

# SYMPHONY LINK DEVELOPMENT KIT

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# Symphony Link Development Kit

# Components

The Symphony Link Development Kit provides all the hardware to setup and experiment with a Symphony Link network.

## The development kit includes...



### A gateway

A Wifi-enabled Symphony Link Gateway (model LL-BST-8-915-SYM-W-I-US), including peripheral components to operate the gateway:

- 915-MHz antenna (Linx Technologies ANT-916-CW-HWR-SMA)
- Wifi antenna (PC Engines antsma)
- Wall-plug adapter (PC Engines ac12vus)
- 7-foot span of Ethernet cable

### USB-UART evaluation boards

One [LL-RLP-20 evaluation board](#) and one [LL-RXR-27 evaluation board](#). Also included:

- mini-USB cable to connect each evaluation board to a PC
- 915-MHz antenna (Linx Technologies ANT-916-CW-HWR-SMA) for each

## A network tester

The network tester is a device to test the coverage of a Symphony Link network. The network tester automatically relays GPS position and on-board sensor data (temperature, pressure, humidity) to a Symphony Link network using an LL-RXR-27 module. Also included:

- 3 AA batteries
- 915-MHz antenna (Linx Technologies ANT-916-CW-HWR-SMA)

# Quick Start Guide

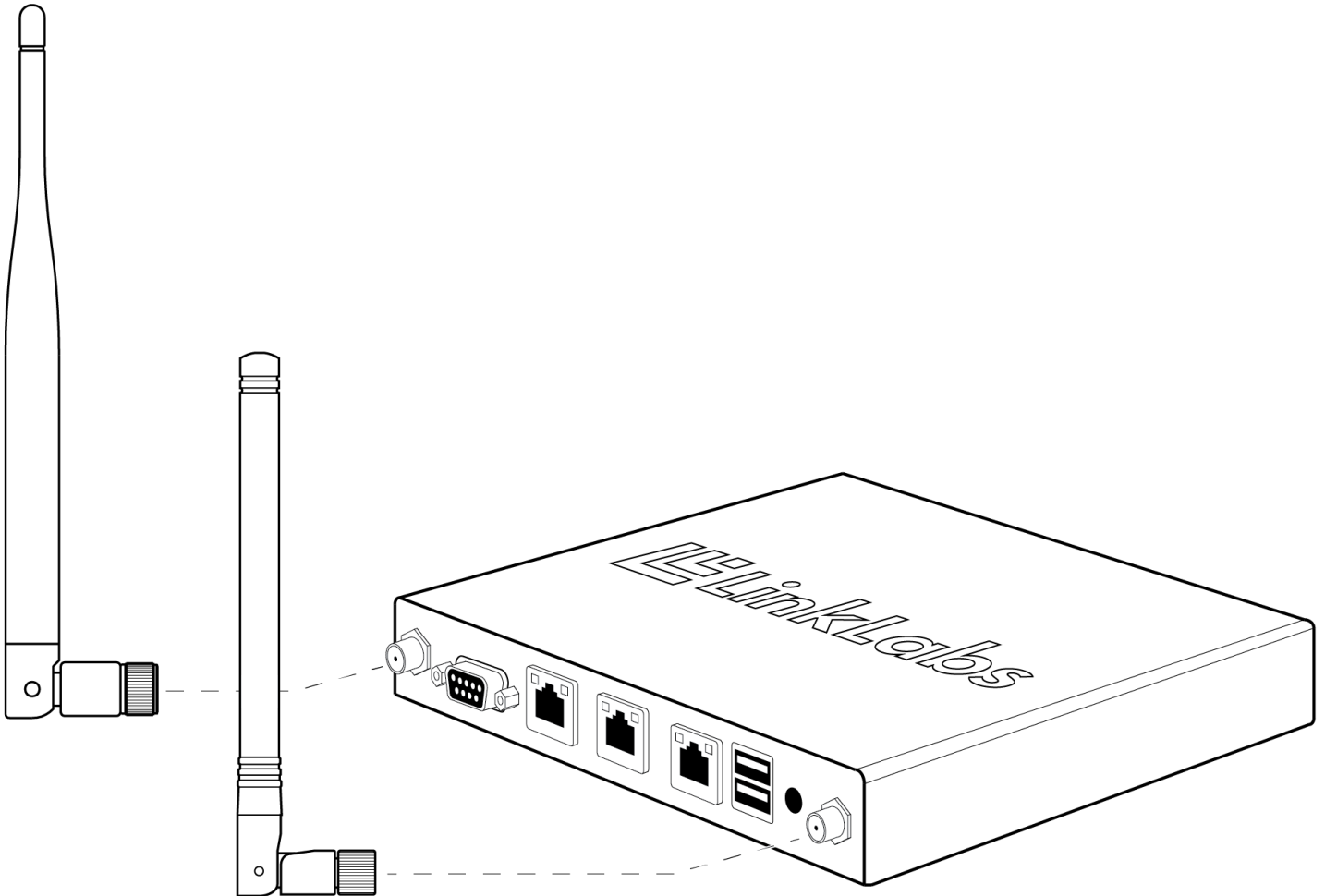
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## Demo Videos

[Setting up your Gateway](#)

[Getting Started with the Evaluation Board](#)

## Step 1: Turn on the gateway



### Connect the antennas.

Connect the 915-MHz antenna to the gateway's **UHF** antenna jack and the Wifi antenna to the **Wifi** jack.

### Apply power.

Connect one end of the wall-plug adapter to the gateway's **Power** port and the other end to an electrical outlet.



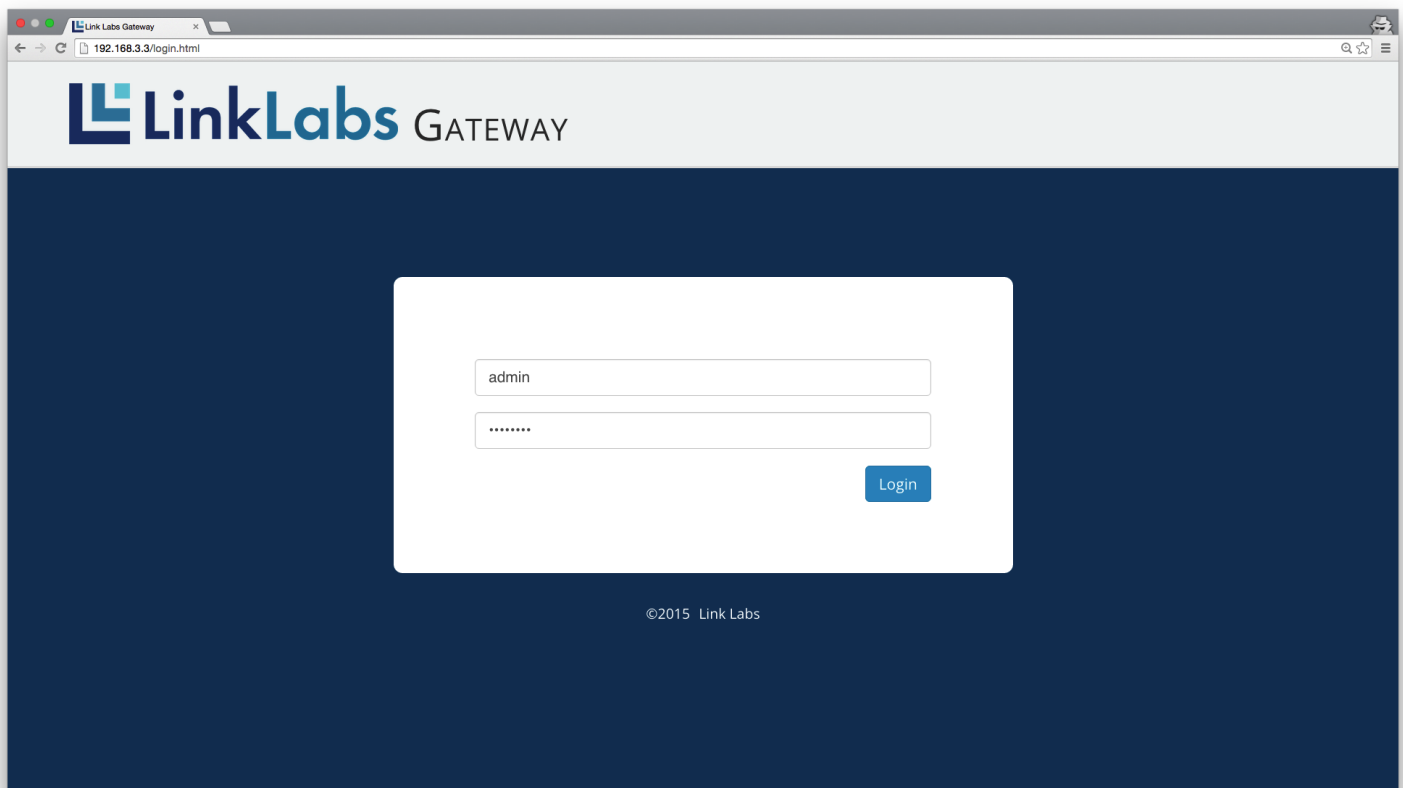
## Step 2: Access the gateway's local webpage

