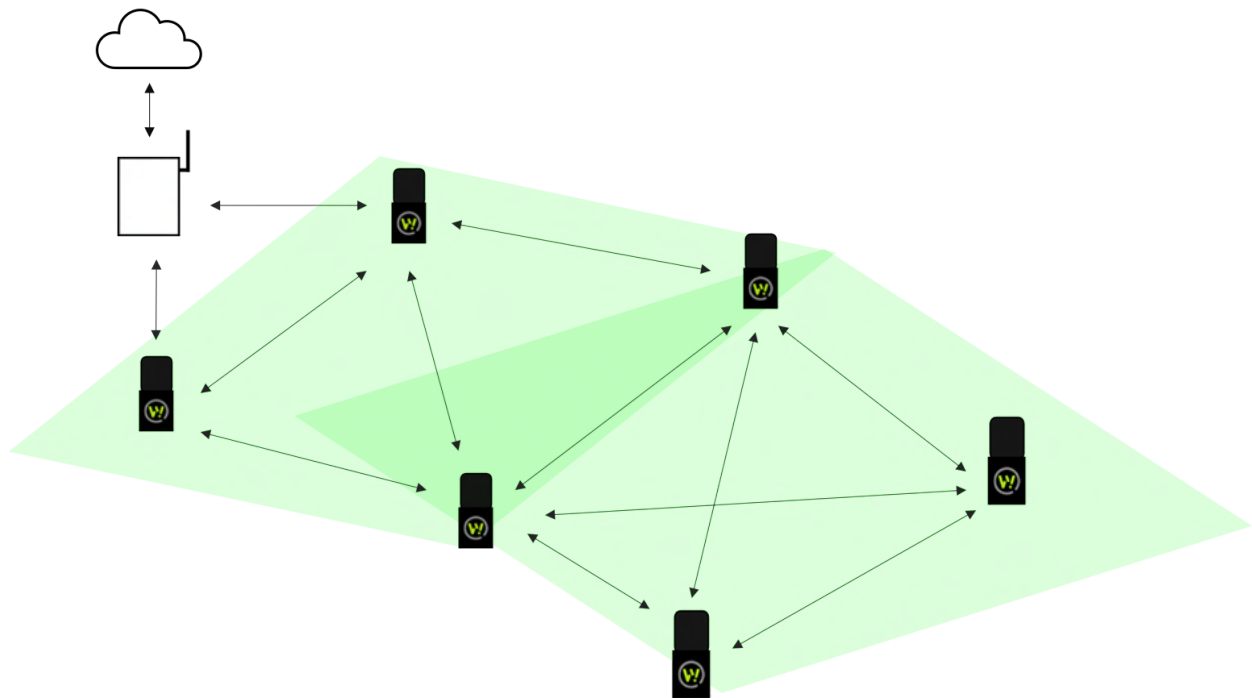


Overview of the system

Wittra's sensor tags, mesh-routers and gateway together form a [mesh network](#) based on 6LoWPAN (IPv6 over Low-Power Wireless Personal Area Networks). The network is IP-enabled down to the sensor tags, where data is communicated wirelessly over IEEE 802.15.4g radios in the Sub-GHz RF band.

The data can easily be accessed via our [Wittra portal](#) by adding an integration; For further information please have a look at [Accessing your data](#).

Mesh network



In a mesh network, data can be routed from one node to another to reach the end destination (in our case a gateway). In comparison, in a star network all nodes would communicate directly with a central hub.

By using a mesh network we extend the range of a network further than one single hop. Mesh networks are self-healing in the sense that data can be re-routed when nodes fail along the path.

In our mesh network we have sensor tags, mesh-routers and a border-router (attached to a gateway).

- A sensor tag acts as a leaf node in a mesh network topology, which means that it will only produce and send data but **not** forward data packets from other devices. Thus, the radio of a

tag does not need to be turned on all the time which decreases power consumption and - as a consequence - increases operational lifetime.

- A mesh-router - in contrast - has the main purpose of forwarding data packets. This is the reason why it needs to be powered all the time.
- A border-router sits inside a gateway. It is the end destination of data packets in a mesh network. The border-router conveys the data to the gateway which then sends the data up securely, via HTTPS, to our Witra portal.

Network settings

Channels

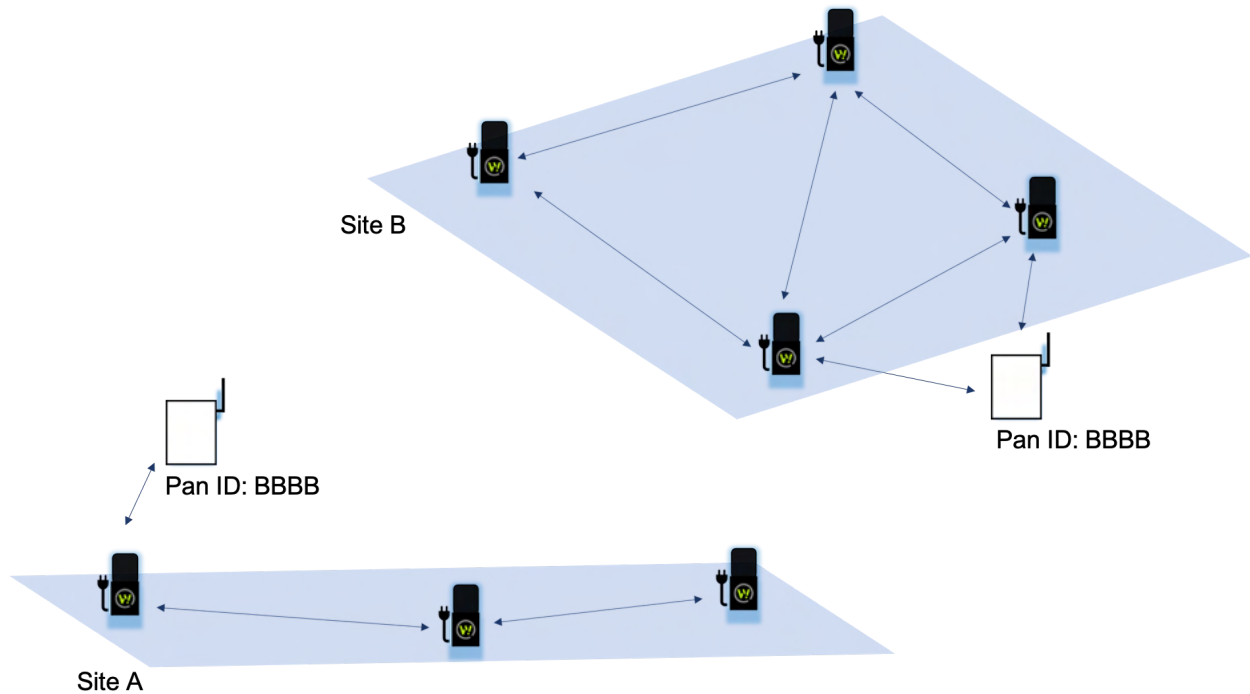
Our solution operates in the Sub-GHz frequency band, and uses Frequency Hopping (FH) for increased reliability. The devices switch frequency several times per second, to mitigate the impact of any individual bad channel. When a transmission fails on a bad channel, new attempts will be performed over different channels, increasing the likelihood to eventually succeed.

Note that the Sub-GHz band is much less prone to interference than the 2.4 GHz band, since there are fewer products on the market that uses this spectrum and at the same time government regulations impose limits on the radio usage per device. However, interference still exists and that is why FH is key to building robust networks.

We will soon offer the ability to configure the channel set for any given system. This way, you will be able to exclude any channel that you want or must keep unused to various administrative reasons. You will also be able to isolate multiple Witra systems if desired, by selecting non-overlapping channel sets.

PAN ID

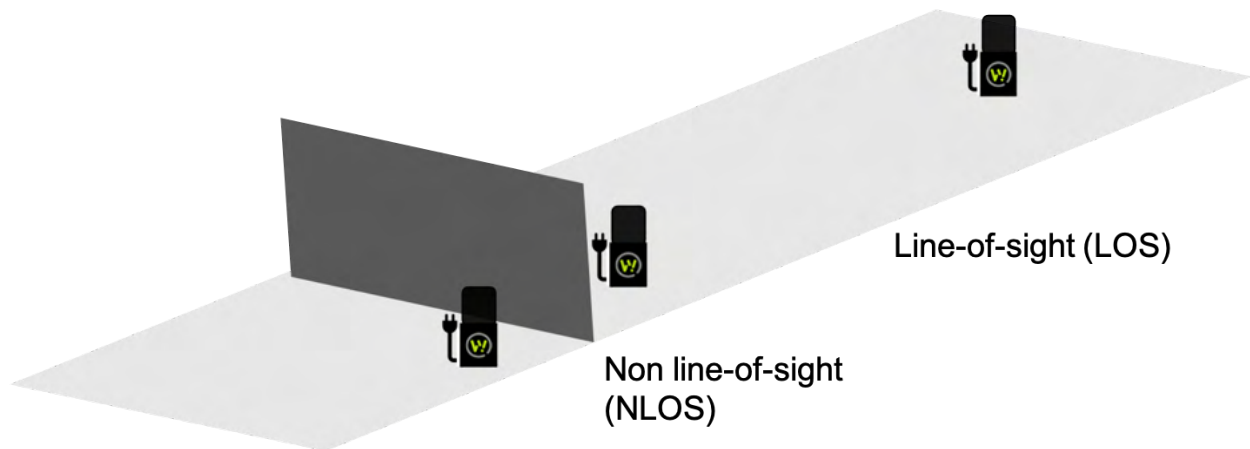
The PAN ID is a unique ID for a group of physically co-located IEEE 802.15.4 devices, each local network should have its own ID. Networks near each other mustn't have the same PAN ID. It is randomly selected at deployment but can be changed at any point of time in the [Witra portal](#). The PAN ID can be used to connect two networks, so a tag can move in between sites.



