

Linux PPPd for LTE CAT M1 Verizon Skywire[®] on Beaglebone Black

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1. Introduction

1.1 Orderable Part Numbers

Orderable Device	Description	Carrier	Network Type
NL-M1DK	Skywire M1 Development Kit	Any	Any
NL-SW-LTE-SVZM20-ES	LTE CAT M1, Engineering Sample	Verizon	LTE
NL-SW-LTE-SVZM20	LTE CAT M1	Verizon	LTE

1.2 Prerequisites



This document assumes you have completed the initial setup of your modem and development kit using the Skywire® M1 Development Kit User Manual up to and including Section 4.9:

<http://nimbelink.com/skywire-m1dk/user-manual/>

If you have not completed those steps, refer to the link above and complete the modem setup before proceeding.

If you are using a device that is communicating via SSH, Telnet, or any other type of Ethernet interface, you must connect to it via USB or serial. Section 2.9 requires the Ethernet interface to be taken down.

2. PPP - 4G LTE CAT M1

2.1 Overview

This example has been tested on the following distributions of Linux:

- BeagleBone Black Debian 8 Kernel 4.4.xx

using a Skywire® NL-SW-LTE-SVZM20 Verizon CATM1 LTE modem. If you are using a different Linux distribution, you may need additional steps to get PPP working.

This example is written using a Beaglebone Black and a NL-AB-BBBC add-on board.

2.2 NL-AB-BBBC Installation Note

The NL-SW-LTE-SVZM20 Skywire modem communicates using the UART protocol. Because of this, there is no requirement to connect the mini-USB cable from the NL-AB-BBBC to the Beaglebone Black; UART communication occurs over the cape headers.

2.3 Elevate to root

In order to make the changes necessary, it is necessary to login to the root account. Log in as the root user, or elevate to root user:

```
$ sudo su
```

You will be prompted to enter your password: enter it, followed by the Enter key.

2.4 Install the "ppp" Package (if necessary)

If necessary, install the ppp package by typing the following command:

```
# apt-get install ppp
```

2.5 Install a Terminal Program (if necessary)

If necessary, install a terminal program of your choice. This example uses picocom:

```
# apt-get install picocom
```

2.6 Verify The Skywire is Connected

It is helpful to verify that we can communicate with the modem using AT commands. You can use your favorite terminal program to do this: screen, minicom, picocom, etc. This example uses the built-in picocom, which is a simple terminal program for serial communications.

The syntax for picocom used in this example is:

```
# picocom -b [baudrate] [port]
```

On the Beaglebone Black Cape, the Skywire's UART communications use:

```
/dev/ttyS4
```

Note: If you are using a different development kit or add-on board--particularly if you are plugging in via a USB-to-UART adapter--it may be necessary to determine how the UART port enumerates on your device. For example, if you are using a NimbeLink CATM1 Development Kit (NL-M1DK), two ports enumerate (both /dev/ttyUSB ports), and you would use the lower-numbered of the two ports.

Issue the command:

```
# picocom -b 921600 /dev/ttyS4
```

followed by the Enter key, and you will open miniterm.py, connected to the Skywire.
Type:

```
AT
```

and you will get a response:

```
OK
```

If you would like to enable echo to see the AT commands, issue:

```
ATE1
```

followed by the Enter key, and you will get the response:

```
OK
```

Now, you can see AT commands as you type them.

Leave picocom open for the next step.

2.7 Write PPP Scripts

We need to write two scripts for PPP to reference when initializing the connection.

Note: We have a GitHub page with the necessary PPP files available for customers to use located here:

<https://github.com/NimbeLink/skywire-ppp-scripts>

We highly recommend downloading that repo and following the instructions in the files related to your modem. The other recommended option is to click on the file you want and copy and paste directly from GitHub.

First, clone the repo and navigate to the cloned repo. Next, as superuser (root) copy the file:

```
vzw-SVZM2x
```

```
to:
```

```
/etc/ppp/peers/
```

or copy-and-paste the contents of:

vzw-SVZM2x

from the GitHub repo to

/etc/ppp/peers/vzw-SVZM2x

The contents of vzw-SVZM2x are shown below:

```
/dev/ttyS4
```

```
921600
```

```
connect "/usr/sbin/chat -v -f /etc/ppp/peers/vzw-SVZM2x-chat"
```

```
noauth
```

```
defaultroute
```

```
usepeerdns
```

```
local
```

```
debug
```

```
updetach
```

Next, copy:

vzw-SVZM2x-chat

to:

/etc/ppp/peers/

or copy-and-paste the contents of

vzw-SVZM2x-chat

from the GitHub repo to

/etc/ppp/peers/vzw-SVZM2x-chat

The contents of vzw-SVZM2x-chat are shown below:

```
TIMEOUT 3
ECHO ON
'' AT
OK AT+CGDCONT=3, "IPV4V6", "[apn]"
OK AT+CFUN=1
OK AT+CGATT=1
OK AT+CGDATA="ppp", 3, 1
CONNECT ''
```

Change [apn] to your APN.

*Note: at time of publishing, private network support on M1 network is not in place, so VZWINTERNET is the APN that should be used. When device firmware supports private networks, all go.nimbelink.com data plans use the APN NIMBLINK.GW12.VZWENTP.

2.8 Take Down the Ethernet Interface

A PPP connection requires that any existing Ethernet connection be taken down. To bring down the Ethernet connection, type the following command:

```
# ifconfig eth0 down
```

(Optional) To verify that the Ethernet connection is down, type:

```
# ifconfig
```

followed by the Enter key. `eth0` should not be listed.

2.9 Bring Up the PPP Interface

To enable the PPP interface, type the following commands:

```
# pon vzw-SVZM2x
```

followed by the enter key. You will see the second script you wrote appear on the screen, followed by the network communication the Skywire modem is going through to get connected.

Once the process is complete, test the connection:

```
# ping -c 2 www.google.com
```

and you should receive a response similar to this:

```
PING www.google.com (216.58.216.196) 56(84) bytes of data.  
64 bytes from ord31s21-in-f4.1e100.net (216.58.216.196): icmp_seq=1 ttl=50 time=47.8 ms  
64 bytes from ord31s21-in-f4.1e100.net (216.58.216.196): icmp_seq=2 ttl=50 time=90.6 ms  
  
--- www.google.com ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1001ms  
rtt min/avg/max/mdev = 47.818/69.237/90.656/21.419 ms
```

This indicates that your PPP connection is up and connected to the network.

2.10 Troubleshooting

- If your PPP fails with the error 0x1 in Section 2.9, chances are your `vzw-SVZM2x` file cannot see your `vzw-SVZM2x` file. Ensure that the last part of line 3 of the `vzw-SVZM2x` file:

```
.../vzw-SVZM2x-chat
```

has the same name as your `vzw-SVZM2x-chat` file. The tool `xxd` may be beneficial to ensure that there are no extra characters in the file and that the files are named the same:

```
$ xxd vzw-SVZM2x
```

If you are still having issues, rename the last part of line 3 in the `vzw-SVZM2x` file to:

```
.../vzw
```

and rename `vzw-SVZM2x-chat` to `vzw` and try again.

- If your PPP fails with the error 0x3 in Section 2.10, you may have poor signal strength. Move the unit closer to a window for a better signal strength.
- If your PPP still fails with error 0x3 in Section 2.10, your APN may be incorrect. Verify that your APN is correct when you set it in Section 2.7.