### Connect a PC.

Wait a minute for the gateway to bootstrap, then connect a PC to the local Ethernet jack (the middle one) using the provided Ethernet cable.

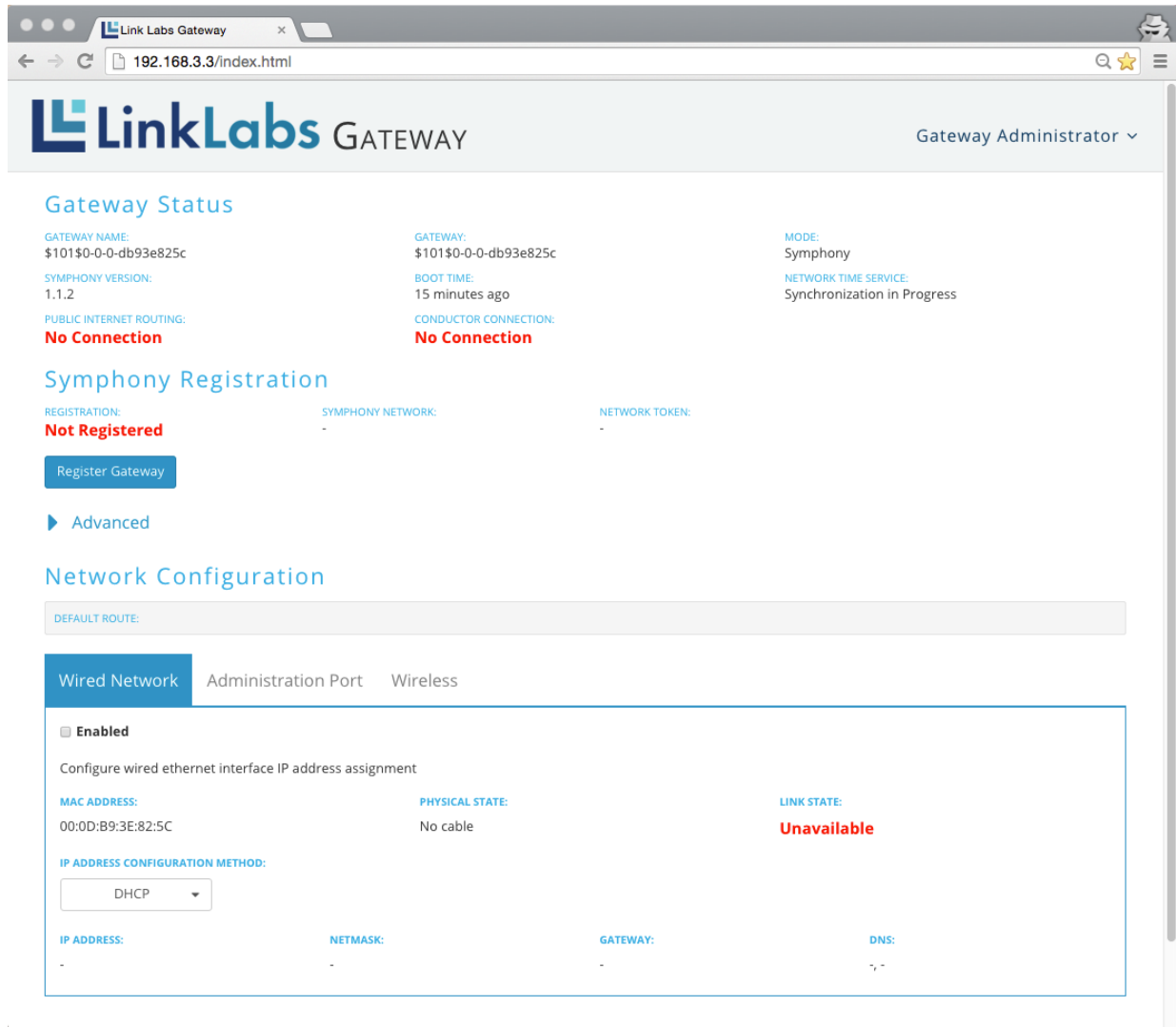
### Navigate to the local webpage.

On the connected PC, open a browser and navigate to **192.168.3.3**. Log in using username "**admin**" and password "**password.**"



## The gateway's local webpage appears.

The local webpage provides an interface to view the status of the gateway, to connect it to the Internet, and to register the gateway with a Conductor account.



The screenshot shows a web browser window with the URL `192.168.3.3/index.html`. The page title is "LinkLabs GATEWAY" and the user is logged in as "Gateway Administrator".

**Gateway Status**

<b>GATEWAY NAME:</b> \$101\$0-0-0-db93e825c	<b>GATEWAY:</b> \$101\$0-0-0-db93e825c	<b>MODE:</b> Symphony
<b>SYMPHONY VERSION:</b> 1.1.2	<b>BOOT TIME:</b> 15 minutes ago	<b>NETWORK TIME SERVICE:</b> Synchronization in Progress
<b>PUBLIC INTERNET ROUTING:</b> <b>No Connection</b>	<b>CONDUCTOR CONNECTION:</b> <b>No Connection</b>	

**Symphony Registration**

<b>REGISTRATION:</b> <b>Not Registered</b>	<b>SYMPHONY NETWORK:</b> -	<b>NETWORK TOKEN:</b> -
-----------------------------------------------	-------------------------------	----------------------------

[Register Gateway](#)

[Advanced](#)

**Network Configuration**

DEFAULT ROUTE: [Empty field]

Wired Network | Administration Port | Wireless

**Enabled**

Configure wired ethernet interface IP address assignment

<b>MAC ADDRESS:</b> 00:0D:B9:3E:82:5C	<b>PHYSICAL STATE:</b> No cable	<b>LINK STATE:</b> <b>Unavailable</b>
------------------------------------------	------------------------------------	------------------------------------------

**IP ADDRESS CONFIGURATION METHOD:**  
DHCP

<b>IP ADDRESS:</b> -	<b>NETMASK:</b> -	<b>GATEWAY:</b> -	<b>DNS:</b> -
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# Step 3: Connect the gateway to the Internet

## To connect using WiFi...

In the **Wireless** tab of the local webpage, select the **Enabled** checkbox.

\*Wired Network Administration Port **\*Wireless**

**Enabled \***

Configure Wifi interface access point and IP address assignment

MAC ADDRESS: 04:F0:21:14:CF:03      PHYSICAL STATE: No Access Point      LINK STATE: **Disconnected**

SSID: \*       SHARED KEY: \*

IP ADDRESS CONFIGURATION METHOD:

IP ADDRESS: -      NETMASK: -      GATEWAY: -      DNS: -

Select a Wifi network from the **SSID** dropdown listbox and enter the password in the **SHARED KEY** editbox. Click **Submit**.