Expected range

The radio in the sensor tag, mesh-router and border-router runs Sub-GHz in the industrial, scientific and medical (ISM) frequency band. By communicating in this frequency domain you have a better range than for example the higher frequency band of 2.4 GHz. You also have a better penetration meaning you can communicate in harsher radio environments such as construction sites and in cities, where line of sight is not an option.

The expected range of the system depends if you have line of sight or non-line of sight and how high up you can put the mesh-routers. But in average the range is around 100-200m.



Secure system

We use a Secure-by-design approach where we incorporate security from the early architecture design stage and throughout the evolution of the products. The key protections we have are

summarized below:

- **Spoofing** is mitigated using an authentication process utilizing JWTs that are signed by a private key stored in a TPM on the gateway which are checked in registered devices on our cloud service, where the respective public key is stored.
- **Tampering** is mitigated using DTLS/TLS to encrypt the data sent between sensor tag and gateway, and between gateway and Wittra portal. One caveat is that with the current protocol bridging between CoAP and HTTP in the gateway, **the gateway has to be a trusted device**.
- **Confidentiality** is obtained by running CoAP over DTLS from sensor tag to gateway and by running HTTP over TLS from gateway to Wittra cloud service. The HTTP/TLS link is verified using an X.509 certificate provided by the server (in this case Google Cloud Platform) and issued by a trusted authority. The CoAP/DTLS link is verified with a Pre-Shared Key (PSK) which is randomly generated at deployment. This key must be kept secret and therefore **the gateway has to be treated as a trusted device**. See [Updating security settings](#) for more information.
- **Elevation of Privileges** is handled by standard Linux account authentication and authorization mechanisms in the gateway. On our Wittra cloud service it is handled by Google's Cloud Identity and Access Management (IAM).

Overview of Wittra portal

Wittra portals provide a rich user interface for administration and maintenance of Wittra solutions. The following screenshot gives you an overview of the Wittra portal.

The screenshot displays the Wittra portal interface for 'Example Project 1'. The top bar shows the organization name and a user profile. The left sidebar contains navigation links for Projects, Settings, and Billing. The main content area features a 'Project Dashboard' with summary cards for Gateways (1), Mesh Routers / Positioning Beacons (3), and Tags (4). Below these cards is a table of devices with columns for Status, Battery, Type, ID, Firmware, Last seen, and Actions.

Status	Battery	Type	ID	Firmware	Last seen	Actions
●	--	Mesh router	D00124800E1B3B8A		--	Details Remove
●	--	Tag	D00124800E1B3C5E		--	Details Remove
●	--	Mesh router	D00124800E1B3C7A		--	Details Remove
●	--	Gateway	G01230187091A112EEE	SENSEIT_RASPBERRYPI4-4.0.0	a minute ago	Details Remove

Top bar

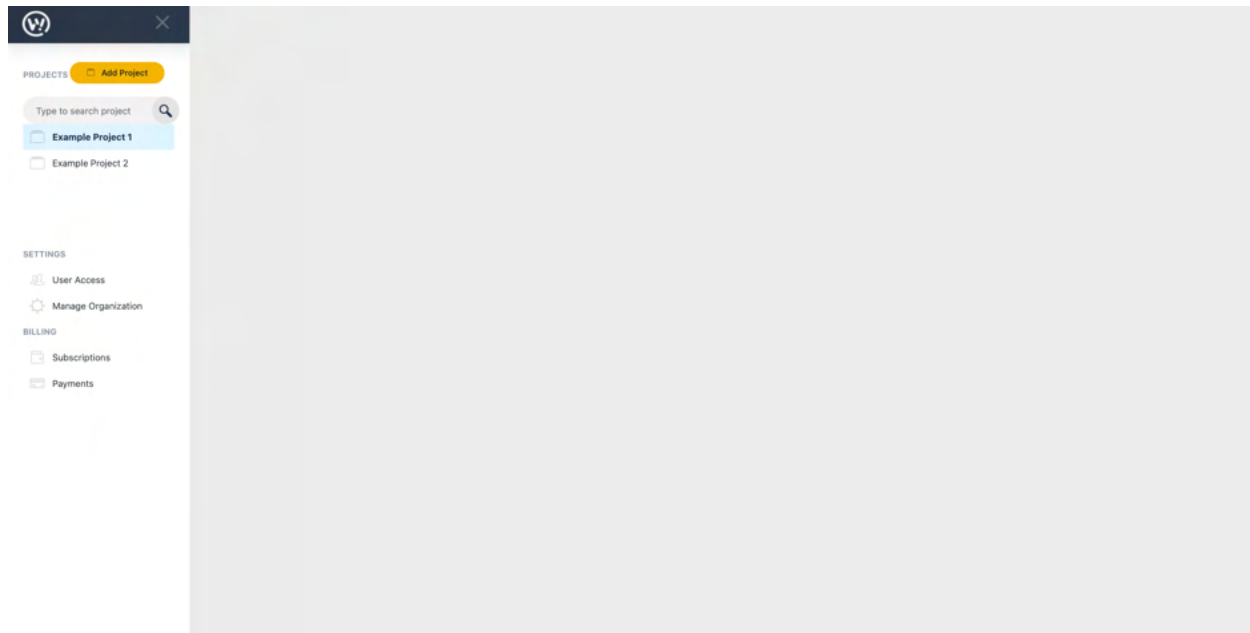


Indicates the name of the organization(s). You can also search through the list using the search functionality.

On the top right there is a  symbol with quick links to guides and walkthroughs.

On the very right you can find your account related information. Here you can edit your user profile information and log out of the portal.

Side panel



Shows the list of projects that is under the current organization. You can also search through the list using the search functionality.

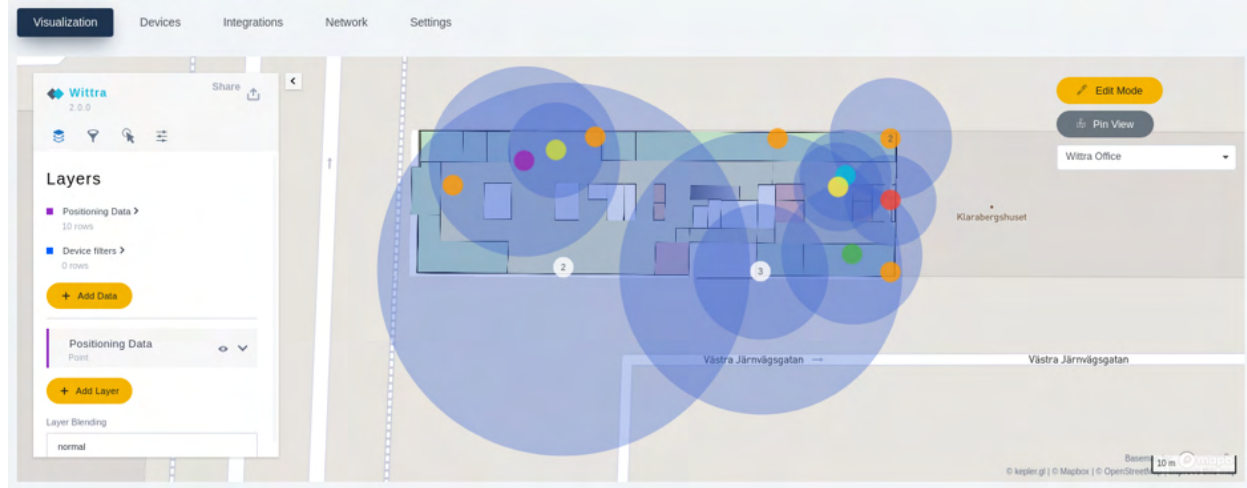
On the bottom left you have an admin view where you can manage your user permissions, organization information and billing.

Project Dashboard

The Project Dashboard is where all the information related to the deployment is displayed. Following sections will describe the functionality of each tabs.

Visualization

Here you can get an overview of the deployment on a map. For further information, please have a look at [Position your devices](#)



Devices

This view provides a list of devices that are added to your project. You can filter them based on the types of devices by clicking on the checkboxes next to device IDs or device names.

Status	Battery	Type	ID	Firmware	Last seen	Actions
●	--	Mesh router	D00124B001E1B3BBA		--	Details Remove
●	--	Tag	D00124B001E1B3C5E		--	Details Remove
●	--	Mesh router	D00124B001E1B3C7A		--	Details Remove

Firmware

For each device, there is a field indicating which firmware version it is running. The firmware version could be highlighted in one of the following colors.

