WELCOME

NEBULAE
DESIGN TO CONNECT

RESEARCH

DESIGN

DEVELOPMENT

MANUFACTURING

ABOUT SLS

WE ARE A

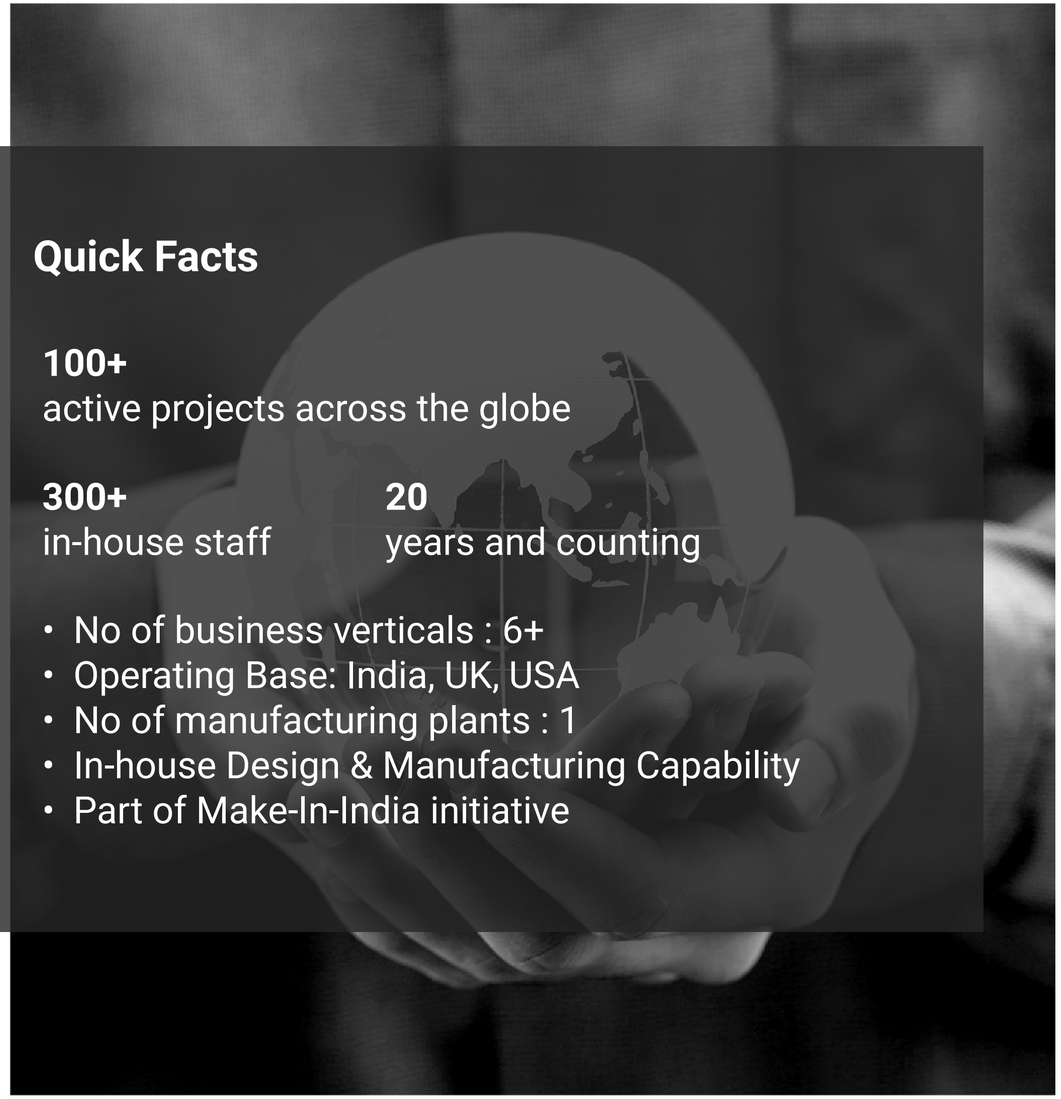
Product and service company

INTO

Hardware & Software

ESTABLISHED AS

Turnkey Solution Provider



Quick Facts

100+
active projects across the globe

300+
in-house staff

20
years and counting

- No of business verticals : 6+
- Operating Base: India, UK, USA
- No of manufacturing plants : 1
- In-house Design & Manufacturing Capability
- Part of Make-In-India initiative

Introduction

Nebulae LoRaWAN Network Server (LNS) is a service / software for operation and management of LoRaWAN networks. From a population of heterogeneous LoRa gateways, the Network Server creates a uniform, secure, resilient, distributed LoRaWAN network with a REST / TLS / WebSocket / MQTT data interface.