\*Wired Network Administration Port **\*Wireless**

**Enabled \***


Configure Wifi interface access point and IP address assignment

MAC ADDRESS: 04:F0:21:14:CF:03      PHYSICAL STATE: No Access Point      LINK STATE: **Disconnected**

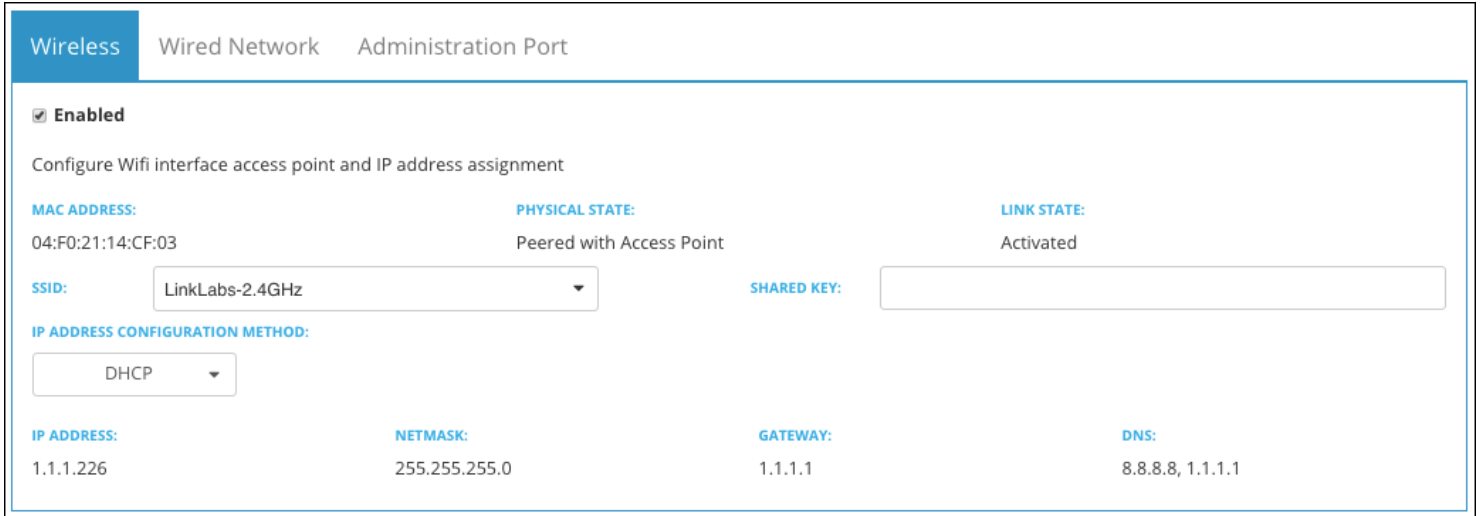
SSID: \*       SHARED KEY: \*

IP ADDRESS CONFIGURATION METHOD:

IP ADDRESS: -      NETMASK: -      GATEWAY: -      DNS: -



After a few moments, the **Wireless** tab updates with the connection information.



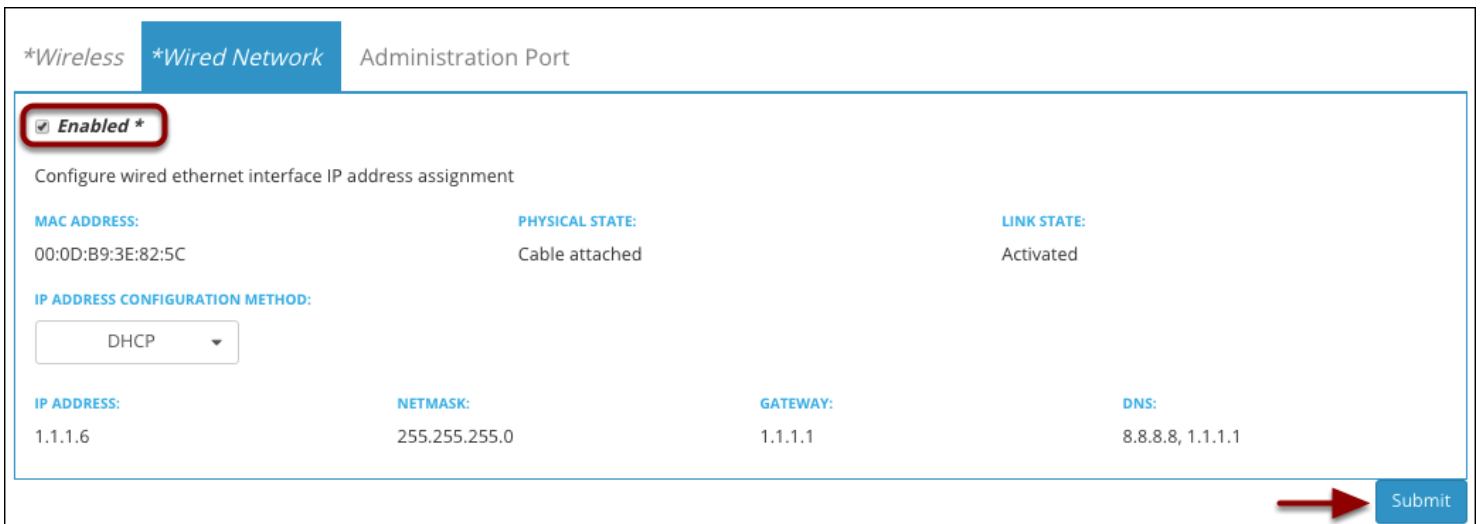
The screenshot shows the 'Wireless' configuration page. At the top, there are three tabs: 'Wireless' (selected), 'Wired Network', and 'Administration Port'. Below the tabs, there is a section titled 'Wireless' with a checked 'Enabled' checkbox. The page contains the following information:

- MAC ADDRESS:** 04:F0:21:14:CF:03
- PHYSICAL STATE:** Peered with Access Point
- LINK STATE:** Activated
- SSID:** LinkLabs-2.4GHz (dropdown menu)
- SHARED KEY:** (empty text input field)
- IP ADDRESS CONFIGURATION METHOD:** DHCP (dropdown menu)
- IP ADDRESS:** 1.1.1.226
- NETMASK:** 255.255.255.0
- GATEWAY:** 1.1.1.1
- DNS:** 8.8.8.8, 1.1.1.1

## To connect via wired Ethernet...

Connect a DHCP-enabled network to the gateway's **LAN** Ethernet jack (the one closest to the serial connector).

In the **Wired Network** tab, select the **Enabled** checkbox. Click **Submit**.



The screenshot shows the 'Wired Network' configuration page. At the top, there are three tabs: '\*Wireless', '\*Wired Network' (selected), and 'Administration Port'. Below the tabs, there is a section titled 'Wired Network' with a checked 'Enabled' checkbox. The page contains the following information:

- MAC ADDRESS:** 00:0D:B9:3E:82:5C
- PHYSICAL STATE:** Cable attached
- LINK STATE:** Activated
- IP ADDRESS CONFIGURATION METHOD:** DHCP (dropdown menu)
- IP ADDRESS:** 1.1.1.6
- NETMASK:** 255.255.255.0
- GATEWAY:** 1.1.1.1
- DNS:** 8.8.8.8, 1.1.1.1

A red arrow points to the 'Submit' button at the bottom right of the page.

After a few moments, the **Wired Network** tab updates with the connection information.

## Step 4: Register the gateway with Conductor

This step connects your gateway to your web-based Conductor account.

### Register the gateway.

Once the gateway is connected to the Internet, click the **Register Gateway** button in the **Symphony Registration** section of the local webpage.

### Symphony Registration

REGISTRATION:	SYMPHONY NETWORK:	NETWORK TOKEN:
<b>Not Registered</b>	-	-

The **Conductor Login** prompt appears. Enter your credentials and click the **Login** button. Or, if you do not have a Conductor account, click the **Create User** button and follow the directions to make an account.

## Conductor Login

Enter your account information for the Link Labs Conductor online interface.  
This same account is used at conductor.link-labs.com.

The **Register Gateway** prompt appears.

In this example, we're going to register the gateway with a new Symphony Link Network. (But if you want, you can simply register the gateway with the **Open Gateway** network.) Click the **Create Network** button.

## Register Gateway \$101\$0-0-0-db93e825c

Select an available network

	NAME	NETWORK TOKEN	ACCOUNT
✓	Open Gateway	OPEN	—

[Register](#) [Create Network](#)

Conductor populates a new, unique network to the list. In this example, it is **Network xB36E**. (We'll rename it later.) Click the **Register** button.

