	eral Interface	Settings		1	
Set IF Down	Down	Aux-Mgt					
Set MAC	DHCP-I	Pv6 🔽 DHCP Rel	ease DHCP	Vendor ID:	None	-	
Set TX Q Len	DHCP-II	Pv4 Secondar	y-IPs DHCP	Client ID:	None	-	
Set MTU	DNS Serve	rs: BLANK	Peerl	P:	NA		
Set Official	IP Address	s: 10.1.1.1	Globa	l IPv6:	AUTO	_	
J Set PROMISC	IP Mask:	255.255.255.	0 Link IF	Pv6:	AUTO		
	Gateway I	P: 0.0.0.0	IPv6 G	w:	AUTO		
Services —	Alias:		MTU:		1500		
П НТТР	MAC Addr:	00:0e:8e:23:1	17:48 TX Q L	en	1000		
FTP	Rpt Timer:	medium (8 s) 🔻 WiFi B	ridge:	NONE	-	
			WiFi Settin	gs			
Low Level	SSID:	BCD-5678	•	AP:	DEFAULT		
	Key/Phrase:			Mode:	802.11abqn		
TSO Enabled	Freq/Channel: !	5180/36		Rate:	OS Default		
UFO Enabled	DTIM-Period: 2			Max-STA:	2007		
GSO Enabled	Beacon: 2	40		_			
LRO Enabled	WPA WPA	2 OSEN WI	EP 📃 Disable I	HT40 🔲 Dis	sable HT80 🔲 Disa	ble SGI	
GRO Enabled	Verbose Del	bug					
Print View Details	Logs	Probe Displ	ay Scan	Sync	Apply OK	Can	icel

F. Select the **Advanced Configuration** tab in the Port-Modify window to configure 802.1x, 802.1u, HotSpot 2.0, RADIUS server and other information.

	vap2 (ct523-	3n-f20) Configure	Settings	$\mathbf{v} \wedge \mathbf{x}$
	Po	ort Status Informat	ion	
	Current: LI	NK-UP GRO NONE		
	Driver Info: P	ort Type: WIFI-AP	Parent: wiphy1	
		Port Configurable	6	
Standard Configura	ation Advanced Config	uration Misc Cor	figuration Custom WiFi	
	Ac	lvanced WiFi Setti	igs	1
Select 'WPA2' on th and enable Advance	e Standard Configuratio ed/802.1x to enable most	n screen to enable of these. Enablin	Advanced/802.1x 3 802.11u enables others.	
Ignore Probes:	zero (0%)	HESSID:	00:00:00:00:00	Í
Ignore Auth-Assoc:	zero (0%)	Realm:	0,ct523-3n-f20.lanforge.local,12[5:6],21[2:4][5:7]	
Ignore Assoc:	zero (0%)	MSI:		
Ignore Re-Assoc:	zero (0%)	Milenage:		j II.
Corrupt GTK:	zero (0%)	Domain:	ct523-3n-f20.lanforge.local	
HS20 Capabilities		Consortium:		j l
HS20 Oper Class		RADIUS IP	127.0.0.1	İ.
HS20 WAN Metrics		RADIUS Port	1821	j
leee80211w:	Disabled (0)	RADIUS Secret	lanforge	
Venue Group:	Unspecified (0)	Venue Type:	Unspecified (0) 💌	
Network Type:	Private (0)	Address Types:	Not Available (0) 🗸	
Network Auth:		3GPP Cell Net:		
Use 80211d	Use 80211h 🛛 Short-Pr	eamble		
Advanced/802.1x	HotSpot 2.0	able DGAF		
Enable 802.11u	802.11u Internet	802.11u ASRA	802.11u ESR 🗌 802.11u UESA	
Print View Details	Logs Probe	Display Scan	Sync Apply OK	Cancel

G. Select the **Custom WiFi** tab to add the following lines for HotSpot 2.0 Release 2. The hostname in the URL will need to match your actual hostname.

<pre>ver_uri=https://osu-server.ct523-3n-f20.lanforge.local/hs20/spp.php/signup?re endly_name=eng:LANforge HS20 Operator =osen@lanforge.com hod_list=1 0 n=logo-64x64.png</pre>	alm=ct523-3n-f20.la
vice_desc=eng:LANforge Example services	
vap2 (ct523-3n-f20) Configure Settings	$(\mathbf{v} \otimes \mathbf{x})$
Port Status Information Current: LINKJIP GBO NONE	
Driver Info: Port Type: WIFI-AP Parent: wiphy1	
Port Configurables	
Standard Configuration Advanced Configuration Misc Configuration Custom WiFi	
User-Specified supplicant/hostapd configuration text: hs20_icone54:54:eng:image/eng:logo:64:54.png:/home/lanforge/hs20/www/lago-64:64.png osu_server_uri=https://cou.server.ct523:3n:f20.lanforge.local/hs20/spp.php/signup?realm=ct523:3n:f20.lanforge.local osu_nai=osen@lanforge.com osu_nai=osen@lanforge.com osu_icon=logo-64:64.png osu_iservice_desc=eng:LANforge Example services	
4	

H. Example hostapd config file for OSEN AP

Example hostapd config file for WPA2 + ANQP AP. These were re-created after the fact, its possible that there is a typo, and the hostname differs from the instructions in this example.