- **Green:** Device firmware is up-to-date with the system version for the project, and the system version is the most recent version.
- **Blue:** Device firmware is up-to-date with the system version for the project.
- **Blue, with a percentage:** The device is currently undergoing an automatic firmware update.
- **Yellow:** Device firmware is outdated.

Last seen and Last boot

The gateway, sensor tags and mesh-routers regularly indicate their presence in the network.

In the [Project Dashboard](#) project view, the time when a device last reported can be seen in the **Last Seen** column. If the device report interval is within normal limits the device is marked with a green indicator. If a device is disconnected or has left the network, the indicator will turn gray.

Under the **Last Boot** column, the device reports the last time it re-started.

Details and Update

The Details view for each device allows you to configure the device, see [Configure your system](#) for more information.

You can select which devices to manually update, see [Updating your system](#) for more information.

Integrations

Here one can create an integration using Webhooks. For further information, please have a look at [Accessing your data](#).

Network

The network tree visualizes the overall architecture of the mesh network, depicting the link quality between the devices. It should be used during the deployment of the system. For further information, please have a look at the [Deployment Guide](#)

Settings

Here you can configure the [System version](#) and [Network settings](#). You can also change the name of the project. If you ever need to delete the project, you can do it here. Note that this step is permanent, and hence, follow the warnings carefully.

Getting started



This guide will help you get started with your IoT Solution from Wittra. This means:

- [Getting started](#)
 - [Meeting your IoT Solution](#)
 - [Powering your devices](#)
 - [Charging the sensor tags](#)
 - [Power the mesh-routers](#)
 - [Connecting your gateway](#)
 - [Setup an Internet connection](#)
 - [Power the Wittra Gateway](#)
 - [Using the Wittra portal](#)
 - [The next steps](#)

NOTE: Do you have any issues getting started? Check out our [Troubleshooting](#) section.

Meeting your IoT Solution

Open the WITTRA™ IOT OUT OF THE BOX, and get to know what it includes.



text

1) Gateway	x1	2) Sensor Tag	x4
3) Mesh-Router	x3	4) Cradle	x7
5) Velcro band	x4	6) Tag tool	x2
7) Power Supply Unit 12V	x1	8) Power Supply Unit 5V	x4
9) External Antenna	x1	10) Magnet	x1
11) USB OTG adapter	x1		

A Tag or a Mesh-router?

To distinguish between mesh-routers and sensor tags, remove the cradle the devices sit in. On the back of each device there is a model number.

- Mesh-routers are marked with model number **MESHROUTER-1.0-<EU/US>**
- Sensor tags are marked with model number **SENSORTAG-1.0-<EU/US>**

Powering your devices

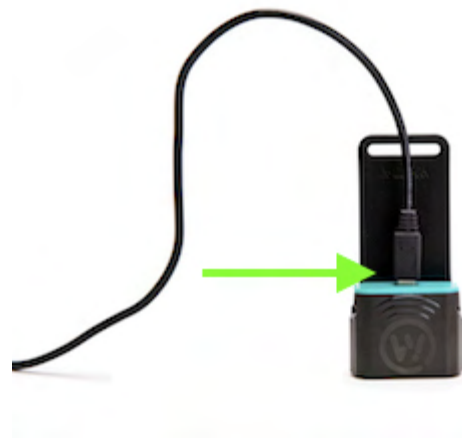
Before you can get started with your IoT Solution you have to charge the devices.

Charging the sensor tags

1. Collect all sensor tags. Initially you need to charge them because they are shipped with low charged batteries.
2. Unmount the protection cover with your hands or by using the accompanying tag tool from the box according to the pictures below. Place the tag tool in front of the tag and push towards the tag and then push up. The protection cover will be released.



3. Connect the Power Supply Unit 5V according to the picture. The Power Supply Unit 5V is included in the box.



4. The first initial charging time is approximately 3 hours. Check out the troubleshooting section to see [how to know when your sensor tag is fully charged](#).

Power the mesh-routers

When the sensor tags are fully charged, plug in the mesh-routers to the power supply. The mesh-routers should always be connected to a power supply.

Set up your gateway

The gateway allows your IoT Solution to connect to the Wittra portal.

Mount the antenna

Start by mounting the antenna on top of the gateway. The antenna is included in the box.



Open your gateway

Press the two metal clips on the bottom of the casing as in shown in picture below.



To assemble the gateway casing once again, please note that the side parts are non symmetrical and need to be mounted on the correct side.

Setup an Internet connection

Plug in an Ethernet network cable in the Gateway according to the picture and connect the other end of the cable to your router or switch. When the cable is connected, continue with the [Power the Wittra Gateway](#) step.



NOTE: The Ethernet cable is not included in your IoT Solution.

Power the Wittra Gateway

1. Connect the 12V Power Supply according to the picture. The 12V Power Supply is included in the box.



2. Wait 3 minutes for the Gateway to boot and start.

This Table depicts the Raspberry Pi's two LED indicators:

LED Color	Blink pattern	Status
Red LED	Steady on	The Gateway is powered.
Green LED	Steady off	The Gateway is not connected to any network. (There might be a link-local connection, but no IP address has been acquired)
Green LED	1 short blink and then 1 second off	The Gateway has connected to the local network but has not yet verified that there is Internet access.
Green LED	Steady on	The Gateway has connected to the network and was also successful in accessing the Internet.

Please refer to the [troubleshooting](#) section for more help.

After you have verified that the gateway is connected to your local network you can reseal the gateway by putting the cover back on.

Using the Wittra portal

You are now ready to register your IoT Solution in the Wittra portal. Go to the [portal](#) and follow the instructions to finish setting up your IoT Solution.

You should perform the following steps in the portal:

1. Setup an organization.
2. Activate a subscription.
3. Setup a project.
4. Register the devices. You will need to enter your batch token to register your devices. The batch token is printed on a sticker inside your WITTRA™ IOT OUT OF THE BOX, it should be visible after removing your gateway from the box, see picture below.



The next steps

- [Overview of Wittra portal](#) for more detailed information on the Wittra portal and its offerings.
- [Accessing your data](#) for inspiration of what you can build with your data and how to set up an integration.
- [Deployment](#) for guidance on how to install your system.
- [Updating your system](#) to have your system run with the latest features.

Updating your system

Wittra regularly releases improved software for all your devices. This page describes the various parts included in updating your devices to the latest releases.

There are two ways to update your Wittra devices (i.e. tags and mesh-routers):

- Manual
- Automatic

Manual update is required for:

- First time use
- PAN ID change
- Security update (e.g. DTLS key update)

An automatic update can take up to 24h. Therefore it's recommended to do a manual update when you want to do a quick update of your system.

What is a system version?

The gateway, mesh-routers and tags each have their own firmware version. The system version indicates a collection of firmware versions intended to work together.

It is recommended to always update the system version when possible, as it may fix bugs in the system, add new features, improve reliability, or contain security updates. To update to the latest system version, navigate to the **Settings** tab in the [Project Dashboard](#).

NOTE: When you have updated the system version under **Settings**, the system will start the automatic update. If you want to speed things up, do a manual update.

Updating your devices

In the Project Dashboard, go to the **Devices** tab. You will find information there on the current version for every device in your project. If any device is out-of-date, it will be indicated here, and you can update it by clicking the **Update devices** button and follow the wizard.

The gateway and border router will download their new firmware directly and install it. Mesh-routers and tags, however, will need to download the firmware either manually or automatically over 6LoWPAN.

Manual update

The manual update method is the faster one, but is limited in range and requires manual intervention (reboot the device in manual update mode).

To update your sensor tags and mesh-routers manually, you will have to collect the devices you wish to update and place them close to the gateway. Set the sensor tags and mesh-routers in manual update mode by using the included magnet and OTG adapter from the box.

Step 1. Unmount the protection cover using the accompanying tag tool from the box or carefully with your hands. Place the tag tool in front of the tag and push towards the tag and then push up. The protection cover will be released.

Step 2. With the micro-USB port protection cover off, place the included magnet on the device. It should be placed roughly in the area indicated by the picture below. With the magnet in place, insert the OTG adapter into the micro-USB port and then remove it again.



The device's LED should start advertising two short blinks followed by a pause to indicate that it has entered manual update mode, after which a device is ready to start the firmware download. If the device does not enter manual update mode, repeat Step 2 until it successfully enters manual update mode.

Step 3. Do this for all of the devices that you would like to update.

Manual firmware update will take approximately 2 minutes per device.

Automatic update

If you do not take any further action, nodes will be automatically upgraded over 6LoWPAN. There is no need to gather the devices nor reboot them into manual update mode. Note that this procedure is significantly slower, and could take between several hours and up to a day (due to lower bandwidth and spectrum regulations).

NOTE: The devices remain fully operational during the download, though once they are ready to reboot you may experience a short disconnection.

Updating network settings

If you need to change your network and security settings ([Settings](#) tab in the Wittra portal), you must get your devices back into manual update mode, as the new configuration would break 6LoWPAN connectivity.

Select your new settings, apply them, and set your devices into manual update mode as described in [Manual update](#).