## Register Gateway \$101\$0-0-0-db93e825c

Select an available network

NAME	NETWORK TOKEN	ACCOUNT
Open Gateway	OPEN	—
✓ <b>Network xB36E</b>	<b>4956b36e</b>	<b>symphony_link@link-labs.com</b>

**Register** **Create Network**

The prompt disappears and the **Symphony Registration** section of the local webpage updates. It shows the gateway is registered with the newly created network. (You may need to refresh your browser.)

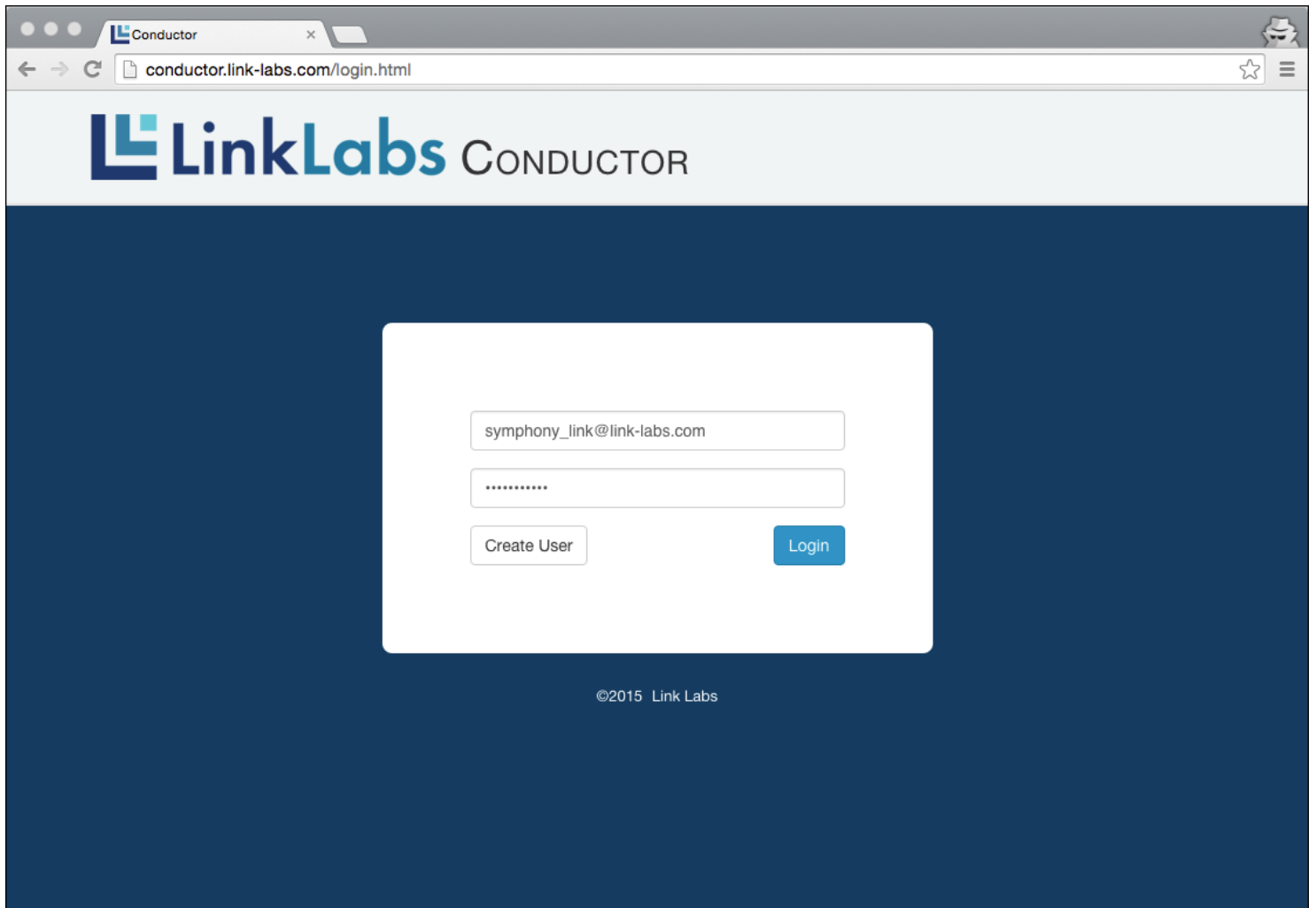
## Symphony Registration

REGISTRATION: Registered	SYMPHONY NETWORK: Network xB36E	NETWORK TOKEN: 4956b36e
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## Step 5: Organize your Conductor account

### Add a new application to your Conductor account.

Open a browser and navigate to [conductor.link-labs.com](http://conductor.link-labs.com). Log in using your account credentials.



The screenshot shows a web browser window with the address bar displaying `conductor.link-labs.com/login.html`. The page header features the LinkLabs logo and the word "CONDUCTOR". The main content area is a dark blue background with a white login form in the center. The form contains two input fields: the first contains the email address `symphony_link@link-labs.com` and the second contains masked characters. Below the input fields are two buttons: "Create User" and "Login". At the bottom of the page, the copyright notice `©2015 Link Labs` is visible.



In the **Applications** section of your Conductor account, click the **Add Application** button.

## Applications

Add Application

NAME	APPLICATION TOKEN	ENDPOINTS
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Conductor generates a new, unique [Application Token](#) and adds it to the list. In this example, the new application is called **Application xFAA9**.

## Applications

Add Application

NAME	APPLICATION TOKEN	ENDPOINTS
Application xFAA9	d1d1ae4f679bbb7ffaa9	0

Click on the name of the new application. The **Application** pop-up window appears.

## APPLICATION APPLICATION xFAA9 ✕

**APPLICATION TOKEN**  
d1d1ae4f679bbb7ffaa9

**CREATED**  
a minute ago

**ENDPOINTS**  
0

**NAME:**

### Downlink


### Message Monitor

TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION
-----------	----------	---------	---------	---------	-------------

Rename the new application by entering "eval board demo" (or whatever you would like to call it) in the **NAME** field of the pop-up window.

APPLICATION APPLICATION xFAA9
✕

<b>APPLICATION TOKEN</b> d1d1ae4f679bbb7ffaa9	<b>CREATED</b> a minute ago	<b>ENDPOINTS</b> 0
--------------------------------------------------	--------------------------------	-----------------------

**NAME:**  

### Downlink

### Message Monitor

TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION

Exit by clicking outside the pop-up window. The new name of the application updates to the list of applications.

## Applications

[Add Application](#)

NAME	APPLICATION TOKEN	ENDPOINTS
eval board demo	d1d1ae4f679bbb7ffaa9	0

Record the [Application Token](#) of the "eval board demo" application -- we'll use it later. In this example, the Application Token is

d1d1ae4f679bbb7ffaa9

## Rename the new Symphony Link network you created in Step 4.

Click on the name of the new network in the **Networks** section of your Conductor account.

### Networks

Add Network

NAME	NETWORK TOKEN	GATEWAYS
OPEN	4f50454e	0
Network xB36E 	4956b36e	1

The **Network** pop-up window appears.

NETWORK NETWORK xB36E
×

**NETWORK TOKEN**  
4956b36e

**GATEWAYS**  
1

**NAME:**

### Message Monitor


TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION

Rename the network by entering "A simple network" (or whatever you would like to call it) into the **NAME** field of the pop-up window.

NETWORK NETWORK xB36E
✕

**NETWORK TOKEN**  
4956b36e

**GATEWAYS**  
1

**NAME:**  

### Message Monitor

TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION

Click outside the pop-up window to exit it. The new name updates to the list of networks. (You may need to refresh your browser.)

