

Configuring Linux ‘pppd’ for Skywire[®] LTE NL-SW-LTE-S7xxx Modem Family

NimbeLink Corp

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1. Introduction

1.1 Applies to the Following Part Numbers

Orderable Device	Description	Manufacturer	Carrier	Network Type
NL-SW-LTE-S7618RD	4G LTE CAT1	NimbeLink	Verizon	LTE
NL-SW-LTE-S7648	4G LTE CAT1	NimbeLink	AT&T/T-Mobile	LTE
NL-SW-LTE-S7588-V	4G LTE CAT4 with HSPA+ Fallback	NimbeLink	Verizon	LTE
NL-SW-LTE-S7588-V-B	4G LTE CAT4 with HSPA+ Fallback	NimbeLink	Verizon	LTE
NL-SW-UAV-S7588	4G LTE CAT4 with HSPA+ Fallback	NimbeLink	Verizon	LTE
NL-SW-LTE-S7588-T	4G LTE CAT4 with HSPA+ Fallback	NimbeLink	AT&T/T-Mobile	LTE, GSM
NL-SW-LTE-S7588-T-C	4G LTE CAT4 with HSPA+ Fallback	NimbeLink	AT&T/T-Mobile	LTE, GSM
NL-SIM-COM	3FF Commercial Temp Range SIM Card	Gemalto	Verizon	LTE
NL-SWDK	Skywire Development Kit	NimbeLink		
TG.30.8113	Cellular Antenna	Taoglas		

1.2 Prerequisites



This document assumes you have completed the initial setup of your modem and development kit. If you have not completed those steps, refer to the Skywire® Development Kit User Manual 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. Step 2.8 requires the Ethernet interface to be taken down.

2. PPP: S7588-V-x, S7618RD AND UAV-S7588 SKYWIRE MODEMS

2.1 Overview

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

- Debian GNU/Linux 7 (wheezy) beaglebone 3.8.13-bone79
- Debian GNU/Linux 8 (jessie) beaglebone 4.4.9-ti-r25
- Ubuntu Linux 14.04 LTS

Using a Skywire 4G LTE CAT4 modem (NL-SW-LTE-S7588-V). This process is identical for NL-SW-LTE-S7618RD and NL-SW-UAV-7588 Skywire modems.

This example is written using Debian GNU/Linux 7 (wheezy) beaglebone 3.8.13-bone79.

2.2 Elevate to root

In order to make the changes necessary, it is necessary to login to the root account. To do so, type the following command into the Terminal:

```
$ sudo -i
```

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

2.3 Check for Updates

Make sure that your Ubuntu system is up to date using the following commands:

```
# apt-get update
```

```
# apt-get upgrade
```

2.4 Install the “ppp” package

To install the ppp package, type the following command:

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

2.5 Verify The Modem is Connected

To verify that our system can see the Skywire® LTE CAT4 modem, type the following command:

```
# lsusb
```

followed by the enter key, and you should have an entry similar to the one below:

```
Bus 001 Device 003: ID 1519:0443
```

If so, the modem is connected properly. If not, verify the modem is connected properly and run the command again.

2.6 Load the “option” Driver (Optional)

The Skywire LTE CAT4 modem does not properly enumerate automatically on some versions of Linux. To enumerate the device, we need to load the “option” driver.

To get our device’s ID, type the following command:

```
# lsusb
```

followed by the enter key, and you should have an entry similar to the one below:

```
Bus 001 Device 003: ID 1519:0443
```

Make note of the eight-character hex code in the device description. To load the option driver, type the following into the Terminal:

```
# modprobe option
```

```
# echo 1519 0443 > /sys/bus/usb-serial/drivers/option1/new_id
```

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-S7588-V
```

to:

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

or copy-and-paste the contents of:

```
vzw-S7588-V
```

from the GitHub repo to

```
/etc/ppp/peers/vzw-S7588-V
```

The contents of `vzw-S7588-V` are shown below:

```
/dev/ttyACM0
115200
connect "/usr/sbin/chat -v -f /etc/ppp/peers/vzw-S7588-V-chat"
noauth
defaultroute
usepeerdns
local
debug
updetach
```

If you are using the NimbeLink BeagleBone Black Cape, you can use the serial connection for PPP. To connect to the modem over a serial connection (using the capes default UART4 connection), edit the line

```
/dev/ttyACM0
```

to:

```
/dev/ttyO4
```

NOTE: The first line containing `/dev/tty*` is where you can define the serial port you would like PPP to use to connect to the modem.

Next, copy:

```
vzw-S7588-V-chat
```

to:

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

or copy-and-paste the contents of

```
vzw-S7588-V-chat
```

from the GitHub repo to

```
/etc/ppp/peers/vzw-S7588-V-chat
```

Make sure to replace `[apn]` with your APN. If the device was activated on `go.nimbelink.com`, the APN is:

```
NIMBLINK.GW12.VZWENTP
```

The contents of `vzw-S7588-V-chat` are shown below:

```
TIMEOUT 35
ECHO ON
'' \rATZ
OK 'ATQ0 V1 E1 S0=0 &C1 &D2 +FCLASS=0'
OK AT+CGDCONT=3,"IP","[apn]","0.0.0.0",0,0
OK ATD*99***3#
CONNECT ''
```

Note: The APN for this device is “nimblink.gw12.vzwentp”. Depending on your device, carrier, or setup, it may be different. Substitute your APN in place of “nimblink.gw12.vzwentp”. For AT&T devices the APN is commonly configured as “broadband”; check with your carrier for the correct APN.

2.8 Take Down the Ethernet Interface

Note: It is possible to leave network interfaces enabled on the Linux PC, while ensuring that the cellular data connection is the primary source of Internet connectivity. This involves replacing the default route in the kernel's IP routing table with the connection you want to use. However, these steps are not covered by this application note.

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:

```
# pppd call vzw-S7588-V
```

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.

3. PPP: S7588-T-X AND S7648 SKYWIRE MODEMS

3.1 Overview

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

- Debian GNU/Linux 8 (jessie) raspberrypi 4.9.35-v7+

Using a Skywire 4G LTE CAT4 modem (NL-SW-LTE-S7588-T) connected via USB using a NL-SWDK Skywire Development Kit. This process is identical on NL-SW-LTE-S7588-T-C and NL-SW-LTE-S7648 Skywire modems.

This example is written using Debian GNU/Linux 8 (jessie) raspberrypi 4.9.35-v7+.

3.2 Elevate to root

In order to make the changes necessary, it is necessary to login to the root account. To do so, type the following command into the Terminal:

```
$ sudo -i
```

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

3.3 Check for Updates

Make sure that your Ubuntu system is up to date using the following commands:

```
# apt-get update
```

```
# apt-get upgrade
```

3.4 Install the “ppp” package

To install the ppp package, type the following command:

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

3.5 Verify The Modem is Connected

To verify that our system can see the Skywire® LTE CAT4 modem, type the following command:

```
# lsusb
```

followed by the enter key, and you should have an entry similar to the one below:

```
Bus 001 Device 003: ID 1519:0443
```

If so, the modem is connected properly. If not, verify the modem is connected properly and run the command again.

3.6 Load the “option” Driver (Optional)

The Skywire LTE CAT4 modem does not properly enumerate automatically on some versions of Linux. To enumerate the device, we need to load the “option” driver.

To get our device’s ID, type the following command:

```
# lsusb
```

followed by the enter key, and you should have an entry similar to the one below:

```
Bus 001 Device 003: ID 1519:0443
```

Make note of the eight-character hex code in the device description. To load the option driver, type the following into the Terminal:

```
# modprobe option
```

```
# echo 1519 0443 > /sys/bus/usb-serial/drivers/option1/new_id
```

3.7 Setup the APN

Using a terminal program of your choice, connect to the the ACM port and issue:

```
AT+CGDCONT=1,"IP","[apn]"
```

replacing "[apn]" with the necessary APN. Finally, issue:

```
AT+CFUN=1,1
```

to reset the Skywire.

Close the terminal program.

3.8 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:

```
att-S7588-T
```

to:

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

or copy-and-paste the contents of:

```
att-S7588-T
```

from the GitHub repo to

```
/etc/ppp/peers/att-S7588-T
```

The contents of `att-S7588-T` are shown below:

```
/dev/ttyACM0
115200
connect "/usr/sbin/chat -v -f /etc/ppp/peers/att-S7588-T-chat"
noauth
defaultroute
usepeerdns
local
debug
updetach
```

The serial connection can also be used for PPP. To connect to the modem over a serial connection, use the UART port instead of the USB port. For example, on the NL-SWDK, plug the USB cable into port J14 and edit the line

```
/dev/ttyACM0
```

to:

```
/dev/ttyUSB0
```

NOTE: The first line containing /dev/tty* is where you can define the serial port you would like PPP to use to connect to the modem.

Next, copy:

```
att-S7588-T-chat
```

to:

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

or copy-and-paste the contents of

```
att-S7588-T-chat
```

from the GitHub repo to

```
/etc/ppp/peers/att-S7588-T-chat
```

The contents of `vzw-S7588-V-chat` are shown below:

```
TIMEOUT 35
ECHO ON
'' \rATZ
OK 'ATQ0 V1 E1 S0=0 &C1 &D2 +FCLASS=0 '
OK ATD*99***1#
CONNECT ''
```

3.9 Take Down the Ethernet Interface

Note: It is possible to leave network interfaces enabled on the Linux PC, while ensuring that the cellular data connection is the primary source of Internet connectivity. This involves replacing the default route in the kernel's IP routing table with the connection you want to use. However, these steps are not covered by this application note.

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.

3.10 Bring up the PPP Interface

To enable the PPP interface, type the following commands:

```
# pppd call att-S7588-T
```

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.