Deployment Guide

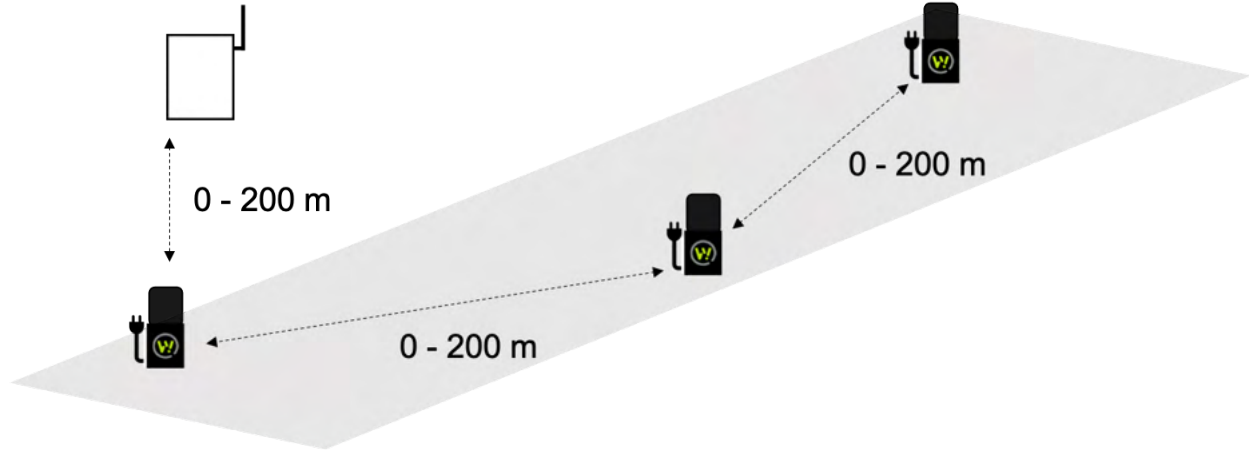
This guide will help you deploy the infrastructure of your system so you can start using your IoT Solution from Wittra. Your gateway and mesh-routers are like base stations, a fixed infrastructure enabling you to create your own network. Note that the tags are not part of the fixed infrastructure; they are mobile devices that send and receive data through the network, using the fixed infrastructure.

NOTE: Do you have any issues? Check out our [Troubleshooting](#) section.

Deploying your system

The following steps describe the setup process.

Step 1. Distribute all Mesh-routers within a range of 0-200 meters distance between Gateway-to-Mesh-router and/or Mesh-router-to-Mesh-router. **All mesh-routers should be powered at all times.**

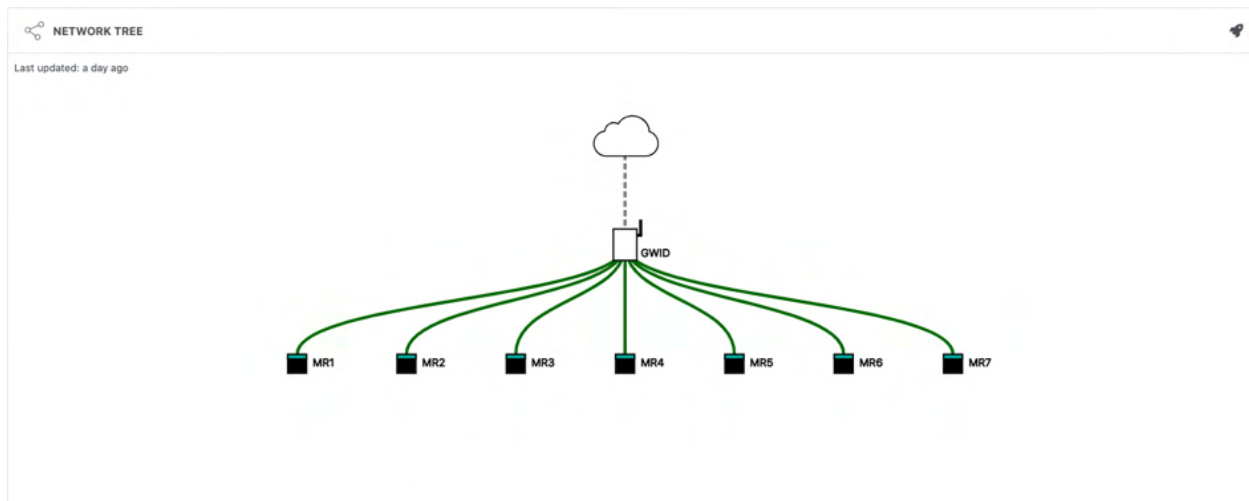


Step 2. Restart each mesh-router in place by inserting the provided OTG adapter.

NOTE: Restart each mesh-router after you put everything in place. Also make sure not to put any other mesh-router in close proximity to the one you are restarting. This is because the mesh-router you are restarting might erroneously choose the other mesh-router as its parent, which would result in an inefficient network topology.

Step 3. Check the link quality status under **NETWORK TREE** view in web-portal.

- Go to the [Wittra portal](#) web-portal
- Select your project and navigate to the **Network** tab Your deployment will be visible under **NETWORK TREE** , but please note that it could take up to ten minutes before the tree is updated. The connection between each device should be *GOOD* or *OK*, i.e. green or yellow lines.



Step 4. (if necessary) If the indication shows *BAD/ERROR* i.e. red or gray lines, move the affected Mesh-router closer to the Gateway or its closest Mesh-router and repeat Step 2.

NOTE: Radio range and link quality depends on multiple parameters, for example, physical obstructions (like walls, metal frames, building materials, etc.), radio and electronic interference from other appliances, etc.

Tags within your network can now start sending data. Check out [Accessing your data](#)

Updating security settings

We use a secure-by-design approach where we incorporate security from the early architecture design stage and throughout the evolution of the products. Read more about security measures employed in [Secure system](#).

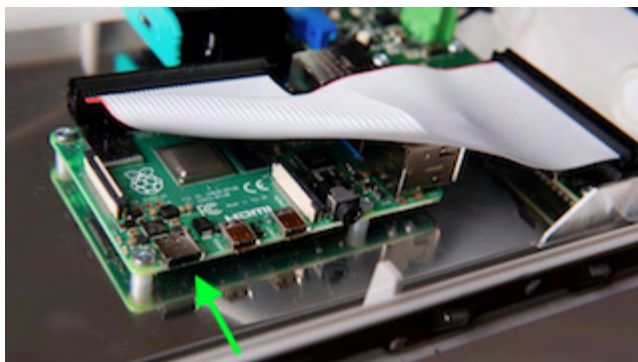
It's good practice to update security settings from time to time. Another reason could be to enable roaming between two sites, see more information on [Roaming](#)

Updating DTLS keys

Follow these steps on the gateway.

1. Disconnect the 12 V Power Supply if it is connected.
2. Connect a USB-A to USB-C cable with the USB-A end into a computer and the USB-C end into the Gateway.

WARNING! The Gateway cannot be powered by the 12 V Power Supply when connecting the USB-C cable to the Raspberry Pi, because this can damage the USB port of the computer!



NOTE: You need to provide the USB-A to USB-C cable yourself.

NOTE: A USB-C to USB-C cable will not work according to raspberrypi.org. If the computer doesn't have a USB-A connection, you need to use a USB-C/USB-A adapter.

3. Wait for the gateway to boot. It can take up to 3 minutes.
4. A virtual USB flash drive will be mounted and show up in the device list on your computer.
5. Open the USB flash drive, and open `security.txt` and follow the guidelines in the file.
6. Safely eject/unmount the virtual USB flash drive.
7. Unplug the USB-A to USB-C cable.

8. Continue with [Power the Witra Gateway](#).

9. Collect all your devices and do a manual update. Follow the steps in [Manual update](#)

NOTE: You will need to manually update all the devices in the network for this change to take effect.

Accessing your data

When your devices are registered and updated they are ready to deliver data. This document describes the different ways you can monitor and make use of the Witra IoT solution.

You can configure your devices to send data at a set interval or when a certain event occurs. Check out [Configure your system](#) for more information.

Register an integration

The devices send sensor data with a regular interval. To access the data, you need to register an integration. The data is pushed via a Webhook, specified as a URL where a publicly reachable web server is expected to be hosted.

To register an integration, go to your Project Dashboard, **Integrations** tab. Click **Create Integration**, select **Webhook** as type (the only type we currently support), and enter a URL that points to your server. The protocol part of the URL must be **https**.

Consuming the data

There are many ways to set up a Webhook server for receiving the data, we have provided a few examples in our GitHub repository github.com/witra/examples.

Data payload

The data is streamed to the Webhook in JSON format. The main body of the message contains a **message** key containing various keys, for example, **attributes**, **data** and **publish_time**.

- The **attributes** field contains information about the message, for example, which device sent the message and through which gateway the message was sent.
- The **data** field contains the sensor data, formatted as a Base64 encoded JSON string. See [Sensor data](#) for more information about the data field.

- The `publish_time` or `publishTime` fields contains timestamps of when the message was sent.

