Configuring mDot^{TM} with Conduit® AP (MTCAP) using LoRa

Getting Started

Refer to the Conduit AP Quick Start Guide for details on your gateway hardware setup and power up.

First-Time Setup of Gateway

Note: This configuration works with the LoRa packet forwarder. You may choose to use Ethernet with LoRa or Cellular with LoRa (if your model has a cellular radio).

This setup wizard helps you configure the main features of your device for initial setup. In most cases, you can accept the provided defaults. See **First-Time Setup** in the software guide for more details.

1. Go to your browser's address line and enter the default IP address for the gateway to access the UI: 192.168.2.1. Most browsers display a warning about HTTP addresses being unsafe. Click on **Advanced** and continue to 192.168.2.1.

2. Upon power up for the first time, the device will be in commissioning mode. The system requires you to set up an administrative user. Enter your desired username and click **OK**.

3. Enter a desired password for the administrative user and click **OK**. This password must be of sufficient length and strength (with a mix of character classes such as letters, numbers, and symbols). Enter the password again to confirm. Click **OK**.

4. The login page appears. Enter username and password.

5. **First-Time Setup Wizard** appears.

6. For **Call Home,**

   a. Accept all default settings (disabled).

   b. Click **Next.**

7. Set the date, time, and time zone.

   a. If the information is correct, accept the default values.

   b. Otherwise, update **Date, Time**, and/or **Time Zone**.

   c. Click **Next**.

8. Configure LAN network interfaces Eth0 and Br0.
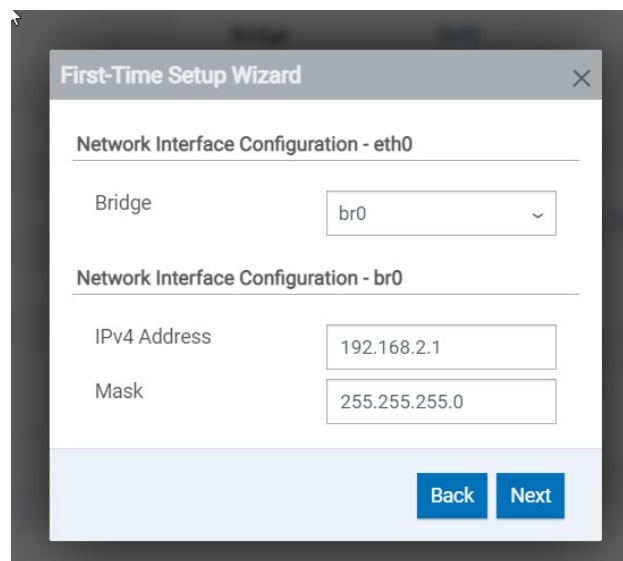
   a. Accept all default settings – **eth0** assigned to the bridge **br0** (with DHCP set automatically). **NOTE:** You will need to make additional configuration changes for Ethernet under Network Interfaces after **First-Time Setup**. See **Using Ethernet with LoRa Packet Forwarder**.

   b. Click **Next**.

9. Configure your device's **Cellular** connection.

First-Time Setup Wizard

Cellular Configuration

☐ Enabled

APN

Back   Next
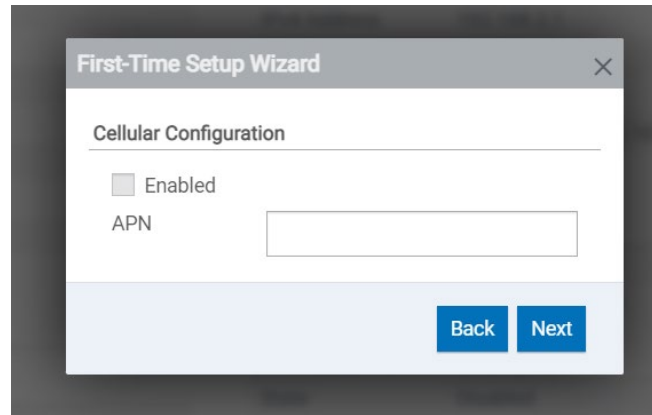
    a. If you have no cellular radio (Ethernet only) in your device or plan to use Ethernet with the LoRa packet forwarder, accept all defaults with **Enabled** deactivated (Cellular is disabled) and APN left blank.

    b. If you have a cellular radio model and plan to use **Cellular** with the LoRa packet forwarder, select **Enabled** (Cellular is enabled).

    c. If required by your network carrier, enter your **APN** (Some carrier networks may set it automatically via OTA registration. Leave it blank in that case).

    d. Click **Next**.

10. For **Cellular Authentication**,

    a. Accept all defaults (NONE).

    b. Click **Next**.