I. Modify wiphy0 and wiphy1 to be on the same channel and select OK. This should only be needed if you are trying to connect multiple LANforge virtual stations to the APs. If using a single station or a third-party device, the channels should not matter.

0	wiphy0 (ct5	23-3n-f20) Configu	re Settings	\bigcirc	\odot ×		
Port Status Information Current: LINK-DOWN NONE Driver Info: Port Type: WIFI-Radio Driver: ath9k() Bus:							
		Port Configurable	es				
Enable ——		General Int	erface Settings	1			
Set IF Down	Down	Aux-Mgt					
Set MAC	DHCP-IPv6	DHCP Release	DHCP Vendor ID:	None 👻			
Set TX Q Len	DHCP-IPv4	Secondary-IPs	DHCP Client ID:	None			
Set MTU	DNS Servers:	BLANK	Peer IP:	NA			
Set Official	IP Address:	0.0.0.0	Global IPv6:	AUTO			
J Set PROMISC	IP Mask:	0.0.0.0	Link IPv6:	AUTO			
	Gateway IP:	0.0.0.0	IPv6 GW:	AUTO			
	Alias:		MTU:	1500			
	MAC Addr:	00:0e:8e:43:3a:71	TX Q Len	0			
	Rpt Timer:	medium (8 s) 🔻	WiFi Bridge:	NONE			
		WiFi	Settings				
	Max-VIFs: 204	18 Max-Stations: 20	48 Max-APs: 8 Su	pports: 802.11abgn			
	Country:	United States (84					
	Channel/Freq	: 36 (5180 Mhz)					
	Antenna:	All	Tx-Pow	er: DEFAULT			
	RTS: DEFAULT Frag: 2346						
	Verbose D	ebug					
Print View Details	Logs	Probe Syr	nc Apply	ОК Са	ncel		

•	wiphy1 (ct5	23-3n-f20) Configu	re Settings	\odot \otimes \otimes			
Port Status Information Current: LINK-DOWN NONE							
		Type. With Hadio	briver. atrisky bu				
		Port Configurabl	es				
Enable		General Int	erface Settings				
	Down	Aux-Mgt					
Set TX OL en	DHCP-IPv6	DHCP Release	DHCP Vendor ID:	None			
Set MTU	DHCP-IPv4	Secondary-IPs	DHCP Client ID:	None 🔽			
Set Offload	DNS Servers:	BLANK	Peer IP:	NA			
Set PROMISC	IP Address:	0.0.0.0	Global IPv6:	AUTO			
J —	IP Mask:	0.0.0.0	Link IPv6:	AUTO			
	Gateway IP:	0.0.0.0	IPv6 GW:	AUTO			
	Alias:		MTU:	1500			
	MAC Addr:	00:0e:8e:43:37:48	TX Q Len	0			
	Rpt Timer:	medium (8 s) 🔽	WiFi Bridge:	NONE			
		WiFi	Settings				
	Max-VIEs: 204	18 Max-Stations: 20	48 Max-APs: 8 Su	pports: 802.11abgn			
	Country:	United States (84	•••				
	Channel/Freq	: 36 (5180 Mhz)	-				
	Antenna:	All	Tx-Pow	er: DEFAULT			
	RTS:	DEFAULT	Frag:	2346			
	Verbose Debug						
Print View Details	Logs	Probe Sy	nc Apply	OK Cancel			

J. In Netsmith, create a Virtual router called OSEN for vap1 and PASSPOINT for vap2, place vap in their respective virtual routers. Setup each VAP with DHCP Service on different IP networks.