Example of a JSON payload:

json

```
{
  "message": {
    "attributes": {
      "deviceId": "D0123456789ABCDEF",
      "gatewayId": "G0123456789ABCDEFEE",
      "version": "v1"
    },
    "data": "eyJiYXR0ZXJ5Ij...",
    "messageId": "1000000000000000",
    "message_id": "1000000000000000",
    "publishTime": "2020-01-01T01:01:01.001Z",
    "publish_time": "2020-01-01T01:01:01.001Z"
  },
  "subscription": "projects/wittra/subscriptions/sub_BS2fnLgSr5e6vC9Sk4Pg"
}
```

Sensor data

The data received from the sensor tag and mesh-router is provided as a Base64 encoded JSON string. When decoded, the data types received in the resulting JSON are the following:

Data type	Unit	Comment
<code>accelerometer</code>	g (9.81 m/s ²)	3D data in x/y/z
<code>battery</code>	V	Battery voltage
<code>gyroscope</code>	°/s	3D data in x/y/z
<code>magnetometer</code>	G (gauss)	3D data in x/y/z
<code>neighbours</code>	dBm	List of neighbour IDs and the signal strength to them
<code>temperature</code>	°C	Temperature measured in the device
<code>timestamp</code>	UTC	Timestamp when a message was received in the cloud
<code>usage</code>	s	Seconds when a device has been in motion or stationary since the last time it posted

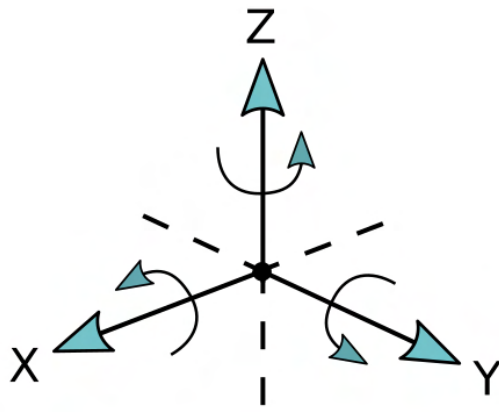
Example sensor data:

json

```
{
  "battery": 3.876,
  "accelerometer": {
    "x": -0.079,
    "y": 0.004,
    "z": 1.016
  },
  "gyroscope": {
    "x": -0.317,
    "y": 0.296,
    "z": 0.479
  },
  "temperature": 25.943,
  "usage": {
    "moving": 0,
    "stationary": 301
  },
  "magnetometer": {
    "x": 0.367,
    "y": 0.196,
    "z": 0.802
  },
  "neighbours": [
    {
      "id": "DFEDCBA9876543210",
      "rssi": -54
    },
    {
      "id": "D0123012301230123",
      "rssi": -55
    }
  ],
  "timestamp": "2020-01-01T01:01:00.000000"
}
```

Device orientation

The axes provided by the `accelerometer` , `gyro` and `magnetometer` fields can be interpreted by the following picture.



For example, if the tag is lying like the picture shown above, the accelerometer should report a Z value of ~ 1 g, due to the floor pushing up on the tag with a force matching the gravitational pull to the center of the earth.

If the tag is spinning on a turn table with a speed of one full revolution per second in a counter clockwise direction, the gyro should report a Z value of ~ 360 $^{\circ}/s$.

Positioning your devices

This guide will help you set up the system for positioning.

Setting up a system for positioning

Following steps describe the set up process.

Step 1. Go to the [Visualization](#) tab and click the *Edit mode* button on the right-hand side.

Step 2. Choose the **Position devices** in the menu to the right and click on each mesh-router to have them appear on the map. When the mesh-routers have appeared on the map, drag them to their true location. To ensure higher accuracy, it is recommended to use a drawing (e.g. a floor plan of the site) as an overlay. Learn more about overlays in the [Map layers](#) section.

NOTE: All mesh-routers need to be placed on the map for the positioning algorithm to work. It is also important that the mesh-routers are deployed to cover the entire site where you want to position your tags, see [Deployment guide](#).

Step 3. Tags will show up on the map on their derived position in the configured timeframe of the tag. Depending on the link quality between the tag and its neighbors the position will have varied accuracy, which is illustrated as circles around the tag on the map. E.g. a large circle means low accuracy.



Map Layers

Step 1. Under the **Visualization** tab click the *Edit mode* button on the right-hand side and select *Layers*.

Step 2. Click the *Add Layer* button and upload a file of your floorplan or site drawing, in JPG or PNG format. Save the file by clicking *Add Layer*.

Step 3. Zoom into your site location on the map. Select your layer on the left hand side, drag and drop the corners to fit the map.

Step 4. Click *Exit Edit Mode* on the right-hand side menu. Choose the newly added layer in the drop down menu labeled *Select map layer*.

Configure your system

Devices

You configure your devices by pressing the *Details* button under the **Devices** tab.

Gateway

The gateway serves as a proxy for the data, passing it on from the network up to cloud. It is not a configurable device in the same sense as a mesh-router and a tag.

What you can configure is a *Name* for your gateway for easier identification, as well as a *Group*. A group can be used when filtering devices on the map in **Visualization** tab.

Mesh-Router

The mesh-routers route data in the network and they are an instrumental part of positioning. If the mesh-routers do not have a good connection between each other, the network will not perform as intended. To monitor the network connection, mesh-routers post the signal-strength (dB) and link quality of its neighbors.

There are two ways of setting a posting interval for a mesh-router. Under *Settings*, you can activate *Interval-based data* and/or *Event-based data* posting.

- For interval-based data you set the posting interval by using the slider above.
- For event-based data you set the difference in signal-strength (dB) for what should count as an event. You also set the sampling interval (s) for an event.

NOTE: The battery-lifetime and congestion likelihood is affected by how often you set the posting interval.

You can set a *Name* for your mesh-router for easier identification, as well as add your mesh-router to a *Group*. A group can be used when filtering devices on the map in **Visualization** tab.

Tag

You can set a *Name* for your tag for easier identification, as well as add your tag to a *Group*. A group can be used when filtering devices on the map in **Vizualisation** tab.

The tag posts sensor data up to the Wittra portal on a configurable interval.

There are two ways of setting a posting interval for a tag: *Interval-based data* and *Event-based data* posting. Event-based data is only applicable for Battery, Temperature, Network, and Usage (Moving/Stationary).

Under *Settings* for each sensor, you can activate *Interval-based data* and/or *Event-based data* posting.

- For interval-based data you set the posting interval for **all** sensors by using the slider under *Sensor data posting interval*.
- For event-based data you set a trigger for a specific event per sensor and set the sampling interval (s) for an event.

Data tab

For each tag, you see all sensors' current values, and how it has changed between postings. We currently support the following sensors.

- Battery
- Temperature
- Usage (moving/stationary)
- Accelerometer
- Gyroscope
- Magnetometer

Network tab

For each tag, you can see a table of its closest neighbors and the signal strength between the tag and its neighbor. The signal strength of a tag's neighbors affects the positioning functionality.

Settings

You can configure your full system under the **Settings** tab in your project.

System version

Here you can set your system's [System version](#). Once you have set your system version, an [automatic update](#) is triggered and the tags and mesh-routers will be automatically upgraded over 6LoWPAN. The automatic procedure may take up to 24 h, so to speed things up you can collect your devices and set them in Manual update mode, as described in [Manual Update](#)

Network settings

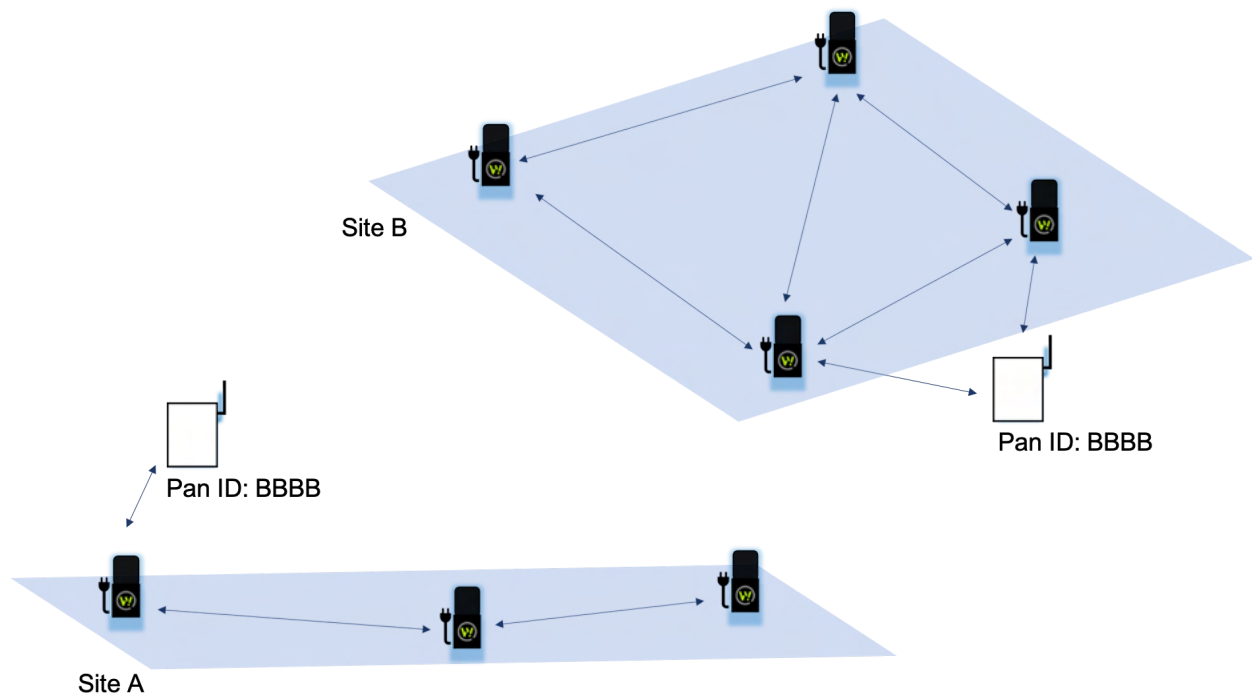
Here you can set a PAN-ID for your network, if you want to connect two networks e.g. on two different sites. To setup roaming between two sites, they both need to have the same PAN-ID.