11. For **Remote Management,**

    a. Accept all defaults (disabled).

    b. Click **Next.**

12. For **HTTP/HTTPS Access**,

    a. Accept all defaults (enable HTTP to HTTPS via LAN).

    b. Click **Next.**

13. For **Bootloader Protection** (setting a u-boot password),

    a. Disable Bootloader Protection (defaults vary with firmware version).
    b. Click **Finish**.

14. To save your changes, click **Save and Apply**.

Configuring LoRa Packet Forwarder

## Using Ethernet with LoRa Packet Forwarder

If you are planning to use Ethernet with the LoRa Packet Forwarder, then you must make this configuration change below before configuring and running Packet Forwarder. If you are using a Cellular connection with LoRa, you can skip these steps.

1. Go to **Network Interfaces.** Click the pencil for the **eth0** interface**.**

2. Under **Network Interface ETH0,** change **Direction** to **WAN.**

3. Under **Mode,** select **DHCP Client.**

4. Click **Submit.**

5. Go to Administration > Access Configuration > HTTPS. Enable HTTPS via WAN.

6. Click **Submit**.

7. Click Save and Apply.

Configuring the Gateway

To activate **LoRa Packet Forwarder** Mode on your device:

1. For **LoRaWAN > Network Settings > LoRa Mode**, select **PACKET FORWARDER** under **Mode**. If **Manual Configuration** is showing, click **Normal Configuration** to switch.

2. For **LoRaWAN > Network Settings > LoRa Packet Forwarder Configuration**, you should select the network to use from the drop-down under **Network: Radio Bridge ChirpStack, The Things Network, Senet,** or **Loriot**. In this case, select **Radio Bridge ChirpStack**.

3. Select the appropriate **Channel Plan** for the Packet Forwarder. Choose from the drop-down menu: **US915: 915, AU915: 915, AS923-1: 915, AS923-2: 915, AS923-3: 915, AS923-4: 915, KR920: 915, EU868: 868, IN865: 868, RU864: 868,** or **ISM2400: 2400**.
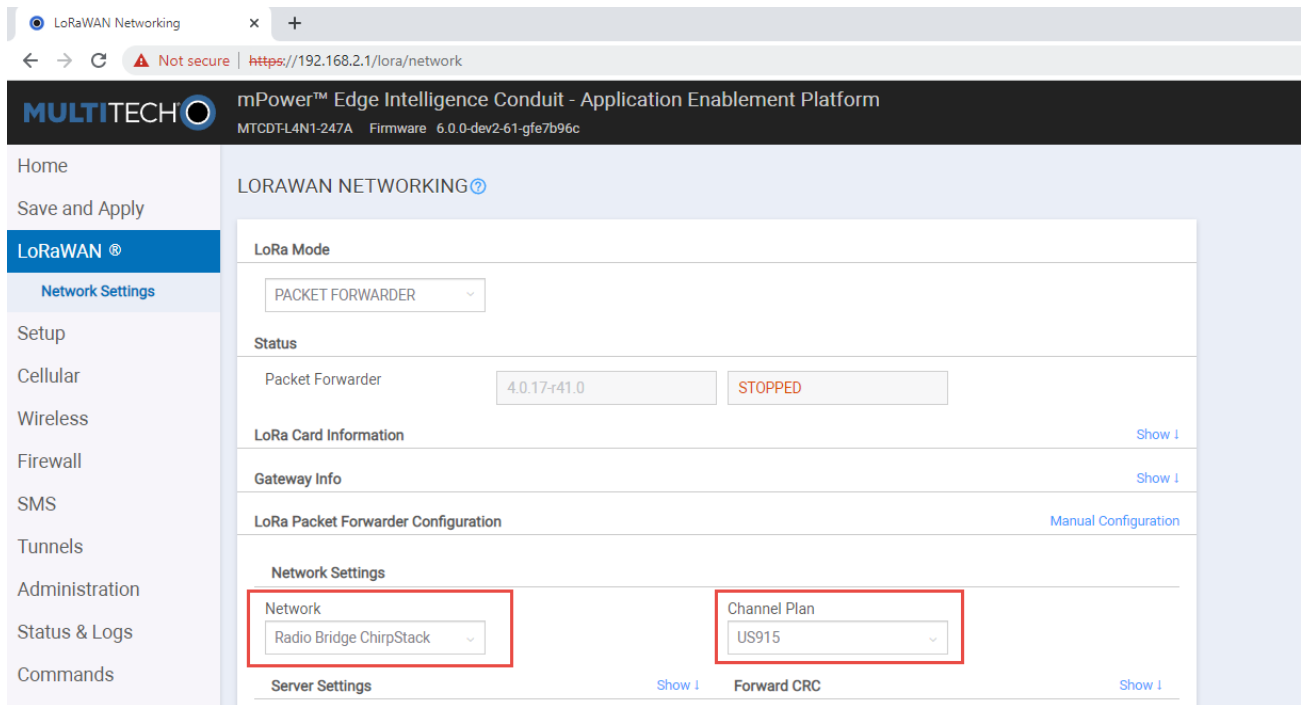
4. Click **Submit**. Then, click **Save and Apply**.
   - Confirm that the Packet Forwarder is now running under **Status**.
   - Show the **LoRa Card Information** and copy the **Gateway EUI** (save for later).
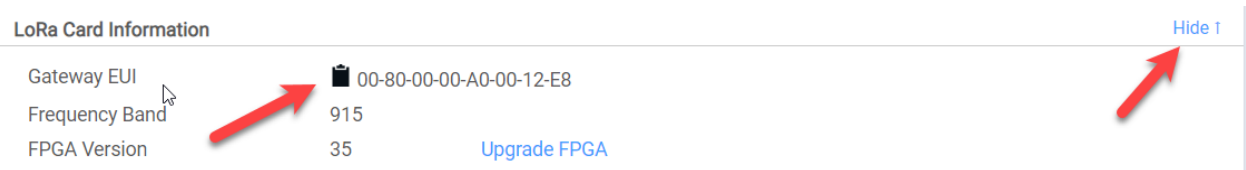
5. Make sure to properly add your gateway and any end devices to the network based on their specific system and instructions. For this example, we will configure the gateway and end device using Radio Bridge Chirpstack.