•	Create/Modi	fy Connection	×
		Interface-Cost:	1
Port 1-A:	10 (vap1)	RIP-Metric:	1
		OSPF Area:	0.0.0.0
Port 1-B: 🗹 Skip	<auto create="" new="" port=""></auto>	VRRP IP:	0.0.0/24
WanLink: 🗹 Skip	<auto create="" new="" wanlink=""></auto>	VRRP ID:	
Bort 2 Pr V Skip	<auto create="" new="" ports<="" td=""><td>VRRP Priority:</td><td></td></auto>	VRRP Priority:	
POIL 2-0. Skip		VRRP Interval:	1
Port 2-A: 🗹 Skip	<auto create="" new="" port=""></auto>	Next-Hop:	0.0.0.0
DHCP Lease Time:	43200	Subnets (a.b.c.d/xx):	
DHCP DNS:	10.88.1.1		
DHCP Range Min:	10.88.1.101]	
DHCP Range Max:	10.88.1.250]	
DHCP Domain:]	
DHCPv6 DNS:		Next-Hop-IPv6:	
DHCPv6 Range Min:		IPv6 Subnets (aaa::0/xx):	
DHCPv6 Range Max:			
DHCPd Config File:			
			11
NAT 🗹 DHCP	DHCPv6 Custom DHCP	VRRP Cand-RP	
	ОК	Cancel	

0	Create/Modify Connection						
			Interface-Cost:	1			
Port 1-A:	11 (vap2)	-	RIP-Metric:	1			
Port 1-B: V Skip	<auto create="" new="" ports<="" td=""><td></td><td>OSPF Area:</td><td>0.0.0.0</td></auto>		OSPF Area:	0.0.0.0			
FOILT-D. COMP			VRRP IP:	0.0.0/24			
WanLink: 🗹 Skip	<auto create="" new="" wanlink=""></auto>	-	VRRP ID:	1			
Port 2-B: 🗹 Skip	<auto create="" new="" port=""></auto>	-	VRRP Priority:	100			
Dort 2 Au II Ship	Auto Croato New Ports		VRRP Interval:	1			
Port Z-A: V Skip	CAULO Create New Ports		Next-Hop:	0.0.0.0			
DHCP Lease Time:	43200		Subnets (a.b.c.d/xx):				
DHCP DNS:	10.1.1.1						
DHCP Range Min:	10.1.1.11						
DHCP Range Max:	10.1.1.100						
DHCP Domain:							
DHCPv6 DNS:			Next-Hop-IPv6:				
DHCPv6 Range Min:			IPv6 Subnets (aaa::0/xx):				
DHCPv6 Range Max:							
DHCPd Config File							
brief a config file.							
NAT V DHCP	🗌 DHCPv6 🛛 🗌 Custom DHC	Р	VRRP Cand-RP				
	ок		Cancel				

K. Check that the VAP hostapd processes are running with the command: ps_auxwww_lgrep_hostapd_vap

If they are not running, check the log files for problems:	
<pre>tail -f /home/lanforge/wifi/hostapd_log_vap1.txt</pre>	
<pre>tail -f /home/lanforge/wifi/hostapd_log_vap2.txt</pre>	

L. Create another virtual router to tie the OSEN and AP virtual routers together. Connect them with Netsmith connections (skipping WanLinks unless you are sure you want them.) Create another virtual port connection to run the OCSP responder and the local DNS server. Select the 'DNS' service. Make sure the default gateway points back towards rddVR4 in the virtual router. In this example, the OCSP responder interface is called rddVR5

• rddVR5 (lf0350-c3b0) Configure Settings 📀 📎 🖉										
Port Status Information										
Current: LINK-UP PROBE-ERROR TSO GSO GRO										
	Driver Info: Port Type: Redirect-Device Peer: rddVR4 rddVR4									
			Port Configura	ables						
Enable		General In	terface Settings		1	Port Rates	-Advert Rates -			
Set MAC	Down	Aux-Mat				O 10bt-HD	10bt-HD			
🔲 Set TX Q Len			DHCR Vender ID.	None		O 100bt-HD	10bt-FD			
Set MTU	DHCP-IPV <u>6</u>	DHCP Release	DHCP Vendor ID:	None		0 100bt-FD 0 1000-FD	100bt-HD			
Set Offload	DHCP-IPv4	Secondary-IPs	DHCP Client ID:	None	-	10G-FD	100bt-FD			
Set PROMISC	DNS Servers:	BLANK	NA		O Autonegotiate	1000-FD				
Set Rx-All/FCS	IP Address:	7.1.3.2	Global IPv6:	AUTO			10G-FD			
Set Bridge Info	IP Mask:	255.255.255.0	Link IPv6:	AUTO		Renegotiate	40G-FD			
Senices	Gateway IP:	Restart Xcvr	Flow-Control							
HTTP	Alias:		MTU:	1500						
ETP	MAC Addr:	ea:bd:b2:80:0b:28	TX Q Len	1000		RX-ALL	Offload			
DNS	Br Cost:	Ignore 💌	Priority:	Ignore	-	RX-FCS	UEO Enabled			
RADIUS	Rpt Timer:	medium (8 s) 🔻	WiFi Bridge:	NONE	•	Bypass NOW!	GSO Enabled			
IPSEC-Client	IPSec GW:		IPSec Password:			Bypass Power-DOWN	LR0 Enabled			
🔲 IPsec-Upstream	IPSec Local ID.:		IPSec Remote ID.			Bypass Disconnect	GRO Enabled			
Print Display Probe Sync Apply QK Cancel										

M. Create a MAC-VLAN on the management port (or use some other port that can reach the internet). Drag this into the top virtual router, and configure Netsmith to use it for the default gateway by setting up the Next Hop and the 0.0.0.0/0 destination. Select NAT as well.