Roaming

You can enable roaming between two or more networks. Note that these networks should not be within range of each other. To enable roaming, follow these steps:

1. Copy the `security.txt` file from gateway B and replace the `security.txt` file in gateway A with this copy.
2. Change the PAN-ID of gateway A to the one of gateway B

NOTE: You will need to manually update all the devices in network A for this change to take effect.



Re-naming project

Here you can re-name your project.

Delete Project

Here you can delete your project. Note that this step is permanent, and hence, follow the warnings carefully.

Troubleshooting

Have an issue? Look here for support.

General

Unboxing and Getting Started

My IoT Out of the Box is not working

1. Look through this page to see if a more specific question matches the issue you have experienced.
2. See [My Gateway is not working](#).
3. Ensure that all hardware looks intact. If not, please contact the supplier.

Can I set up my sensor network outdoors?

In short, yes. However, there are two main considerations for this:

1. It is only the sensor tag that is weatherproof. If you set up the gateway or the mesh-routers outdoors they need to be protected from different weather conditions, such as rain.
2. The gateway is a **trusted device**, which should be located where you have physical protection against malicious agents.

Where do I find my batch token?

The batch token is printed on a sticker inside your IoT Out of the Box, it should be visible after removing your Gateway from the kit.

I do not have a power supply/power cable

The devices require standard Micro-USB charging devices, see details in the respective device [datasheet](#). The hardware can be purchased from your Wittra hardware supplier or any supplier who offers a standard micro-USB charger that follows the requirements in the datasheet and Micro-USB standards.

I don't have an USB-A to USB-C adapter

The adapter can be purchased from any supplier offering the standard adapter according to the USB standards.

My IoT Out of the Box is missing parts

Please contact the supplier from whom you purchased the "IOT OUT OF THE BOX".

How many sensor tags and mesh-routers can I connect to the network

Your subscription will state the number of devices you can connect to your network. The maximum number of mesh-routers are depending on the number of sensor tags and traffic in your network. Please contact [Wittra Customer Support](#) for further information and network dimensioning.

Other Issues

I can't find a solution to my problem

If you cannot find the solution to the problem(s) you are experiencing you can contact our [customer support](#).

How do I contact customer support?

The email address to our customer support is support@wittra.se. Also, you can find more information on the [support page](#).

I would like to buy more sensor tags, gateways and mesh-routers

Please contact your Wittra hardware supplier for additional sales.

I would like to return my IoT Out of the Box

Please contact your supplier from whom you purchased the "IOT OUT OF THE BOX".

I would like to return my gateway

Please contact your supplier from whom you purchased the gateway.

I would like to return my mesh-router

Please contact your supplier from whom you purchased the mesh-router.

I would like to return my sensor tag

Please contact your supplier from whom you purchased the sensor tag.

I have lost my release key/tag tool for the USB connector cover protection

Please contact your Wittra hardware supplier for additional sales.

Gateway

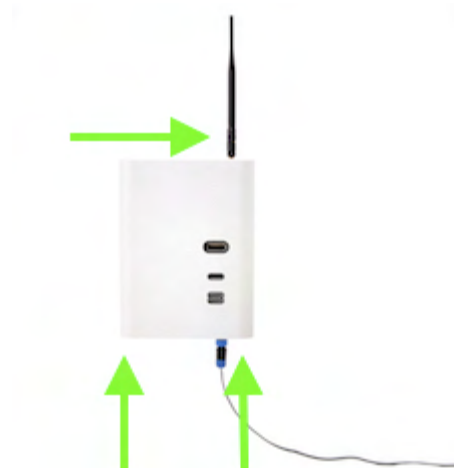
Unboxing and Getting Started

How do I install a new Gateway?

Please have a look at the [Set-up your Wittra Gateway section](#) in the [Getting started guide](#).

I can't open my Gateway

The Gateway is opened by pushing the two side locks upwards. These can be found on the underside of the gateway (marked by two green arrows in the picture below). Note that the right side lock can only be fastened on the right side and the left side lock can only be fastened on the left side.



How do I see if my Gateway is working?

In the [Wittra portal](#), navigate to the project for which you have registered the gateway. Once in the project view, you can see a list of gateways on the left-hand side. You should now be able to locate your gateway ID in the list. If the gateway's status shows up as green it is working.

If you have not yet registered the gateway, go to the [Wittra portal](#) and follow the registration instructions. If you have registered the gateway but it is not in the list of gateways on the portal,

please see section [My gateway is not working](#).

My Gateway is not working

If you have a gateway that is **not** visible on the portal go to part 1, otherwise go directly to part 2.

Part 1. Gateway is offline in portal

Please start by opening the gateway casing and check that the power LED on the Raspberry Pi shows a steady red and that the motherboard's (the board on which the border router is mounted) LED shows a steady green. If not please check that all cables are plugged in correctly and that the gateway is powered up.

If you got the gateway powered up, please proceed with the steps below.

The green LED on the Raspberry Pi itself indicates the network connection state. First check that the green LED on the Raspberry Pi itself is lit a solid green, which indicates that the Raspberry Pi has been able to connect to your LAN and the Internet.

If the LED is not a steady green light this might indicate that something is wrong with the LAN itself. Otherwise it could indicate that the gateway can connect to the LAN, but is not able to connect to the Internet.

This table depicts the two LED indicators of the Raspberry Pi:

LED Color	Blink pattern	Status
RED LED	Steady on	The Gateway is powered.
Green LED	Steady off	The Gateway is not connected to any network. (There might be a link-local connection, but no IP address has been acquired)
Green LED	1 short blink and then 1 second off	The Gateway has connected to the local network but has not yet verified that there is Internet access.
Green LED	Steady on	The Gateway has connected to the network and was also successful in accessing the Internet.

After having verified that the Raspberry Pi is able to connect to the LAN and the Internet, try restarting your gateway to see if the error disappears and that the gateway shows up on the Wittra portal with status green (online).

If that does not help, please revisit the setup instructions in the [Getting started documentation](#) and verify that you have set up the Internet connection correctly.

Part 2. Gateway is online in portal but is not working correctly

If the Gateway is online on the Wittra portal it means it has been set up correctly to the Internet. First try and restart your gateway to see if the error disappears.

If that is not the case, please try and update the gateway on the [Wittra portal](#).

If the gateway still is not working, try to perform the update procedure again.

Configuration and Settings

How do I connect my Gateway to my router via an Ethernet cable?

Please look in the [Setup an Internet connection](/getting-started.md#Setup an Internet connection) section of the [Getting started](#) documentation.

Mesh-Router

General

How do I charge my mesh-router?

The mesh-router could be charged using a standard Micro-USB charger but should always be deployed and installed using fixed power.

How do I see when a mesh-router is fully charged?

When charging, your mesh-router will blink slowly. The LED will be on for three seconds, then off for three seconds, and so on. Once the battery is full, the LED will stop blinking in this pattern.

I need to reset my mesh-router

The mesh-router is reset the same way as a [tag](#).

Mounting and Attaching

Can I use my mesh-router in cold climate

The temperature ranges for the mesh-router is specified in the mesh-router [datasheet](#)

Do I need to protect my mesh-router in heavy rain?

The mesh-router should not be exposed to heavy rain. If you are mounting your mesh-router outdoors, please set it up under some sort of rain cover, e.g. under the eaves of a building.

Upgrade and Updates

After an update of the mesh-router, the mesh-router is not working

Please allow some time to pass after an update to allow the mesh-router to come back online. It might be the case that other devices in the mesh network have not finished updating yet. Please also ensure that the mesh-router is plugged into a power source.

If the problem persists after other mesh-routers are online with the same version, try using your OTG adapter to reboot the device close to a mesh-router which is showing up as online in the portal.

If the device still is not coming online, try to perform the update procedure again.

Sensor Tag

General

How do I charge my tag?

Remove the USB connector cover protection using the included release key tool. This will expose the micro-USB charging port. To charge, plug in the included USB charger using a micro-USB cable.

My sensor tag doesn't seem to charge

If the sensor tag is not indicating a [charge pattern](#) and is not posting data, try to [reset the sensor tag](#) using the OTG adapter.

If the problem persists, please contact the support of your supplier from whom you purchased the sensor tag.

How do I see when a sensor tag is fully charged?

When charging, your sensor tag will blink slowly. The LED will be on for three seconds, then off for three seconds, and so on. Once the battery is full, the LED will stop blinking in this pattern.

I need to reset my tag

Use the OTG adapter included in the kit to plug into the micro USB connector at the top of the device, you should see two quick blinks which indicate that the device has rebooted and the OTG adapter can be unplugged.

Do I need to protect my sensor tag in heavy rain?

