

How to Configure a Simple Access Point Router on the UC-8100-LX

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1 Introduction

The purpose of this technical note is to document the procedure to build a wireless Wi-Fi router using the UC-8100-LX series, which consists of UC-8131-LX, UC-8132-LX, UC-8162-LX, and UC-8112-LX. The UC-8100-LX product line comes equipped with a wireless module and is suitable for Linux programmers who prefer to design their own Wireless Access Routers, instead of purchasing off-the-shelf solutions. The UC-8100 wireless computing platform is especially useful in applications that require a reliable and secure gateway computer to do both data acquisition and data processing for field devices with wireless capabilities. Configuring a Wireless Access Point Router on the UC-8100-LX consists of the following two parts:

Part 1: Setting up the link layer

The `hostapd` package that you configure here will help wireless clients associate with the software Access Point on the UC-8100-LX and send or receive IP packets.

Part 2: Setting up the network configuration

The second part is about setting up the network configuration to enable communication between the UC-8100-LX and the wireless clients that connect to it.

NOTE	A basic understanding of Linux is required before you read this document. The procedure specified in this document might not work with other Moxa products because of the different versions of the Debian OS used.
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2 Hardware Requirement

To build a Wireless Access Point Router, you will require the following:

- A product in the UC-8100-LX series
- WiFi-BGN package
- (optional) ANT-WDB-ARM-02 antenna

For applications that acquire and store data, we also recommend a 2 GB microSD card with pre-installed OS.

3 Software Requirement

The UC-8100-LX comes pre-installed with the Debian Linux distribution. The Debian distribution provides a management tool, the Advanced Package Tool (APT), which allows you to install the Debian software packages from the Moxa repository, either locally, or through the Internet. You will require the following three software packages: `hostapd`, `haveged`, and `isc-dhcp-server`. In addition to these, you will also require the Ralink firmware to enable the access point features in the UC-8100-LX chipset.

To install the Debian software packages, login to the console port as the `root` user, enable network access, and type the following command:

```
apt-get install isc-dhcp-server hostapd haveged firmware-ralink -y
```

4 Configuring a Wireless Access Point Router on the UC-8100-LX

The configuration of a Wireless Access Point Router on the UC-8100-LX consists of the following:

4.1 Configuring the `hostapd` Package

The `hostapd` daemon enables the wireless link layer by creating a station that wireless devices can connect to. In the following example, we have selected `WPA2` encryption to secure the connection between the wireless station, and the wireless infrastructure. The network SSID is set to `ILove5566` and SSID broadcast is disabled to facilitate troubleshooting of network issues. The modified content of the `/etc/hostapd.conf` file based on these new configuration settings are shown below:

```
interface=wlan0
driver=nl80211
ssid=ILove5566
hw_mode=g
channel=4
macaddr_acl=0
ignore_broadcast_ssid=0
wpa=3 # wpa/wpa2
wpa_passphrase=55665566
wpa_key_mgmt=WPA-PSK
```

```
wpa_pairwise=TKIP CCMP
#wpa_pairwise=TKIP
rsn_pairwise=CCMP
wmm_enabled=1
ieee80211n=1
auth_algs=1
ht_capab=[HT40+][SHORT-GI-40]
#beacon_int=100
# Country code (ISO/IEC 3166-1). Used to set regulatory domain.
# Set as needed to indicate country in which device is operating.
# This can limit available channels and transmit power.
#country_code=US
```

4.2 Configuring the Ethernet Network

The UC-8100 Ethernet network configuration consists of setting up the network interface and building a daemon that can assign IP addresses to the clients that connect to the UC-8100. The **LAN 1** Ethernet port on the UC-8100 is configured with a pre-defined static IP address, 192.168.3.127, and a netmask 255.255.255.0. The outbound Ethernet interface on the port is set up as a default gateway with the IP address, 192.168.3.254.

The network configuration files for Debian distribution are located in the `/etc/network` directory. For this example, you need to modify the files corresponding to the Ethernet wireless interfaces. The `ifconfig` command is used to configure the wireless interfaces (see *4.5 Setting Up UC-8100 to Automatically Boot Up as an AP Router*).

```
auto eth0 eth1 lo
iface lo inet loopback
# embedded ethernet LAN1
iface eth0 inet static
    address 192.168.3.127
    network 192.168.3.0
    netmask 255.255.255.0
    broadcast 192.168.3.255
# embedded ethernet LAN2
iface eth1 inet static
    address 192.168.4.127
```

```
network 192.168.4.0
netmask 255.255.255.0
broadcast 192.168.4.255
```