Create/Modify Connection							
			Interface-Cost:	1			
Port 1-A:	3 (eth0#0)	-	RIP-Metric:	1			
			OSPF Area:	0.0.0.0			
Port 1-B: 🗹 Skip	<auto create="" new="" port=""></auto>	•	VRRP IP:	0.0.0/24			
WanLink: 🗹 Skip	<auto create="" new="" wanlink=""></auto>	-	VRRP ID:				
Port 2-B: 🔽 Skip	<auto create="" new="" port=""></auto>	-	VRRP Priority:				
		\square	VRRP Interval:	1			
Port 2-A: 🗹 Skip	<auto create="" new="" port=""></auto>	•	Next-Hop:	192.168.100.1			
DHCP Lease Time:	43200		Subnets (a.b.c.d/xx):				
DHCP DNS:			0.0.0/0				
DHCP Range Min:							
DHCP Range Max:							
DHCP Domain:							
DHCPv6 DNS:			Next-Hop-IPv6:				
DHCPv6 Range Min:			IPv6 Subnets (aaa::0/xx):				
DHCPv6 Range Max:							
DHCPd Config File:							
NAT DHCP	DHCPv6 Custom D	HCF	VRRP Cand-RP				
	<u>0</u> K		<u>C</u> ancel				

N. When the configuration is completed, Netsmith will look something like this. Apply it, wait a minute to let everything settle, and move to the next step



For more information see WiFi Testing: Configuring a Virtual AP with Limited Stations, Virtual Router with NAT Cookbook, Virtual Router with DHCP Cookbook

- 5. Start services on the AP system. You need to do this each time you re-apply Netsmith.
 - A. First, make sure that /etc/hosts on the AP system matches the IP addresses for the vap0, vap1, and the ocsp port (as shown in Netsmith). In this example, I added these rows to /etc/hosts:

```
###LANFORGE-HOSTS-START###
# This section may be over-written by lf_kinstall.pl
127.0.0.1 osu-client.lf0350-c3b0.lanforge.local
10.88.1.1 osu-server.lf0350-c3b0.lanforge.local
127.0.0.1 osu-revoked.lf0350-c3b0.lanforge.local
10.88.1.1 osu-signup.lf0350-c3b0.lanforge.local
7.1.3.2 ocsp.lf0350-c3b0.lanforge.local
###LANFORGE-HOSTS-STOP###
###-LF-HOSTAME-NEXT-###
192.168.100.154 lf0350-c3b0 lanforge-srv
```

B. Start the Online Certificate Status Protocol (OCSP) script which will restart the OCSP Responder and update the cache once per minute. It is only required on the VAP or server side of a HotSpot 2.0 R2 network. Currently you will need to manually clean up old processes if you are re-doing this step.

```
su - root
cd /home/lanforge
. lanforge.profile
vrf_exec.bash rddVR5 ./ocsp.bash > /dev/null 2>&1 &
```

- C. Start Apache httpd configured for HS20 on the Osen AP. You may need to manually stop old httpd processes. vrf_exec.bash_vap0_httpd -f /etc/httpd/conf/httpd-hs20.conf
- 6. This is the start of the Station side configuration. Do these actions on the Station LANforge system. Create devinfo.xml and devdetail.xml files in /home/lanforge/wifi/osu_wlan2

A. /home/lanforge/wifi/osu_wlan2/devinfo.xml

B. /home/lanforge/wifi/osu_wlan2/devdetail.xml



7. Setup wlan2 as the HotSpot 2.0 R2 client.

A. Modify wlan2 on the Port Mgr tab and set the SSID to the OSEN AP's SSID 'ABCD-1234' in this example and set the authentication to **OSEN**.