Your sensor tag is designed for full exposure to all types of weather. Just ensure that the USB connector cover is properly attached.

Configuration and Settings

Can I change the interval when the tag is sending data?

Yes, in the [Wittra portal](#), it is possible to set the update interval for each sensor and tag.

Upgrade and Update

I need to update my tag

When a tag needs an update its version will be marked in orange in the [Wittra portal](#), at the top of the project page the **Update devices** button will take you through the update wizard.

After an update of the sensor tag, the sensor tag is not working

Please allow some time to pass after an update to allow the sensor tag to come back online. It might be the case that other devices in the mesh network have not finished updating yet. Please also ensure that the sensor tag has a sufficient battery charge.

If the problem persists after other mesh-routers and sensor tags are online with the same version, try using your OTG adapter to reboot the device close to a mesh-router which is showing up as online in the portal.

If the device still is not coming online, try to perform the update procedure again.

API

General

Where do I set my Webhook address?

Please look at [Register an integration](#) for information on how to register a Webhook.

The Webhook is not working

Make sure that the Webhook server is reachable from the internet, i.e. that no firewall blocks incoming TCP traffic on the port used by the server. Take a look at our [examples](#) on how to set up a test Webhook server.

What is the format of the streamed sensor data?

Please look at [Data payload](#) for more information regarding the payload in the data stream.

What type of sensor data do I receive?

Please look at [Sensor data](#) for more information regarding the sensor data in the data stream.

Where do I find examples of what applications and services I can build?

There are examples and accompanying documentation available in Wittra's [examples GitHub repository](#).

Can I have more than one integration/Webhook?

Yes, you can add multiple integrations to your project. Note that the same data will be sent to all integrations. This can be useful if you want your data to go into multiple existing systems.

Datasheets

Datasheets for Wittra Products are available for download in PDF format using the links below.

- [Wittra IoT Out of the Box](#)
- [Wittra Sensor Tag](#)
- [Wittra Mesh-Router](#)
- [Wittra Gateway](#)

Release Notes

18 March 2021

System Version 3.4.0

- The calculation that limits a device from sending too much data now takes the region (Europe or North America) into account.
- Increased the size of each data block when sending firmware to devices, resulting in faster automatic updates.
- Adjusted timings when the device is joining a network to save battery power.
- Fixed a bug that caused the gyroscope to report too small values.
- Fixed a bug when devices posts data that could previously cause the device to run out of free memory.
- The initialization sequence for each device has been refactored for improved stability.
- Various bug fixes.
- Cloud config automatically propagates to GW services.
- Gateways can now update up to three devices simultaneously, in Manual Update Mode.
- New version of Tunslip6 for the border-router in the gateway.
- Gateway contains software license information in the file system.
- Various bug fixes.

Portal Version 4.6.1

- Possible to see why a device has rebooted in the in detailed view of a service.
- These release notes are now present in the home page of the portal, as well as in the documentation.
- Users that are added to an organisation are now only invited, and not directly added.
- Some columns/cells in the device table have had descriptions added, visible when hovering above them.
- Possibility to upgrade and downgrade between subscription tiers.

- Each project is now tied to a specific region; Europe or North America.
- Clarifications in the modal for performing manual firmware updates.
- Clarifications when changing the system version for a project.
- Possibility to edit the name of a project.
- Added a column with timestamps indicating when a device was started (uptime).
- Improved and extended documentation.
- Many bug fixes.

1 March 2021

System Version 3.3.0

- Improved Manual Update OAD procedure.
- Bug fixes in security chip.
- Minor changes to the HW PIN driver.
- The network traffic through the border router is now monitored, and if the region specific regulations are exceeded it will turn off radio traffic. (This previously existed only on tags and MRs.)
- Several improvements to RSSI proximity, to achieve higher accuracy and faster responsiveness.
- Fixed an issue where devices would be unable to transmit.
- If a device is put into Manual Update Mode when there is an automatic update running, the device will no longer boot back into the old application.

Portal Version 4.4.2

- Editing the PAN ID of a network is now done in the project settings view.
- Improved the map view when many devices are at located close to each other.
- Several bug fixes.

12 February 2021

System Version 3.2.0

- TPM bug fixed in mb-watchdogd on the gateway.
- Several improvements have been done to ensure network stability.

Portal Version 4.3.0

- New flow for manually updating device firmware.
- Refined network deployment tool.
- Possibility to leave organizations.

28 January 2021

Portal Version 4.1.1

- Optimization of realtime data propagated to the portal
- Minor bug fixes
- Performance update to the data fetching in the portal

22 January 2021

System Version 3.1.0

Please note that this is a new major version. If you upgrade to this version, you need to upgrade all devices in the IoT network, and not just a subset of them.

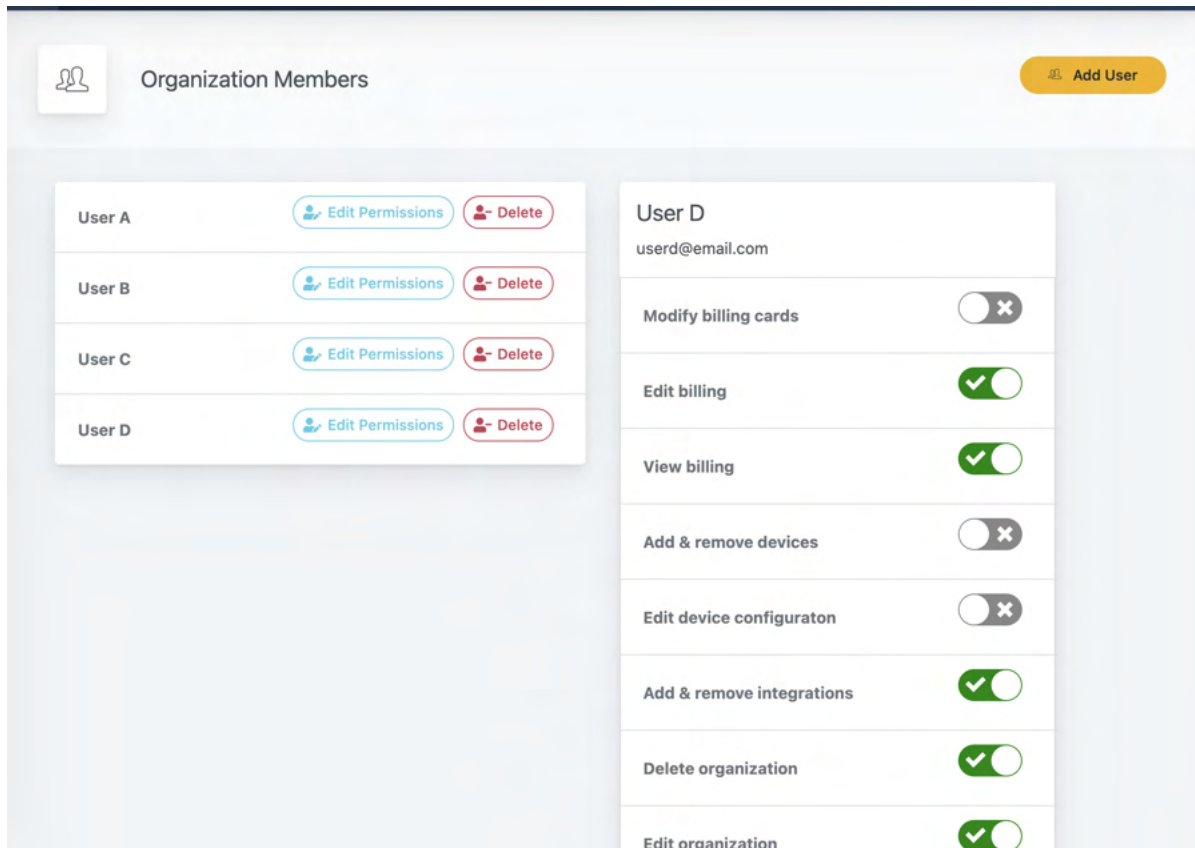
- Introduced experimental support for geographical positioning of tags. This is built upon RSSI tags' and mesh-routers' RSSI values, and requires no additional hardware.
- Introduced support for Frequency Hopping, which removes the need to set a specific frequency for the Sub-GHz network, between tags, mesh-routers and gateways. This increases reliability as well as throughput, allowing for larger networks to be built and more data to be sent.

- Tags now post battery information, with an expected remaining percentage.
- Now supports greater distance 6LoWPAN updates over the Wittra network
- When upgrading firmware automatically, the estimated time until completion is now sent by the devices that are being updated.
- COAP stability enhancements w.r.t. reconnection and timeout
- Tags now post a heartbeat message every five minutes.
- Tags now post the total transmission (TX) time.
- The underlying operating system for tags and mesh-routers has been changed to TI-RTOS.
- Radio usage for each device is now reported to the cloud portal.
- Temperature and battery data can now be received in the cloud portal as event-based data. The configuration is done in the portal.
- Devices now report their uptime for the duration that they have been on.