Configuring Network for the Gateway

1. Go to the Radio Bridge console, https://console.radiobridge.com/login.
2. Create a new account if you do not already have one. If you do, login.
3. Go the pane on the left side and select **Gateways**.
4. Click **Add Gateway** on the right side.
5. You should see a list of **LoRa Network Servers**. Select **Chirpstack**.

6. Complete the following information. Some items are optional. Note the required fields.*

    a. **Gateway Name***- Enter a user-defined Gateway name. Example: TestGateway.

    b. **Gateway EUI***- Enter the Gateway EUI that you copied earlier from **LoRaWAN > LoRa Network Settings > LoRa Card Information**. Paste the EUI into this field. ***NOTE:** Remove any dashes.*

    c. **Select Region***- Required. Under 'Select Region' you can select **US915 or EU868** for Europe. (If your channel plan is not for US but in the 900's, select US915. If your channel plan is not for Europe but in the 800's, select EU868.)

    d. **IP Address**- The **IP Address** allows you to have a quick link to the gateway interface. If the gateway is on a local LAN, enter the IP Address of that gateway. If you have a private cellular SIM, enter the private IP address of that SIM.

    e. **Description**- Enter information to describe the gateway.


7. Click **Register Gateway**. You should receive a confirmation message that it's successful.
8. Close the window. You should see the gateway in the RB console and the last check-in date (under **Last Seen**) in the gateway list. If it is blank, click on the refresh icon on the far right.

Configuring the End Device

To configure the end device, mDot™, this process requires: an mDot (LoRa end device), LoRa antenna, and Micro UDK Developer Board with USB interface.
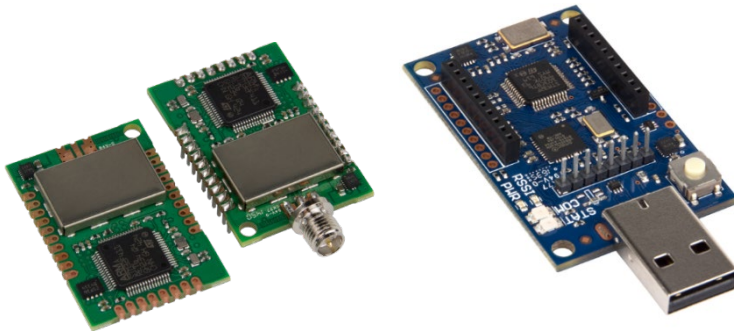
mDot (MTDOT)   **Micro UDK (MTMDK)**

Refer to the mDot Quick Start Guide for details on your end device hardware setup.

1. Plug the mDot onto the Micro UDK board.
2. Attach the LoRa antenna to the mDot.
3. Plug the USB port into a PC or a Laptop.
4. Once the mDot is plugged into a PC, it will show up as drive.
5. Refer to Device Manager under the Control Panel. Note the com port numbers used by the mDot.
6. Open Tera Term or a similar application. It will show the COM ports you can open.
7. Choose Serial Port connection and select the first port that matches.
8. Go to the serial port setup and make sure it is properly configured with the following:
   a) Speed: 115200
   b) Data: 8 bit
   c) Parity: none
   d) Stop bits: 1 bit
   e) Flow control: none
9. To test the terminal connection, enter the AT Command: AT. The response should be: OK. If not, open another instance and select the other port. Make sure the port setup is correct (see step 8). Enter AT again to verify. You should receive the OK response.