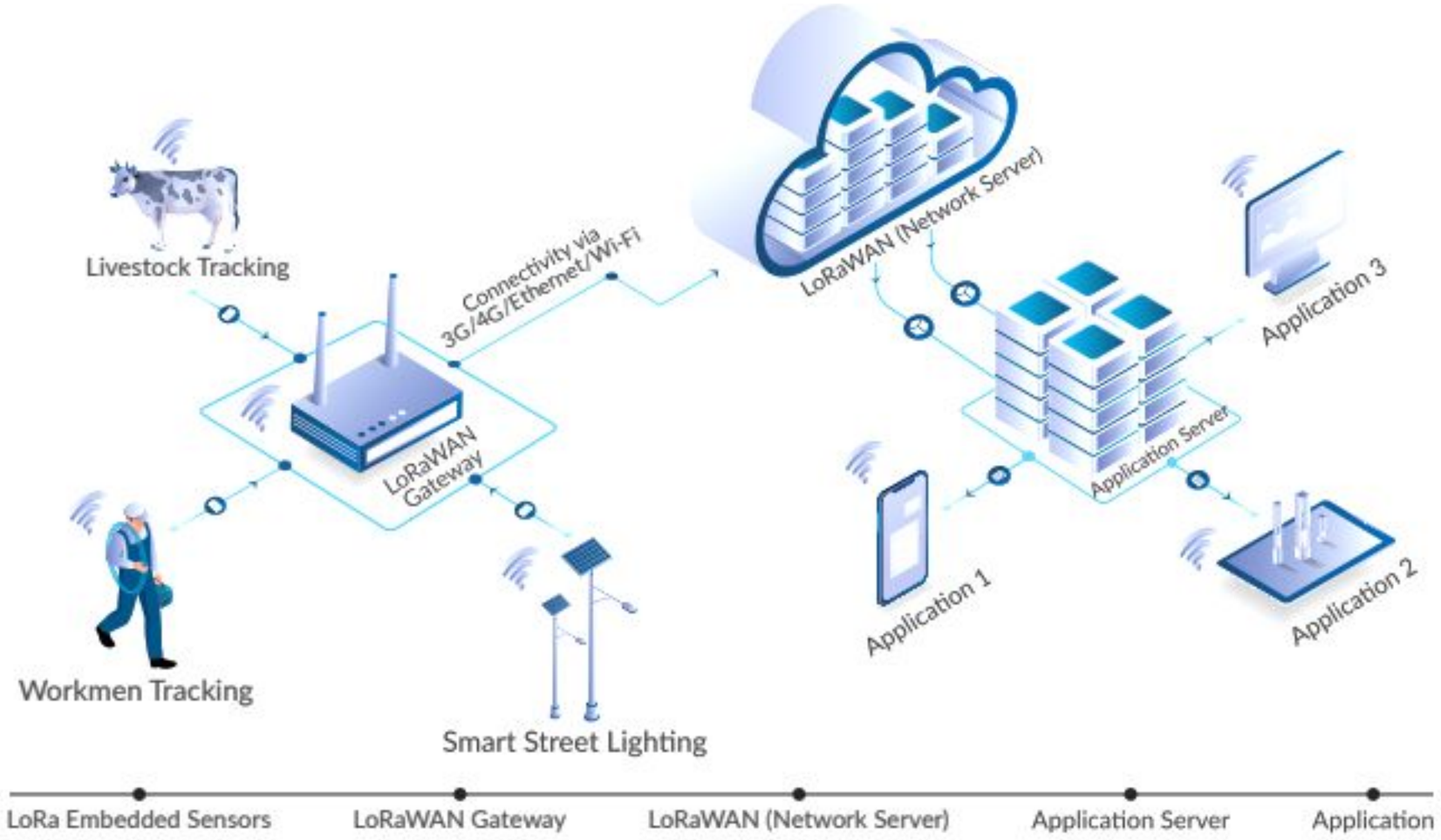
Nebulae LoRaWAN Network Server enables connectivity, management, and monitoring of devices, gateways, and end-user applications. Its main objectives are to ensure the security, scalability, and reliability of data routing throughout the network with the maintenance of Low-Cost Deployment.