Port Status Information Current: DOWN LINK-DOWN GRO NONE Driver Info: Port Type: WIFI-STA Parent: wiphy2 Port Configurables Standard Configuration Advanced Configuration Misc Configuration Custom WiFi Enable General Interface Settings Set IF Down Aux-Mgt Set MAC DHCP-IPv6 DHCP Release DHCP Vendor ID: None Set TX Q Len DHCP-IPv4 Secondary-IPs DHCP Client ID: None Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2"Colspan		wlan2 (ct5	23-3n-f20) Configu	re Settings							
Current: DOWN LINK-DOWN GRO NONE Driver Info: Port Type: WIFI-STA Parent: wiphy2 Port Configurables Standard Configuration Advanced Configuration Misc Configuration Standard Configuration Advanced Configuration Misc Configuration Custom WiFi Enable General Interface Settings Set IF Down Aux-Mgt Port Configuration None Set MAC DHCP-IPv6 DHCP Release DHCP Vendor ID: None Set MTU DHCP-IPv4 Secondary-IPs DHCP Client ID: None Set Offload DNS Servers: BLANK Peer IP: NA Set PROMISC IP Address: 0.0.0 Global IPv6: AUTO P Mask: 0.0.0.0 IPv6 GW: AUTO IPv6 GW: AUTO HTTP Gateway IP: 0.0.0.0 IPv6 GW: AUTO IPv6 IPv6 IPv6 IPv6 NAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 IPv6 IPv6 <th colspan="9">Port Status Information</th>	Port Status Information										
Driver Info: Port Type: WIFI-STA Parent: Wipny2 Port Configurables Standard Configuration Advanced Configuration Misc Configuration Custom WiFi General Interface Settings Set IF Down Advanced Configuration Misc Configuration Custom WiFi General Interface Settings Set IF Down Advanced Configuration Misc Configuration Custom WiFi Set IF Down Advanced Configuration Misc Configuration Custom WiFi Set IF Down Advanced Configuration Misc Configuration Custom WiFi Set IF Down Advanced Configuration Misc Configuration Custom WiFi Set IF Down Advanced Configuration Misc Configuration Set TX Q Len None Set MTU DHCP Client ID: None None PROMISC IP Address: 0.0.0.0 Link IPv6: AUTO FTP Alias: Mote: Mot	Current: DOWN LINK-DOWN GRO NONE										
Port Configurables Standard Configuration Misc Configuration Custom WiFi Enable General Interface Settings Set IF Down Aux-Mgt Set MAC DHCP-IPv6 DHCP Release DHCP Vendor ID: None Set TX Q Len DHCP-IPv4 Secondary-IPs DHCP Client ID: None Image: Color of the secondary-IPs Set Offload DNS Servers: BLANK Peer IP: NA Set PROMISC IP Address: 0.0.0.0 Global IPv6: AUTO Services IP Mask: 0.0.0.0 Inki IPv6: AUTO HTTP Gateway IP: 0.0.0.0 IPv6 GW: AUTO HTTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:0 TX Q Len 1000 RADIUS MAC Addr: 00:03:7f:00:00:0 TX Q Len 1000 PROMISC SSID: ABCD-1234 AP: DEFAULT PROMISC SSID: ABCD-1234 AP: DEFAULT GSO Enabled Freq/Channel: 5180/36 Rate: 0S Default Freq/Channel: 5	Driver Info: Port Type: WIFI-STA Parent: wiphy2										
Standard Configuration Advanced Configuration Misc Configuration Custom WiFi Enable General Interface Settings Set IF Down Aux-Mgt Set MAC DHCP-IPv6 DHCP Release DHCP Vendor ID: None Set TX Q Len DHCP-IPv4 Secondary-IPs DHCP Client ID: None Image: Control of the secondary-IPs Set MTU DHCP-IPv4 Secondary-IPs DHCP Client ID: None Image: Control of the secondary-IPs Set PROMISC IP Address: 0.0.0.0 Global IPv6: AUTO Set PROMISC IP Mask: 0.0.0.0 Link IPv6: AUTO HTTP Alias: MTU: 1500 HTTP Alias: MTU: 1500 Cow Level Rpt Timer: faster (1 s) WiFi Bridge: NONE PROMISC SSID: ABCD-1234 AP: DEFAULT WiFi Settings SSID: ABCD-1234 AP: DEFAULT Cos Enabled GS Default V GS Default V WPA WPA2 OSEN WEP Disable HT40 Disable SGI <td></td> <td></td> <td>Port Configurab</td> <td>les</td> <td></td>			Port Configurab	les							
Enable General Interface Settings Set IF Down Aux-Mgt Set MAC DHCP-IPv6 DHCP Release DHCP Vendor ID: None Set TX Q Len DHCP-IPv4 Secondary-IPs DHCP Client ID: None Set MTU DNS Servers: BLANK Peer IP: NA Set PROMISC IP Address: 0.0.0.0 Global IPv6: AUTO FTP Mask: 0.0.0.0 IPv6 GW: AUTO HTTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 Rt Timer: faster (1 s) WiFi Bridge: NONE Image: Transition of the settings PROMISC SSID: ABCD-1234 AP: DEFAULT Image: Transition of the settings WIF0 Enabled GSO Enabled Freq/Channel: 5180/36 Rate: 0S Default Image: Transition of the settings WPA WPA 2 OSEN WEP Disable HT40 Disable SGI	Standard Configur	ation Advanc	ed Configuration	Misc Configu	ration Custom WiFi						
Set IF Down Aux-Mgt Set MAC DHCP-IPv6 DHCP Release DHCP Vendor ID: None Set MTU DHCP-IPv4 Secondary-IPs DHCP Client ID: None Set MTU DHCP-IPv4 Secondary-IPs DHCP Client ID: None Set MTU DHCP-IPv4 Secondary-IPs DHCP Client ID: None Set Offload DNS Servers: BLANK Peer IP: NA Set PROMISC IP Address: 0.0.0 Global IPv6: AUTO HTTP Gateway IP: 0.0.0 IPv6 GW: AUTO HTTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 RADIUS Rpt Timer: faster (1 s) WiFi Bridge: NONE PROMISC SSID: ABCD-1234 AP: DEFAULT VFO Enabled Key/Phrase: Mode: 802.11abqn-AC Freq/Channel: 5180/36 Rate: OS Default V GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	Enable —		General In	terface Settin	ngs						