## Networks

[Add Network](#)

NAME	NETWORK TOKEN	GATEWAYS
OPEN	4f50454e	0
A simple network 	4956b36e	1

Record the [Network Token](#) associated with "A simple network" -- we'll use it later. In this example, it is:

4956b36e

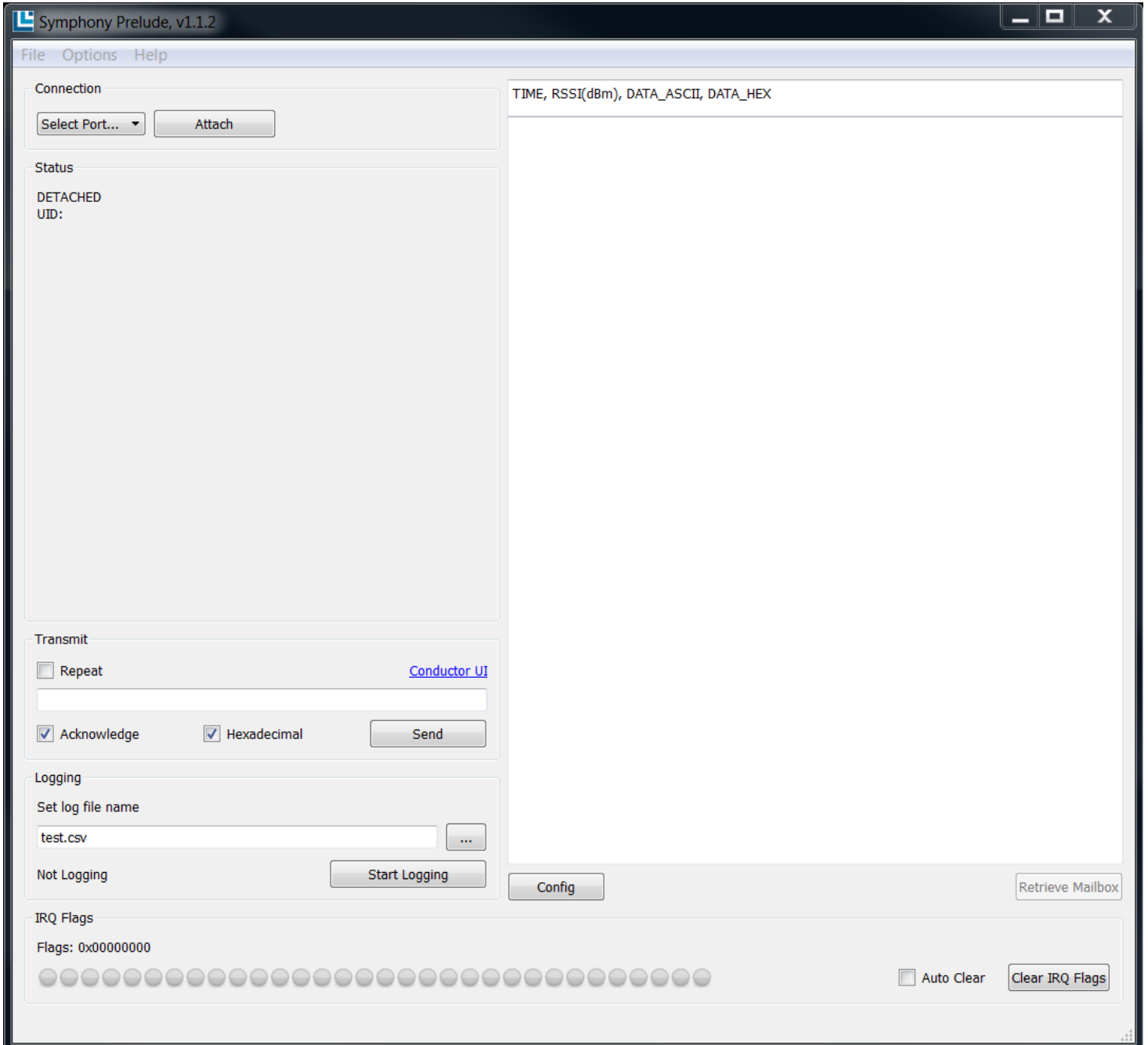
## Step 6: Setup the USB-UART evaluation board

### Install Prelude.

Download and run the latest [Windows installer](#) for Prelude. Follow the on-screen instructions to install Prelude to your PC.

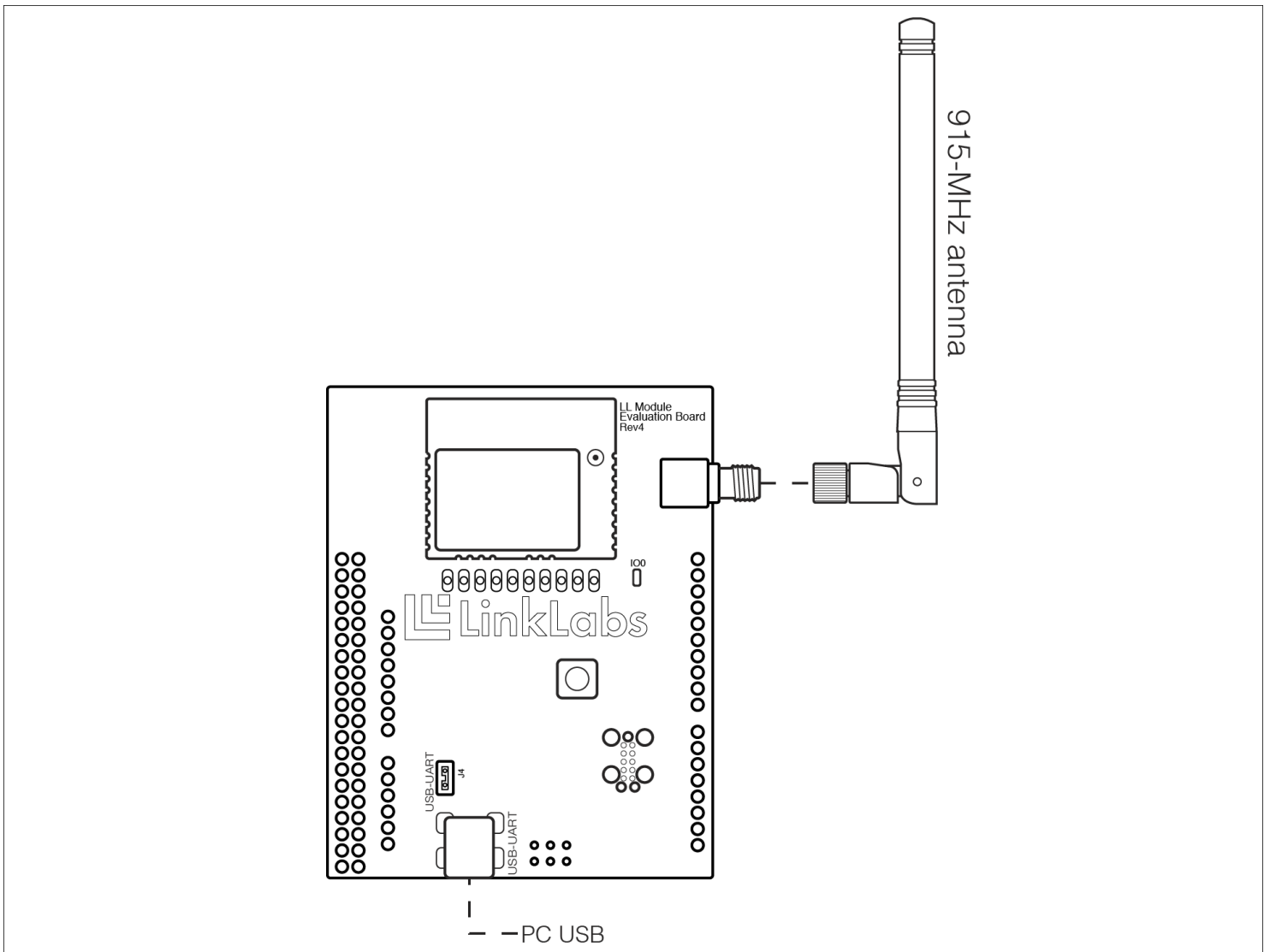


When installation is finished, launch the Prelude application.