The primary roles of the Network Server are:

- Granting and protecting access to the network
- Securing data transport from gateways to data consumers
- End-device and gateway provisioning
- Gateway management and monitoring
- Application & device management and monitoring
- Network health and status monitoring

Eco-System

LoRaWAN networks are deployed in a star-of-stars topology. A typical LoRaWAN network consists of the following elements.



Why Nebulae LoRaWAN Server?

Nebulae LoRaWAN Network Server	Open Source servers
• Full stack of features of users	• Very limited features
• Remote & Local Multicast Support	• Support only Local Multicast
• Multiband Region Support	• Not provided
• Fully KPI's Reports of Gateways & Devices for Analytics	• Partially Provided
• Documentation and technical support	• No proper documentation and restricted support
• Highly secure IoT network with no risk to data security	• Data breaching and no data security
• Support scalable infrastructure	• No scalability
• Support for Private Deployment on timely basis	• Deployment is time consuming

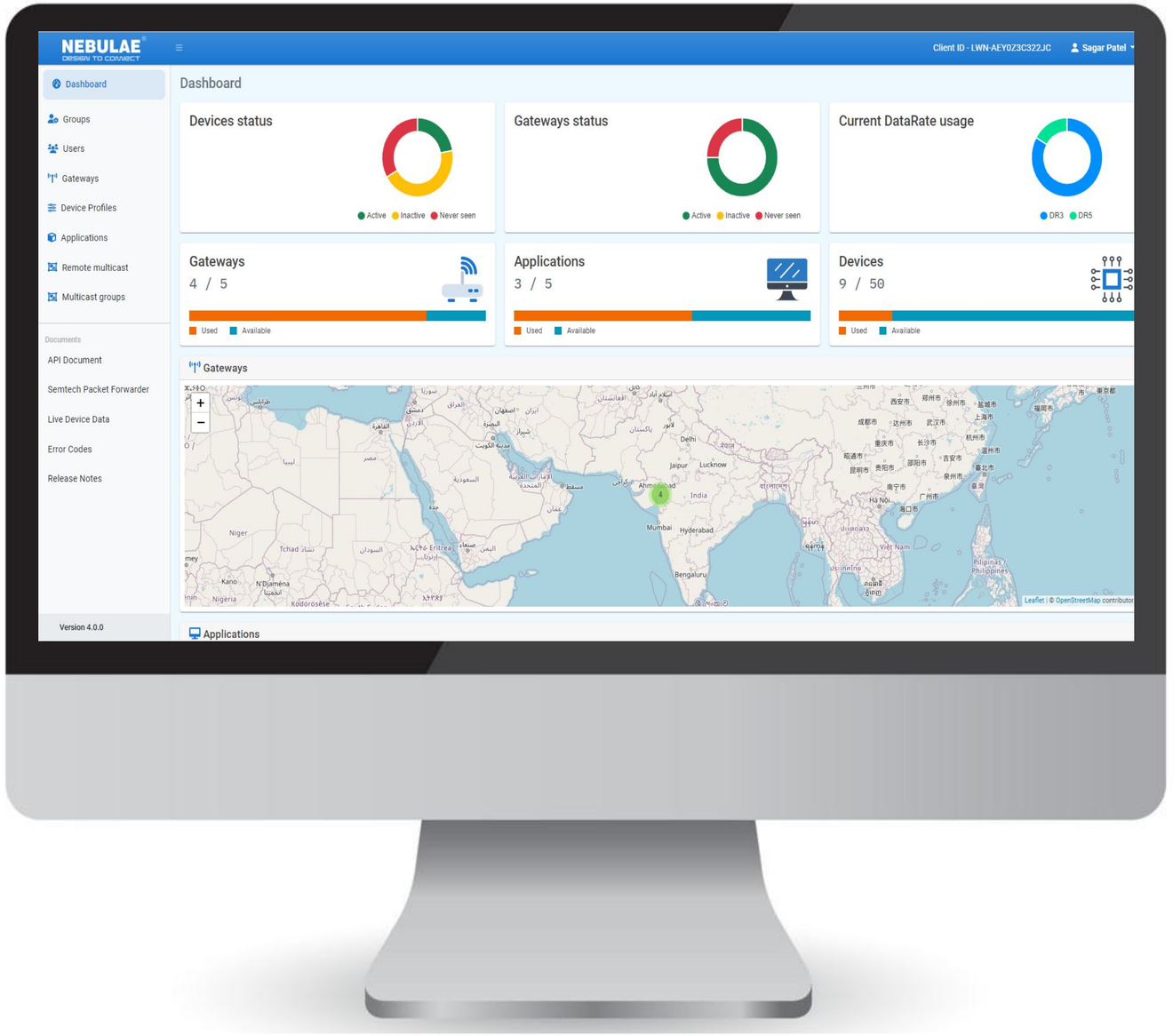
Dashboard- Features

Nebulae's LoRaWAN Network Server is an ubiquitous, easy to handle, and hassle-free IoT ecosystem.

Users can register up to 5 devices to test and evaluate their applications for FREE with our industry-standard LoRaWAN Network Server and can get real-time data reporting and visualization in no time.

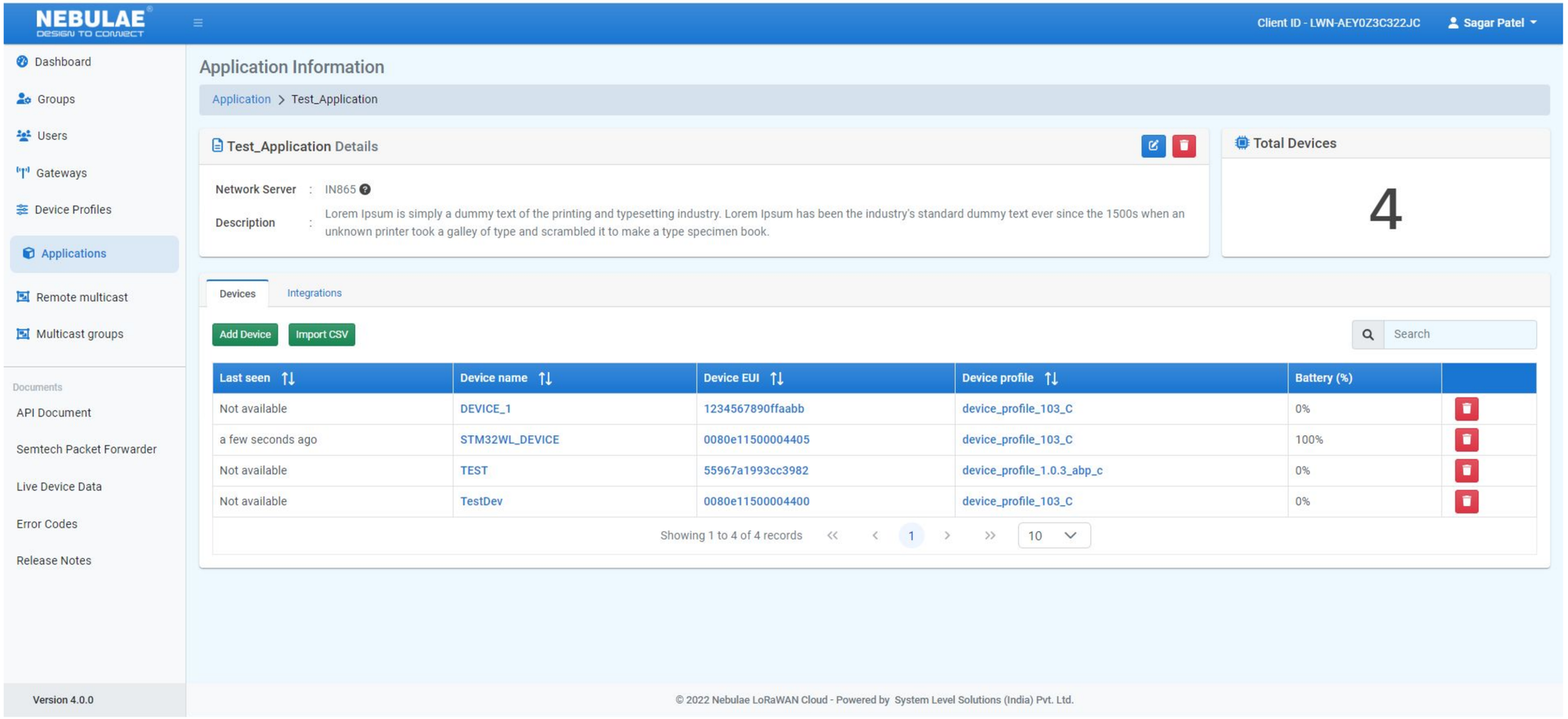
We have over more than 10,000 devices & 100+ gateways registered, deployed and running upfront on our platform.