Set MAC DHCP-IPv6 ✓ DHCP Release DHCP Vendor ID: None Set TX Q Len ✓ DHCP-IPv4 Secondary-IPs DHCP Client ID: None ✓ Set Offload DNS Servers: BLANK Peer IP: NA ✓ Set Offload IP Address: 0.0.0 Global IPv6: AUTO Set PROMISC IP Address: 0.0.0 Link IPv6: AUTO HTTP Gateway IP: 0.0.0 IPv6 GW: AUTO HTTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 RADIUS Rpt Timer: faster (1 s) WiFi Bridge: NONE ✓ PROMISC SID: ABCD-1234 AP: DEFAULT ✓ UFO Enabled SSID: ABCD-1234 AP: DEFAULT ✓ LRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	Set IF Down	✓ Down	Aux-Mgt								
Set TX Q Len ✓ DHCP-IPv4 Secondary-IPs DHCP Client ID: None ▼ Set Offload DNS Servers: BLANK Peer IP: NA ▼ Set PROMISC IP Address: 0.0.0 Global IPv6: AUTO ■ HTTP Gateway IP: 0.0.0 Link IPv6: AUTO ■ HTTP Gateway IP: 0.0.0 IPv6 GW: AUTO ■ HTTP Alias: MTU: 1500 ■ ■ ■ RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 ■ ■ Low Level Rpt Timer: Faster (1 s) ✓ WiFi Bridge: NONE ▼ PROMISC SSID: ABCD-1234 ✓ AP: DEFAULT ✓ UFO Enabled SSID: ABCD-1234 ✓ AP: DEFAULT ✓ UFO Enabled Key/Phrase: Mode: 802.11abqn-AC ✓ GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	Set MAC		DHCP Release	DHCP Vendo	r ID: None						
Set MTU Difference Set Offload Set Offload DNS Servers: BLANK Peer IP: NA Set PROMISC IP Address: 0.0.0 Global IPv6: AUTO IP Address: 0.0.0 Link IPv6: AUTO HTTP Gateway IP: 0.0.0 IPv6 GW: AUTO HTTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 Row Level Rpt Timer: faster (1 s) WiFi Bridge: NONE ▼ PROMISC SID: ABCD-1234 AP: DEFAULT EFAULT LRO Enabled SID: ABCD-1234 AP: DEFAULT V GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	Set TX Q Len		Secondary-IRs	DHCP Client	ID: None						
Set Offload DNS Servers: BLANK Peer IP: NA Set PROMISC IP Address: 0.0.0.0 Global IPv6: AUTO Services IP Mask: 0.0.0.0 Link IPv6: AUTO HTTP Gateway IP: 0.0.0.0 IPv6 GW: AUTO FTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 Low Level Rpt Timer: Faster (1 s) WiFi Bridge: NONE ▼ PROMISC WiFi Settings SSID: ABCD-1234 AP: DEFAULT ✓ GSO Enabled Freq/Channel: S180/36 Rate: OS Default ▼ GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	Set MTU		DIANK		None V						
Set PROMISC IP Address. 0.0.0.0 Global IPV0. A010 Services IP Mask: 0.0.0.0 Link IPv6: AUTO HTTP Gateway IP: 0.0.0.0 IPv6 GW: AUTO FTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 Low Level Rpt Timer: Faster (1 s) ▼ WiFi Bridge: NONE ▼ PROMISC WiFi Settings SSID: ABCD-1234 ▲ AP: DEFAULT ▼ UFO Enabled SSID: ABCD-1234 ▲ AP: DEFAULT ▼ LRO Enabled Freq/Channel: 5180/36 Rate: 0S Default ▼ WPA WPA2 OSEN WEP Disable HT40 Disable SGI	Set Offload	DNS Servers:	DNS Servers: BLANK Peer IP: NA								
Services In Filask. 0.0.0.0 Entri Proc. A010 HTTP Gateway IP: 0.0.0.0 IPv6 GW: AUTO FTP Alias: MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 Low Level Rpt Timer: faster (1.s) WiFi Bridge: NONE PROMISC WiFi Settings SSID: ABCD-1234 AP: DEFAULT Key/Phrase: Mode: 802.11abgn-AC Freq/Channel: 5180/36 Rate: OS Default V WPA WPA2 OSEN WEP Disable HT40	Set PROMISC	IP Mack:	IP Address: 0.0.0.0 Global IPv6: AU10								
HTTP Gleenay n. 1 Store Alias: Alias: MTU: 1500 FTP Alias: MTU: 1500 MTU: 1500 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 Low Level Rpt Timer: faster (1 s) WiFi Bridge: NONE PROMISC WiFi Settings SSID: ABCD-1234 AP: DEFAULT Key/Phrase: Mode: 802.11abgn-AC Freq/Channel: SID: ABCD-1234 OS Default V	-Services-	Gateway IP	0.0.0.0	IPv6 GW:	AUTO						
Prip Andor 0:03:7f:00:00:00 TX Q Len 1000 RADIUS MAC Addr: 00:03:7f:00:00:00 TX Q Len 1000 Low Level Rpt Timer: Faster (1 s) WiFi Bridge: NONE PROMISC WiFi Settings TSO Enabled SSID: ABCD-1234 AP: DEFAULT Key/Phrase: Mode: 802.11abgn-AC Freq/Channel: 5180/36 Rate: OS Default GGO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI		Alias:	0.0.0	MTU:	1500						
Low Level Rpt Timer: faster (1 s) WiFi Bridge: NONE PROMISC WiFi Settings TSO Enabled SSID: ABCD-1234 AP: DEFAULT UFO Enabled Key/Phrase: Mode: 802.11abgn-AC Freq/Channel: 5180/36 LRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI		MAC Addr:	00:03:7f:00:00:00	TX O Len	1000						
Low Level Npt Thildel: Wir bridge: Protection PROMISC WiFi Settings TSO Enabled SSID: ABCD-1234 AP: DEFAULT UFO Enabled Key/Phrase: Mode: 802.11abgn-AC Image: Contection LRO Enabled Freq/Channel: 5180/36 Rate: OS Default Image: Contection GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	ADIUS	Rot Timer:	faster (1 s)	WiFi Bridge	NONE						
WiFi Settings Image: State of the state of t		The filler.		wiir bridge.							
SSID: ABCD-1234 ABCD-1234 AP: DEFAULT GSO Enabled Key/Phrase: Mode: 802.11abqn-AC LRO Enabled Freq/Channel: 5180/36 Rate: OS Default GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	TSO Enabled	_	WiF	i Settings							
GSO Enabled Key/Phrase: Mode: 802.11abqn-AC LRO Enabled Freq/Channel: 5180/36 Rate: OS Default GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI		SSID:	ABCD-1234	▼ AP:	DEFAULT						
LRO Enabled Freq/Channel: 5180/36 Rate: OS Default Image: Control of the state of t	GSO Enabled	Key/Phrase:		Mode:	802.11abqn-AC 💌						
GRO Enabled WPA WPA2 OSEN WEP Disable HT40 Disable SGI	LRO Enabled	Freq/Channel: 5180/36 Rate: OS Default									
	GRO Enabled	🗌 WPA 🗌 WPA2 🗹 OSEN 🗌 WEP 🗌 Disable HT40 🗌 Disable SGI									
	View Details	Probe	Display Scan	Sync	Apply OK						