## Connect the evaluation board.

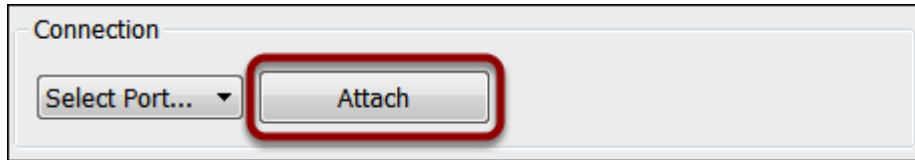
Connect the evaluation board to a PC using a mini-USB cable.



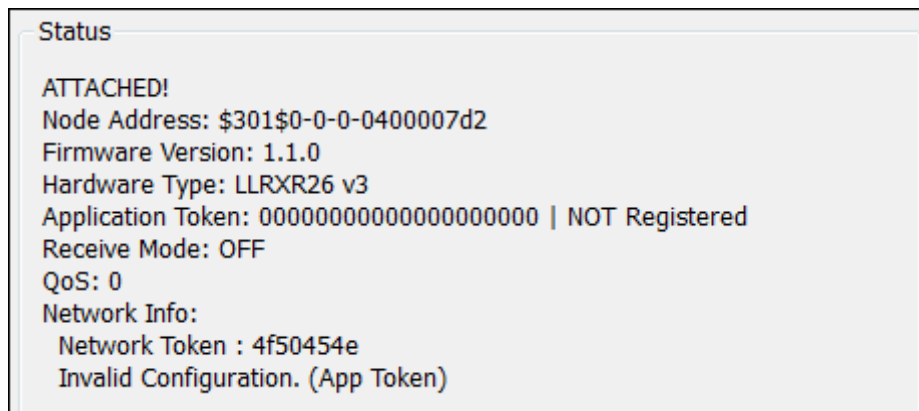
Once connected, a red LED on the evaluation board lights up. This LED lights up anytime the Symphony Link Module has set one or more [interrupt request flags](#). (In this case, the LED indicates a RESET event has occurred because you just supplied power to the board.)



From the **Select Port** dropdown of Prelude's **Connection** group box, select the COM port associated with the evaluation board. Click **Attach**.



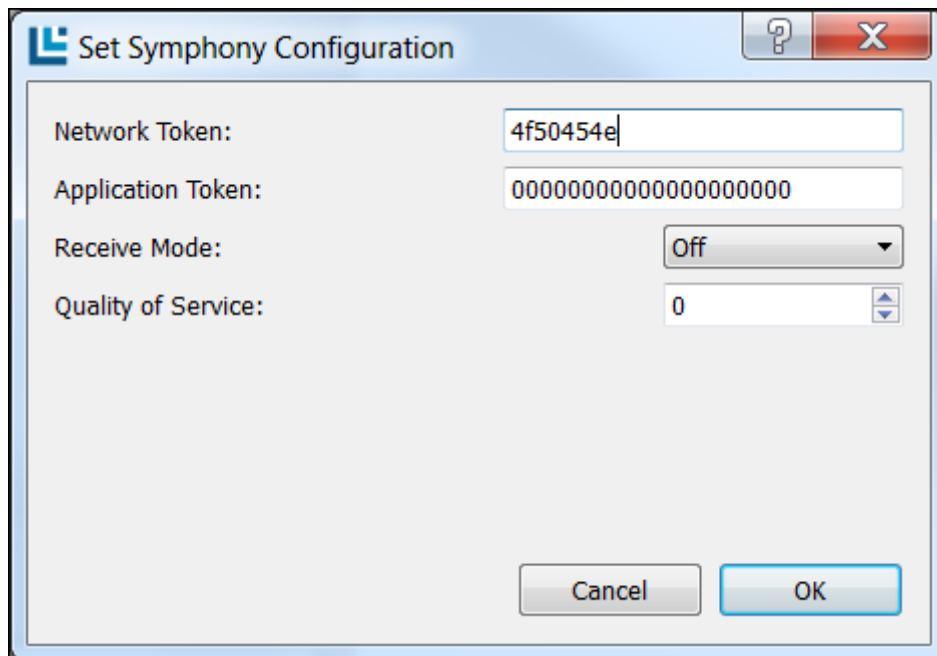
Prelude's **Status** groupbox will begin to update with the module's parameters.



## Step 7: Register the module

### Shift the module to "A simple network."

From Prelude's **Options** menu, select **Set Symphony Configuration**. The **Set Symphony Configuration** pop-up appears.

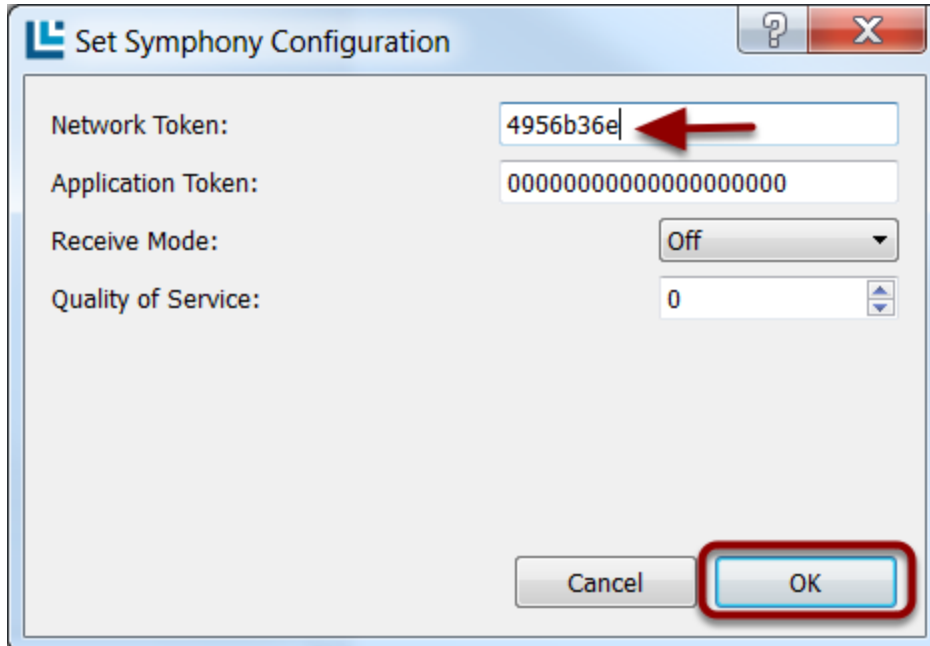


The image shows a dialog box titled "Set Symphony Configuration" with a LinkLabs logo in the top-left corner and help and close buttons in the top-right. The dialog contains four configuration fields:

- Network Token:** A text input field containing the value "4f50454e".
- Application Token:** A text input field containing a long string of zeros: "00000000000000000000000000000000".
- Receive Mode:** A dropdown menu currently set to "Off".
- Quality of Service:** A spin box currently set to "0".

At the bottom of the dialog are two buttons: "Cancel" and "OK".

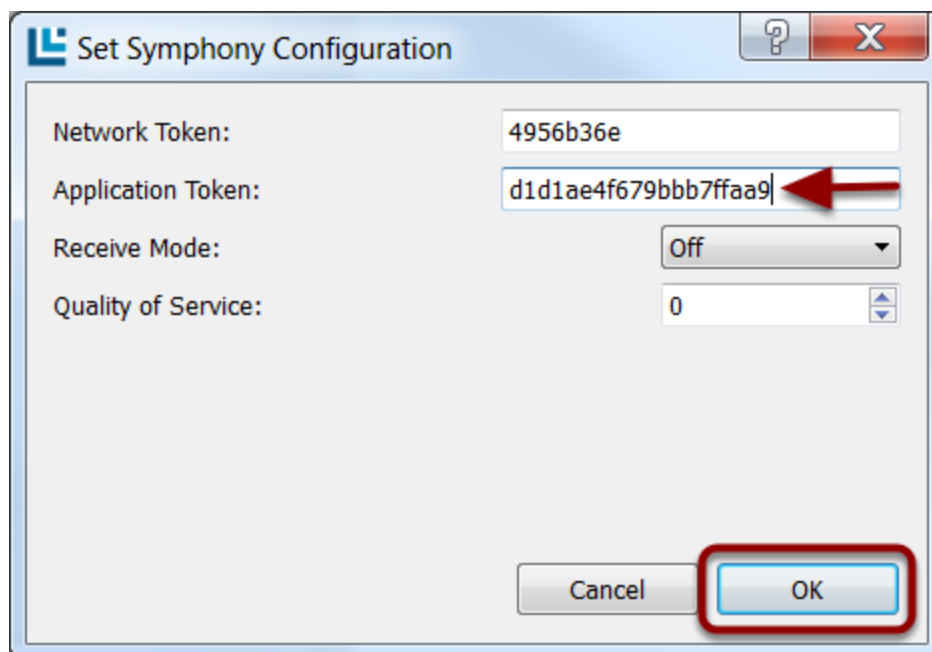
In the **Network Token** editbox, enter the Network Token of "A simple network." Click **OK**.



