

# Enabling CDC-ETHER Connection for Skywire<sup>®</sup> CAT1

NimbeLink Corp

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## 1. Introduction

### 1.1 Orderable Part Numbers

Orderable Device	Description	Carrier	Network Type
NL-SW-LTE-GELS3	Skywire CAT1 LTE Firmware 4.3.1.0	Verizon	LTE
NL-SW-LTE-GELS3-B	Skywire CAT1 LTE Firmware 4.3.2.0	Verizon	LTE
NL-SW-LTE-GELS3-C	Skywire CAT1 LTE Firmware 4.3.3.0	Verizon	LTE
NL-AB-BBBC	Skywire BeagleBone Black Cape	Any	Any

## 1.2 Overview

The Skywire® CAT1 LTE modem supports CDC\_ETHER, an Ethernet over USB protocol that allows for an easy data connection. This application note provides a working example of setting up the CDC\_ETHER connection on a BeagleBone Black.

## 1.3 A Note on CDC\_ETHER

For CDC\_ETHER to work, the Linux kernel needs to have support for the CDC\_ETHER USB device class built in. If it does, then when the modem is connected via USB, an ethernet device will simply appear (usually as “usb0”, “usb1”, etc.). If it does not appear, then chances are the Linux kernel version you have does not support CDC\_ETHER.

## 1.4 Testing

This procedure was tested on the following OSs and hardware:

### Hardware

BeagleBone Black Rev. 3

### Operating Systems Supported

Debian 8.3 (Kernel 4.1.15-ti-rt-r43)

### Operating Systems found as NOT Supported by default

Debian 7.x (Kernel 3.8.x)

# 2. BeagleBone Black Setup

## 2.1 Overview

Setting up the CDC\_ETHER connection on the BeagleBone Black allows for automatic setup and connection, providing an easy way to get a internet data connection to your BeagleBone Black.

## 2.2 BeagleBone Black Setup

Start your BeagleBone Black and log in as `root`.

Edit the following file with your favorite text editor. This example uses `nano`:

```
# nano /etc/network/interfaces
```

There will be setup for having the USB port share internet with your workstation, and unless it has been edited, will read as follows:

```
# Ethernet/RNDIS gadget (g_ether)
# Used by: /opt/scripts/boot/autoconfigure_usb0.sh
iface usb0 inet static
    address 192.168.7.2
    netmask 255.255.255.252
    network 192.168.7.0
    gateway 192.168.7.1
```

By default, this enables sharing internet access over the USB port from a PC. Comment out the lines that set up this connection to prevent conflict with the CDC\_ETHER connection:

```
# Ethernet/RNDIS gadget (g_ether)
# Used by: /opt/scripts/boot/autoconfigure_usb0.sh
#iface usb0 inet static
#    address 192.168.7.2
#    netmask 255.255.255.252
#    network 192.168.7.0
#    gateway 192.168.7.1
```

Save and close the file, and reboot the BeagleBone Black:

```
# reboot
```

## 2.2 Modem Setup

You will need to set your APN in the modem. To do this, connect to the modem using a terminal program such as `screen`, `minicom`, or `picocom`. This example uses `picocom`, and the modem will show up as `/dev/ttyACM0`:

```
# picocom -b 115200 /dev/ttyACM0
```

Once connected, issue the following command:

```
AT+CGDCONT=3,"IPV4V6","[your apn]"
```

replacing `[your apn]` with the APN of your SIM. For instance, if you setup your modem with a Public Static IP address, you would enter:

```
AT+CGDCONT=3,"IPV4V6","mw01.vzwinternet"
```

Depending on the firmware of the modem you are using, you may need to issue an AT command to enable `CDC_ETHER` functionality.

To check the firmware of your modem, connect to it using a terminal program such as `screen`, `minicom`, or `picocom`. This example uses `picocom`, and the modem will show up as `/dev/ttyACM0`:

```
# picocom -b 115200 /dev/ttyACM0
```

Once connected, issue the following command to check the firmware version:

```
ATI
```

If you have version 4.3.1.0c, exit your terminal program, shutdown the Beaglebone Black, and power cycle the modem and Beaglebone Black, making sure to remove both USB and DC power. Reboot, and then continue to step 2.3. If you have version 4.3.2.0, issue the command:

```
ATI1
```

If your version listed on the line `A-REVISION` is 4.3.2.0-22272, exit your terminal program, shutdown the Beaglebone Black, and power cycle the modem and Beaglebone Black, making sure to remove both USB and DC power. Reboot, and then continue to step 2.3.