B. In wlan2 Advanced WiFi Settings, select Advanced/802.1x, set Key Management, EAP Identity and CA Cert File.

	Current: DOWN LI	US VK-	DOWN GRO NO	NE
	Driver Info: Port Type	e: V	VIFI-STA Parent	t: wiphy2
	Port Co	onf	igurables	
Standard Configurati	on Advanced Config	ura	tion Misc Cor	figuration Custom WiFi
	Advanced	1 11	IFI Settings	
Select 'WPA2' on th and enable Advance	he Standard Configura ced/802.1x to enable m	tio osi	n screen to ena t of these. Enab	ble Advanced/802.1x ling 802.11u enables others.
Key Management:	OSEN	•	HESSID:	
Pairwise Ciphers:	DEFAULT	-	Realm:	
Group Ciphers:	DEFAULT	-	Client Cert:	
WPA PSK:			IMSI:	
EAP Methods:	DEFAULT	-	Milenage:	
EAP Identity:	osen@lanforge.com		Domain:	
EAP Anon Identity:		_	Consortium:	
EAP Password:			Phase-1:	
EAP Pin:			Phase-2:	
Private Key:			PK Password:	
CA Cert File:	/home/lanforge/ota-ca.p	em	PAC File:	
Network Auth:			leee80211w:	Disabled (0) 💌
Advanced/802.1	x 🗌 Enable 802.11u		HotSpot 2.0	Enable PKC