## Register the module to the "eval board demo" application.

Re-open the **Set Symphony Configuration** pop-up (**Option > Set Symphony Config**).

In the **Application Token** editbox, enter the Application Token of the "eval board demo" application. Click **OK**.



The screenshot shows a dialog box titled "Set Symphony Configuration" with a blue header bar containing the LinkLabs logo and window control buttons. The dialog contains four configuration fields: "Network Token" with the value "4956b36e", "Application Token" with the value "d1d1ae4f679bbb7ffaa9" (highlighted by a red arrow), "Receive Mode" set to "Off" in a dropdown menu, and "Quality of Service" set to "0" in a spinner box. At the bottom, there are "Cancel" and "OK" buttons, with the "OK" button highlighted by a red rounded rectangle.

Prelude's **Status** pane begins to update as the Symphony Link Module connects to the gateway and registers its Application Token with Conductor.

```

Status
ATTACHED!
Node Address: $301$0-0-0-0400007d2
Firmware Version: 1.1.0
Hardware Type: LLRXR26 v3
Application Token: d1d1ae4f679bbb7ffaa9 | Registered ←
Receive Mode: OFF
QoS: 0
Network Info:
  Network Token : 4956b36e
  Gateway Address : $101$0-0-0-db93e825c
  Gateway Channel : 39
  Gateway Frequency : 923187205 [Hz]
  Time Since Last Rx : 103 [Seconds]
  RSSI : -59 [dBm]
  SNR : 7
  GW Connection Status : CONNECTED ←
  
```

In your Conductor account, the "eval board demo" application now shows that it includes one **ENDPOINT** (meaning one Symphony Link Module).

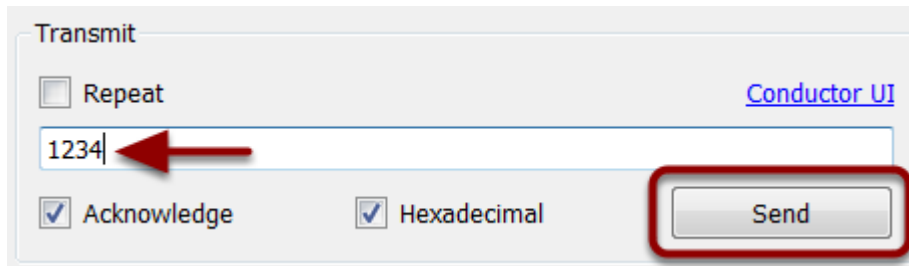
## Applications

[Add Application](#)

NAME	APPLICATION TOKEN	ENDPOINTS
eval board dem	d1d1ae4f679bbb7ffaa9	1 ←

## Step 8: Send an uplink message

In Prelude's **Transmit** groupbox, enter a hex-string message, like "1234". Click **Send**.



In the **Applications** section of your Conductor account, click on the "eval board demo" application to open the application's pop-up window.

APPLICATION EVAL BOARD DEM
✕

**APPLICATION TOKEN**  
d1d1ae4f679bbb7ffaa9

**CREATED**  
an hour ago

**ENDPOINTS**  
1

**NAME:**

### Downlink

Select an endpoint
▼

Hex payload

### Message Monitor

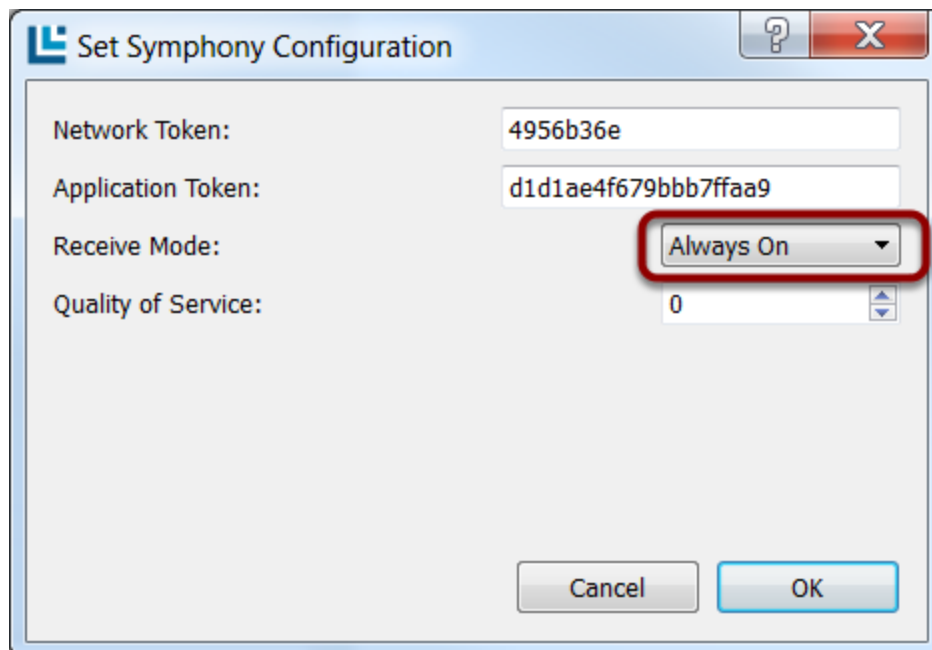
TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION
2015-12-30 17:18:38	\$30150-0-0-0400007d2	ex1234	Gateway x825C	A simple networ	eval board dem

If the uplink operation is successful, the message posts to the **PAYLOAD** section of the **Message Monitor**.

## Step 9: Send a downlink message

### Downlink using "Downlink Always On" mode...

From Prelude's **Options** menu, select **Set Symphony Config**. Set the **Receive Mode** dropdown to **Always On**. Click **OK**.



The screenshot shows a dialog box titled "Set Symphony Configuration" with the following fields and values:

Field	Value
Network Token:	4956b36e
Application Token:	d1d1ae4f679bbb7ffaa9
Receive Mode:	Always On
Quality of Service:	0

Buttons: Cancel, OK

In your Conductor account, find the **Downlink** section of the "eval board demo" pop-up window.

# APPLICATION EVAL BOARD DEM ✕

**APPLICATION TOKEN**

d1d1ae4f679bbb7ffaa9

**CREATED**

an hour ago

**ENDPOINTS**

1

**NAME:**

eval board dem

## Downlink

Select an endpoint ▾

Hex payload

## Message Monitor

TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION
2015-12-30 17:18:38	\$301\$0-0-0-0400007d2	0x1234	Gateway x825C	A simple networ	eval board dem



Using the **Select an endpoint** dropdown, select the UUID of the Symphony Link Module on your evaluation board. Enter a hex-string message in the **Hex payload** editbox, like "4321". Press **Send Message**.