If your version listed on the line `A-REVISION` is 4.3.2.0-25132 or greater, or 4.3.3.0-29632 or greater, the `CDC_ETHER` connection does not start on power up. In order for it to start by default, issue the following command:

```
AT+SQNAUTOINTERNET=1
```

Exit your terminal program, shutdown the Beaglebone Black, and power cycle the modem and Beaglebone Black, making sure to remove both USB and DC power. Reboot, and then continue to step 2.3.

## 2.3 Verify and Test The Connection

Once the BeagleBone Black has rebooted, log in. The CDC\_ETHER connection will automatically come up as `usb1`:

```
# ifconfig
eth0      Link encap:Ethernet  HWaddr 68:9e:19:8f:eb:0d
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:177

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:180 errors:0 dropped:0 overruns:0 frame:0
          TX packets:180 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:14888 (14.5 KiB)  TX bytes:14888 (14.5 KiB)

usb1      Link encap:Ethernet  HWaddr 02:10:81:64:82:60
          inet addr:192.168.15.144  Bcast:192.168.15.255
          Mask:255.255.255.0
          inet6 addr: 2600:1014:b058:dacd:10:81ff:fe64:8260/64
          Scope:Global
          inet6 addr: fe80::10:81ff:fe64:8260/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:145 errors:0 dropped:0 overruns:0 frame:0
          TX packets:204 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:15402 (15.0 KiB)  TX bytes:26119 (25.5 KiB)
```

You can now test the connection:

```
# ping google.com
PING google.com (63.84.3.23) 56(84) bytes of data.
64 bytes from 63.84.3.23: icmp_seq=1 ttl=52 time=45.0 ms
64 bytes from 63.84.3.23: icmp_seq=2 ttl=52 time=51.0 ms
64 bytes from 63.84.3.23: icmp_seq=3 ttl=52 time=62.3 ms
64 bytes from 63.84.3.23: icmp_seq=4 ttl=52 time=54.9 ms
64 bytes from 63.84.3.23: icmp_seq=5 ttl=52 time=307 ms
64 bytes from 63.84.3.23: icmp_seq=6 ttl=52 time=55.3 ms
64 bytes from 63.84.3.23: icmp_seq=7 ttl=52 time=59.8 ms
^C
--- google.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 20066ms
rtt min/avg/max/mdev = 45.068/90.926/307.869/88.724 ms
```

Your CDC\_ETHER connection is now setup.

## 3 Troubleshooting

### No connection in Section 2.3

Firmware version: 25132 and newer

If you do not get an internet connection with your testing in Section 2.3, use your terminal program to connect to the Skywire and issue the following command:

```
AT^SICA?
```

If the response looks similar to below:

```
^SICA: 1,1
```

```
^SICA: 2,0
```

```
^SICA: 3,1
```

```
^SICA: 4,0
```

```
^SICA: 8,0
```

Specifically, if the third line read:

```
^SICA: 3,0
```

Then the modem was not able to connect to the network correctly. The most common reason for this is the APN is not correct. Verify that your APN is correct and re-enter it. If you signed up for service at [go.nimbelink.com](http://go.nimbelink.com), the default APN is:

```
NIMBLINK.GW12.VZWENTP
```

If you specifically requested a Public Dynamic IP address, the default APN is:

```
VZWINTERNET
```

If you specifically requested a Public Static IP address, the default APN is:

```
MW01.VZWSTATIC
```

However, this APN differs by region.

If the above options do not work and you signed up for service through NimbeLink, please contact us at:

[product.support@nimbelink.com](mailto:product.support@nimbelink.com)

to get your APN information. Please include your SIM ID and IMEI of your Skywire .

If you signed up for service directly through Verizon or through another partner, please contact Verizon or that partner to get your APN information.