Configuring Network for End Device

Open the Terminal connected to the mDot that supports AT commands.

1. Find the Device ID of the mDot. Enter the AT Command: AT+DI. For this sample device, it is Device ID - 0080000000009ce4.

2. To get the Network Key, enter the following AT Command: AT+NK
   ```
   Network Key:     010203040506070809101112131415 16
   ```
3. To get the App EUI Network ID, enter the following AT Command AT+NI
   ```
   App EUI:          0101010101010101
   ```
4. Use a text editor like Notepad++ or Notepad. Cut and paste these values into a text editor for later use. **NOTE:** All three values should be unique. The Device ID is assigned by the device manufacturer. But Network Key and App EUI can be assigned by the network provider, device manufacturer, or the user. Those two values must match the corresponding values required in the next procedure, Connecting End Device to the Network and Sending/Receiving Data, steps 2e and 2f, otherwise the join process will not succeed.

   ```
   Device ID (AT+DI):            0080000000009ce4

   Network Key (AT+NK):          010203040506070809101112131415 16

   App EUI or Join EUI (AT+NI):  0101010101010101
   ```

5. Go to the Radio Bridge console, https://console.radiobridge.com/login.
6. Login and go to **Devices**.
7. Click on **Add Device**.
8. Select **Chirpstack** as the **Network** used.
9. Enter the end device information for the mDot.
   a. **Device Name:** Enter a user-defined **Device** Name to identify your mDot.
   b. **Device ID:** For **Device ID**, enter the EUI from the mDot that resulted from the AT+DI command.
   c. **Device Key:** Enter the Network Key from the mDot that resulted from the AT+NI command.
   d. **Select Device Type:** For Select Device Type, choose LoRa xDot/mDot Sensor.
   e. **Select/Enter Join EUI:** Accept the Join EUI as is.

f. **Select Region:** For the **Region,** select **US915** or **EU868**. (If your channel plan is not for US but in the 900's, select **US915**. If your channel plan is not for Europe but in the 800's, select **EU868**.)

10. Click **Continue**.
11. Click **Confirm**.
12. Then review your device. Click **View Device** and the system will show the device.

Connecting End Device to the Network and Sending/Receiving Data

1. Go to the terminal window to configure your mDot for LoRa communications.
2. Enter the following commands.

   a. AT – confirm that you're communicating with your device
   b. AT&F – reset to factory defaults
   c. AT+PN=1 – enable public network
   d. AT+NJM=1 – configure for OTA Network Join
   e. AT+NI=0, 0101010101010101 – configured App EUI Network ID*
   f. AT+NK=0,01020304050607080910111213141516 – configured Network Key*
   g. AT&W – save current configuration
   h. AT+JOIN - join LoRa network

   ***NOTE**: The required values in steps 2e and 2f must match the values provided in the previous procedure, Configuring Network for End Device, steps 2 and 3, otherwise the join process will not succeed.

```
OK
at

OK
AT&F

OK
AT+PN=1

OK
AT+NJM=1

OK
AT+NI=0,01010101 01010101
Set Network ID: 01-01-01-01-01-01-01-01

OK
AT+NK=0,0102030405060708091011121314151516
Set Network Key: 01.02.03.04.05.06.07.08.09.10.11.12.13.14.15.16

OK
AT&W

OK
AT+JOIN
Successfully joined network

OK
AT+NJS
1

OK
```

3. AT+NJS – confirm joining server, result of 1 = yes, 0 = no
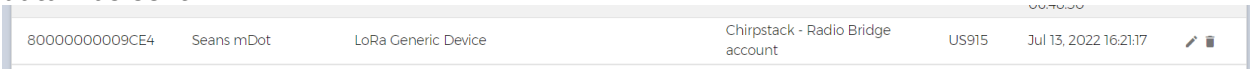4. Enter AT+SEND=Hello World

```
at+send=Hello World

OK
```

5. Go to the Radio Bridge Console and click on **Devices**.
6. You should see that your device is connected during the most recent instance where data was sent.

| 80000000009CE4 | Seans mDot | LoRa Generic Device | Chirpstack - Radio Bridge account | US915 | Jul 13, 2022 16:21:17 | 🖉 🗑 |

7. If you click on the device, it shows the resulting sent data and the HEX to ASCII Decode.

Message Log						🔻 ⋮
Time & Data		**Location**	**Link Quality**	**SNR**	**RSSI**	**API**
Jul 14, 2022 10:57:15		--	📶	9.2	-27	--
Data: 48656c6c6f20576f726c64		Hello World				