## APPLICATION EVAL BOARD DEM

×

<b>APPLICATION TOKEN</b> d1d1ae4f679bbb7ffaa9	<b>CREATED</b> an hour ago	<b>ENDPOINTS</b> 1
--------------------------------------------------	-------------------------------	-----------------------

**NAME:**

### Downlink

\$301\$0-0-0-0400007d2

▼

4321

Send Message

### Message Monitor

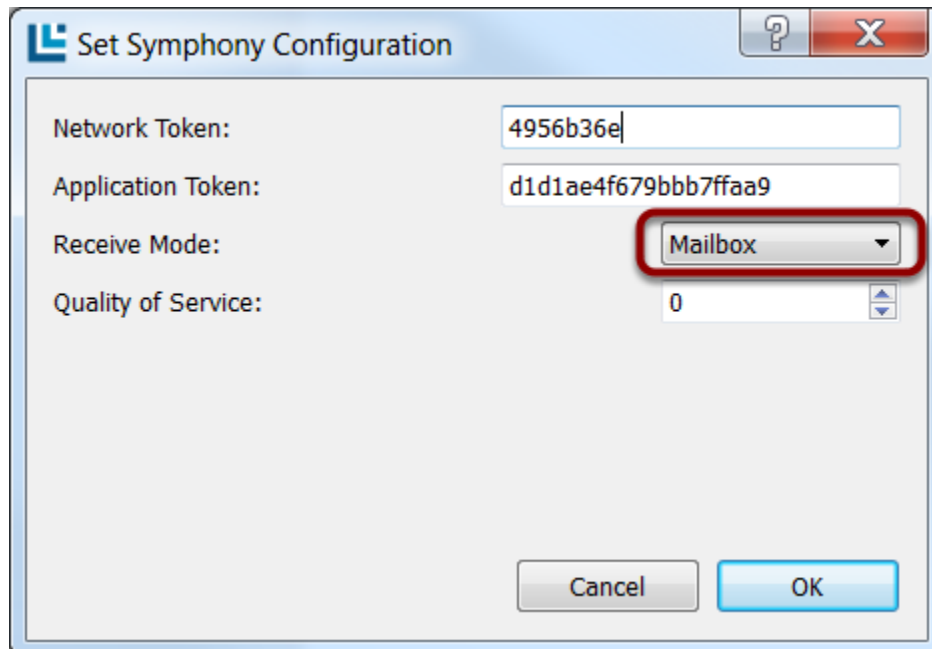
TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION
2015-12-30 17:18:38	\$301\$0-0-0-0400007d2	0x1234	Gateway x825C	A simple networ	eval board dem

The message will post to Prelude's **Receive Window**.

TIME, RSSI(dBm), DATA_ASCII, DATA_HEX
12:36:36, -58, CI, 4321

## Downlink using "Mailbox" mode...

From Prelude's **Options** menu, select **Set Symphony Config**. Set the **Receive Mode** dropdown to **Mailbox**. Click **OK**.



The screenshot shows a dialog box titled "Set Symphony Configuration" with a blue header bar containing the LinkLabs logo and window control buttons. The dialog contains four configuration fields:

- Network Token:** A text input field containing "4956b36e".
- Application Token:** A text input field containing "d1d1ae4f679bbb7ffaa9".
- Receive Mode:** A dropdown menu with "Mailbox" selected. This field is highlighted with a red rectangular border.
- Quality of Service:** A numeric input field with "0" and up/down arrow buttons.

At the bottom of the dialog are two buttons: "Cancel" and "OK".

In your Conductor account, find the **Downlink** section of the "eval board demo" pop-up window.

# APPLICATION EVAL BOARD DEM ✕

**APPLICATION TOKEN**

d1d1ae4f679bbb7ffaa9

**CREATED**

an hour ago

**ENDPOINTS**

1

**NAME:**

eval board dem

## Downlink

Select an endpoint ▾

Hex payload

## Message Monitor

TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION
2015-12-30 17:18:38	\$301\$0-0-0-0400007d2	0x1234	Gateway x825C	A simple networ	eval board dem

Using the **Select an endpoint** dropdown, select the UUID of the Symphony Link Module on your evaluation board. Enter a hex-string message in the **Hex payload** editbox, like "4321". Press **Send Message**.

## APPLICATION EVAL BOARD DEM ✕

### APPLICATION TOKEN

d1d1ae4f679bbb7ffaa9

### CREATED

an hour ago

### ENDPOINTS

1

NAME:

eval board dem

## Downlink

\$301\$0-0-0-0400007d2

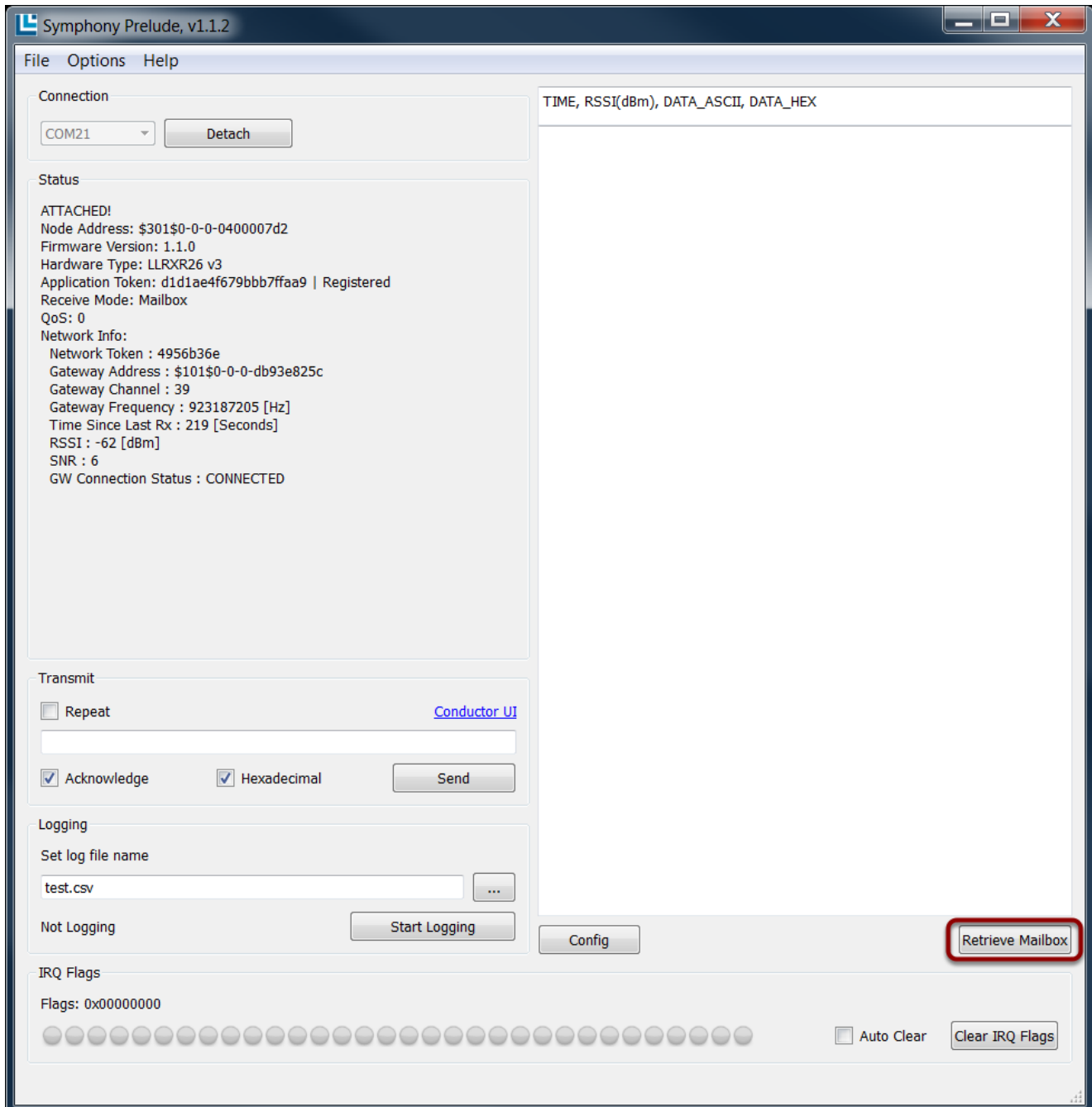
4321

Send Message

## Message Monitor

TIMESTAMP	ENDPOINT	PAYLOAD	GATEWAY	NETWORK	APPLICATION
2015-12-30 17:18:38	\$301\$0-0-0-0400007d2	0x1234	Gateway x825C	A simple networ	eval board dem

In Prelude, click the **Retrieve Mailbox** button.



The message will post to Prelude's **Receive Window**.

TIME, RSSI(dBm), DATA_ASCII, DATA_HEX
10:23:04, -60, CI, 4321 