4.3 Setting Up the DHCP Server and the Wireless Interface

A DHCP server is used to authenticate client devices. Only the client devices that pass authentication are assigned IP addresses, and can connect to the internet. To enable the DHCP service, you need to define the IP address pool, and the interface(s) to which clients can send their requests. Modify `/etc/dhcp/dhcpd.conf`, the DHCP configuration file, which is used to define the IP address pool as follows:

```
subnet 10.10.0.0 netmask 255.255.255.0 {
    range 10.10.0.25 10.10.0.50;
    option routers 10.10.0.1;
    option subnet-mask 255.255.255.0;
    option broadcast-address 10.10.0.255;
    option domain-name-servers 192.168.50.33;
    interface wlan0;
```

NOTE	The "option domain-name-servers" depend on the configuration of your DNS server.
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After you have set up the DHCP server, modify the `/etc/default/isc-dhcp-server` file to configure wireless interfaces that listen for client requests, as shown in the example below:

```
# Path to dhcpd's config file (default: /etc/dhcp/dhcpd.conf).
DHCPD_CONF=/etc/dhcp/dhcpd.conf

# Path to dhcpd's PID file (default: /var/run/dhcpd.pid).
DHCPD_PID=/var/run/dhcpd.pid

# Additional options to start dhcpd with.
# Don't use options -cf or -pf here; use DHCPD_CONF/ DHCPD_PID instead
#OPTIONS=""
```

```
# On what interfaces should the DHCP server (dhcpd) serve DHCP requests?  
# Separate multiple interfaces with spaces, e.g. "eth0 eth1".  
INTERFACES="wlan0"
```

To prevent interference between the Wi-Fi module and the DHCP server during system boot up, remove the `isc-dhcp-server` entry from the `init.d` service and type the following at the command line:

```
# inserv -r isc-dhcp-server
```

To configure UC-8100 as a simple Access Point, you need to run the `hostapd` and `dhcpd` packages, and setup the wireless interface. Type the following at the command line to setup the wireless interface:

```
ifconfig wlan0 10.10.0.1 netmask 255.255.255.0  
hostapd /etc/hostapd/hostapd.conf -B  
/etc/init.d/isc-dhcp-server start
```

In the above example, the wireless interface (`wlan0`) is assigned the IP address 10.10.0.1.

NOTE	Since the wireless interface is an inbound interface, the IP address assigned to the wireless clients will be in the 10.10.0.0 C class range.
-------------	---

4.4 Setting Up Network Address Translation

To set up Network Address Translation (NAT) for inbound to outbound requests on the UC-8100-LX, type the following at the command line:

```
echo "1" > /proc/sys/net/ipv4/ip_forward  
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
```

However, NAT service does not automatically run on system boot up. If you want to set up UC-8100-LX as an Access Point Router when it boots up, refer to *4.5 Setting Up UC-8100 to Automatically Boot Up as an AP Router*.

4.5 Setting Up UC-8100 to Automatically Boot Up as an AP Router

To automatically run your UC-8100 as an AP router, you need to enable the following at boot up:

- wlan0
- hostapd package
- DHCP server
- NAT

Modify the `rc.local` file located at `/etc/rc.local` as illustrated in the following example:

```
#!/bin/sh -e
#
# rc.local
#
# This script is executed at the end of each multiuser runlevel.
# Make sure that the script will "exit 0" on success or any other
# value on error.
#
# In order to enable or disable this script just change the execution
# bits.
#
# By default this script does nothing.

# Setup wlan0
ifconfig wlan0 10.10.0.1 netmask 255.255.255.0

# Enable hostapd
hostapd /etc/hostapd/hostapd.conf -B

# Enable dhcpd
/etc/init.d/isc-dhcp-server start

# Enable IP forward
echo "1" > /proc/sys/net/ipv4/ip_forward
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE

exit 0
```

5 Troubleshooting

Most Debian distributions provide a system log that contains detailed information on the current process and system status for easy troubleshooting. The UC-8100-LX comes with a default system log package, `rsyslogd`, which you can enable during system boot up using the following command:

```
# insserv -d rsyslog
```

If you want `rsyslogd` to record current activity but not start automatically on boot up, use the following command:

```
# /etc/init.d/rsyslog start
```

You can view the log file to check a log entry recorded by the `rsyslog` daemon using the following command:

```
# cat /var/log/syslogd
```

6 References

https://wiki.archlinux.org/index.php/Software_access_point

<https://wiki.debian.org/Apt>

<http://www.moxa.com/product/uc-8100.htm>