Portal Version 4.0.3

- The portal has been reworked in its entirety. With the new portal, you will get crucial information about your Wittra IoT devices with fewer clicks, and it is easier to get an overview of your Wittra system.
- It is now possible to put labels on devices, allowing to group devices e.g. in the same building or on the same floor.
- It is now possible to upload image layers on top of the map, e.g. custom blueprints of a building.
- True position of gateways and mesh-routers can be set in the map for a project.
- The portal displays battery information received from the tags.
- If the location of a tag has been measured with the aforementioned experimental RSSI-based positioning, it will show up in the new *Visualization* tab, in the view for a project in the portal.
- The portal is now event-driven in the sense that both changes and new data are now instantaneously displayed.
- Automatic update of the system is now available. With one click, all devices in a project can now be automatically updated within 24-hours.

- It is possible to choose any supported system version for a project, instead of only the latest.
- Deployment tool. A graph showing the relationship between the components in a Wittra IoT network.
- Permissions have been added on an organization level. It is now possible to restrict or grant users permissions to certain views and actions in the portal.



- In the portal, Data Endpoints have been renamed to Integrations.
- It is possible to configure devices to report data only when changes happen (event-based), in addition to reporting at fixed intervals.
- There is an option to configure multiple devices at the same time.
- New payment system:
 - A dedicated Billing page with all billing information.
 - You can now add one or several payment cards to your organization and choose from which card Wittra will charge at the end of the month.
 - Pay outstanding bills directly in the portal.

Support

If you are having issues getting started with the Wittra IoT Solution, check out our [getting started guide](#). If you cannot find your solution there, we also encourage you to look through the

[Troubleshooting](#) section. You're also welcome to contact us at support@wittra.se for further assistance.

Wittra also offers technical support plans and service packages to help our customers get the most out of the Wittra products. If you are interested in more information about support plans and service packages, please contact support@wittra.se.

Legal

Legal documents about Wittra's products and service, as well as compliance and operating information.

Regulatory Compliance and Safety Information

Responsible party: Wittra Sweden AB

Contact: support@wittra.se

Gateway

	EU	US
Product Name	GATEWAY 1.0 EU	GATEWAY 1.0 US
Model Number	GATEWAY-1.0-EU	GATEWAY-1.0-US
Part Number	1000186	1000347

WARNING Gateway

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product shall only be connected to the external power supply provided by Wittra, rated at 5V DC, and a maximum current of 1500 – 2000 mA.

This product should not be used within 20 cm of the body.

Instructions for safe use

To avoid malfunction or damage to your Gateway please observe the following:

Keep the device away from water, fire, humidity or hot environments.

Do **not** expose it to exaggerated heat or cold, the Gateway is designed for reliable operation at normal ambient room temperatures.

Do **not** attempt to disassemble, repair or modify the device.

Do **not** use a damaged charger or USB cable to charge the device.

Do **not** use any other chargers than those recommended.

Do **not** use the device where wireless device are not allowed.

Do **not** disassemble, crush, puncture, short external contacts, or dispose of the battery in fire or water.

Take care whilst handling the Gateway to avoid mechanical damage or discharge that might cause electrical damage.

Border Router

	EU and US
Product Name	BORDER ROUTER 1.0
Model Number	BORDER-ROUTER-1.0
Part Number	1000239

WARNING Border Router

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product shall only be connected to an external power via the Gateway.

This product should not be operated at temperatures below -10 or over +60 Degrees Celsius.

Instructions for safe use

To avoid malfunction or damage to your Border Router please observe the following:

Keep the device away from water, fire, humidity or hot environments.

Do **not** attempt to disassemble, repair or modify the device.

Do **not** use a damaged charger or USB cable to charge the device.

Do **not** use any other chargers than those recommended.

Do **not** use the device where wireless device are not allowed.

Do **not** disassemble, crush, puncture, short external contacts, or dispose of the battery in fire or water.

Do **not** expose it to exaggerated heat or cold, the Border Router is designed for reliable operation at temperatures ranging from -10 to +60 Degrees Celsius.

Do **not** attempt to remove or otherwise separate the device from the casing, this might cause mechanical or electrical damage to the product.

Do **not** remove the Border Router from the inside of the Gateway, this will cause the whole Network to go down and might also damage the Gateway and/or Border Router.

Take care whilst handling to avoid mechanical damage.

Sensor Tag

	EU	US
Product Name	SENSOR TAG 1.0 EU	SENSOR TAG 1.0 US
Model Number	SENSOR-TAG-1.0-EU	SENSOR-TAG-1.0-US
Part Number	1000158	1000348

WARNING Sensor Tag

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product shall only be connected to an external power supply rated at 5 V DC, and minimum current of 100 mA. Any external power supply used with the Sensor Tag shall comply with relevant regulations and standards applicable in the country of intended use.

This product is only deemed waterproof according to IP67 if the protection cover to the microUSB charger is on.

This product should not be operated at temperatures below -10 or over +60 Degrees Celsius.

Instructions for safe use

To avoid malfunction or damage to your Sensor Tag please observe the following:

Keep the device away from water, fire, humidity or hot environments.

Do **not** attempt to disassemble, repair or modify the device.

Do **not** use a damaged charger or USB cable to charge the device.

Do **not** use any other chargers than those recommended.

Do **not** use the device where wireless device are not allowed.

Do **not** disassemble, crush, puncture, short external contacts, or dispose of the battery in fire or water.

Do **not** expose it to water, moisture or place on a conductive surface whilst in operation when the protection cover is off.

Do **not** expose it to exaggerated heat or cold, the Sensor Tag is designed for reliable operation at temperatures ranging from -10 to +60 Degrees Celsius.

Do **not** charge the battery at temperatures outside of room temperature between +10 to +45 Degrees Celsius.

Do **not** attempt to remove or otherwise separate the device from the casing, this might cause mechanical or electrical damage to the product.

Take care whilst handling to avoid mechanical damage.

Mesh-Router

	EU	US
Product Name	MESH-ROUTER 1.0 EU	MESH-ROUTER 1.0 US

Model Number	MESHROUTER-1.0-EU	MESHROUTER-1.0-US
Part Number	1000240	1000349

WARNING Mesh-Router

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product shall only be connected to an external power supply rated at 5 V DC, and minimum current of 100 mA. Any external power supply used with the Mesh-Router shall comply with relevant regulations and standards applicable in the country of intended use.

This product is only deemed waterproof according to IP67 if the protection cover to the microUSB charger is on.

This product should not be operated at temperatures below -10 or over +60 Degrees Celsius.

Instructions for safe use

To avoid malfunction or damage to your Mesh-Router please observe the following:

Keep the device away from water, fire, humidity or hot environments.

Do **not** attempt to disassemble, repair or modify the device.

Do **not** use a damaged charger or USB cable to charge the device.

Do **not** use any other chargers than those recommended.

Do **not** use the device where wireless device are not allowed.

Do **not** disassemble, crush, puncture, short external contacts, or dispose of the battery in fire or water.

Do **not** expose it to water, moisture or place on a conductive surface whilst in operation when the protection cover is off.

Do **not** expose it to exaggerated heat or cold, the Mesh-Router is designed for reliable operation at temperatures ranging from -10 to +60 Degrees Celsius.

Do **not** charge the battery at temperatures outside of room temperature between +10 to +45 Degrees Celsius.

Do **not** attempt to remove or otherwise separate the device from the casing, this might cause mechanical or electrical damage to the product.

Take care whilst handling to avoid mechanical damage.

Compliance Information

The devices complies with the relevant provisions of the ROHS Directive for the European Union.

This product is in conformity with the protection requirements of Directive 2014/53/EU (RED) on the harmonisation of the laws of the Member States.

WEEE Directive Statement for the European Union

In Common with all Electronic and Electrical products the devices should not be disposed of in household waste. Alternative arrangements may apply in other jurisdictions.

Industry Canada Class B Emission Compliance Statement RSS-Gen & RSS-247 statement: This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RSS-102 Statement: This equipment complies with Industry Canada radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme à l'exposition aux rayonnements Industry Canada limites établies pour un environnement non contrôlé.

Warnings

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Shielded Ethernet cable must be used with this unit to ensure compliance with the Class B FCC limits.

Terms of Service

Describes the rules you agree to when using our service.

Check out the Wittra [Terms of Service](#).

Privacy Policy

Explains what information we collect and why as well as how we use it.

Check out the Wittra [Privacy Policy](#).

Legal Notice

Check out the Wittra [Legal Notice](#).

Licensing of the Wittra Platform

Wittra Portal Copyright (c) 2021 Nida Tech AB. All rights reserved.

Third Party Notices and/or Licenses

The following third party modules are used by the Wittra platform, and come with their own notices and licenses, the table below shows a list of those with their respective licensing terms. The full-text notices are shown below the table. Please note that the modules below may have other dependencies, please refer to their own licensing information for more details.

Provider	Component	License Information
Google Inc	Firebase	Apache License 2.0
Google Inc	Firebase UI React	Apache License 2.0
Kirollos Risk	Fuse JS	Apache License 2.0
Google Inc.	Firebase Admin	Apache

		License 2.0
Google Inc.	Google Cloud Python Client	Apache License 2.0
Google Inc.	Google Discovery API Python Client	Apache License 2.0
Google Inc.	Google OAuth2 Client	Apache License 2.0
Dropbox Inc., Google Inc., Skyscanner Ltd., WeWork Companies Inc.	gRPC	Apache License 2.0
Kenneth Reitz	Requests	Apache License 2.0
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