C. In wlan2 Misc Configuration, set OCSP to Required.

w	lan2 (ct523-3n-f20)	Co	onfigure Settings		\sim		
	Port Status Information						
C	urrent: DOWN LINI	<-D	OWN GRO NONE				
D	river Info: Port Type:	WI	FI-STA Parent: w	iphy2			
	Port Cor	nfig	jurables				
Standard Configuration	Advanced Configu	rat	ion Misc Configu	uration Custom WiFi	1		
	More Wi	Fi 9	Settings		1		
OCSP:	Required (2)	-]				
Freq-2.4:	0xfffffff		Freq-5:	0xfffffff			
AMPDU-Factor:	OS Default	-	AMPDU-Density:	OS Default 🗸			
Max-AMSDU:	OS Default	-	Bridge-IP:	0.0.0.0			
X-Coordinate:	0		Y-Coordinate:	0			
Z-Coordinate:	0		j				
Post IF-UP Script:							
Custom WPA Cfg WPA Cfg:							
🗌 Scan Hidden 🔲 /	Allow Migration 🔲 IBS	ss	Mode		·		
Restart DHCP on	Connect Sk	rin	Portal on Boam				
		"P					
		_					
	Deska Dist						
view Details	Probe Display	Sca	in Sync	Арріу ОК	Cance		

- D. Admin up wlan2 and it will associate with the OSEN AP and obtain an IP address on the OSEN AP IP network.
- 8. Initiate Online Sign-Up
 - A. Some notes about the following command: We use the LD_PRELOAD trick to override the default DNS servers in the hs20-osu-client program. This means you need to know the DNS ahead of time, and set it with the NAMESERVER environment variable. A second DNS server could be set as NAMESERVER2. In a terminal window type the following:

cd /home/lanforge/wifi/osu_wlan2 LD_PRELOAD=/home/lanforge/local/lib/resolvconf-override.so NAMESERVER1=7.1.3.2 \ vrf_exec wlan2 ~lanforge/local/hs20/client/hs20-osu-client -x /home/lanforge/local/hs20/spp/spp.xsd -dd -S wlan2 signup

B. Select 'LANforge HS20 Operator' from the Service Provider List.

Hotspot 2.0 client (as superuser)	\sim \times
Select service operator	
Select service operator	
[eng] LANforge HS20 Operator	
[eng] LANforge Example services	
20010-00-06-22-17-48	
SSID: ABCD-1234	
JRL: https://osu-server.ct523-3n-f20.lanforge.local/hs20/spp.php/signup?realm=ct523-3n-f20.lanforge.local nethods: OMA-DM SOAP-XML-SPP	

C. Select 'Sign up for free access' from the Online Sign-Up page.

Hotspot 2.0 signup (as superuser)	$\mathbf{S} \otimes \mathbf{S}$						
Sign up for a subscription - ct523-3n-f20.lanforge.local							
Sign up for free access							
Select a username and password. Leave password empty to get automatically generated and machine managed password. Username: Password: Complete subscription registration							
Enroll a client certificate							

D. Select the Accept button to complete the Online Sign-Up.



- 9. The wlan2 station will obtain an IP address on the Passpoint AP IP network and should be able to access the internet
- 10. If wlan2 is reset or reassociates with the OSEN AP, you will have to remove the Service Provider (SP) directory before attempting the Online Sign-Up again.

 cd
 /home/lanforge/wifi/osu_wlan2

 rm
 -rf
 SP
- 11. NOTES: We found it very difficult to get all of the details correct in this example. Here are some debug notes and links to certain files that may help others or ourselves debug this in the future.
 - A. /etc/hosts on the AP system.
 - B. /etc/hosts on the Station system.
 - C. apache_hs20_config.tar.gz configuration files.
 - D. To debug pem files: openssl x509 -in /home/lanforge/hs20/ca/signup-server.pem -text -noout

Candela Technologies, Inc., 2417 Main Street, Suite 201, Ferndale, WA 98248, USA www.candelatech.com | sales@candelatech.com | +1.360.380.1618