Register free at **https://lora.nebulae.io/**



Device Management

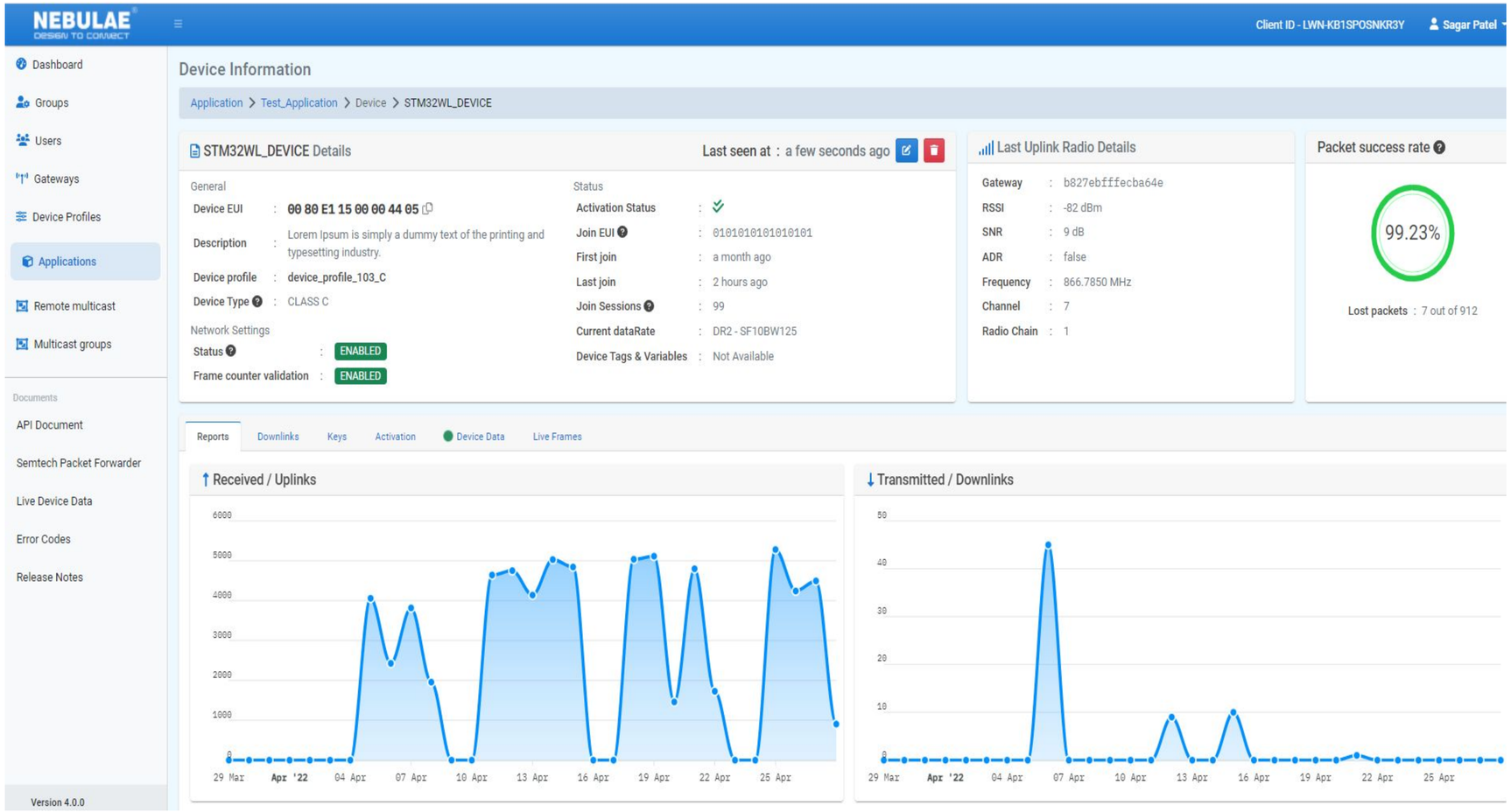
Bidding adieu to on-field and tedious device management, with Nebulae LoRaWAN Network Server user can add devices in bulk and also manage and control all the devices in an ecosystem.



Device Level – KPI's/Reports

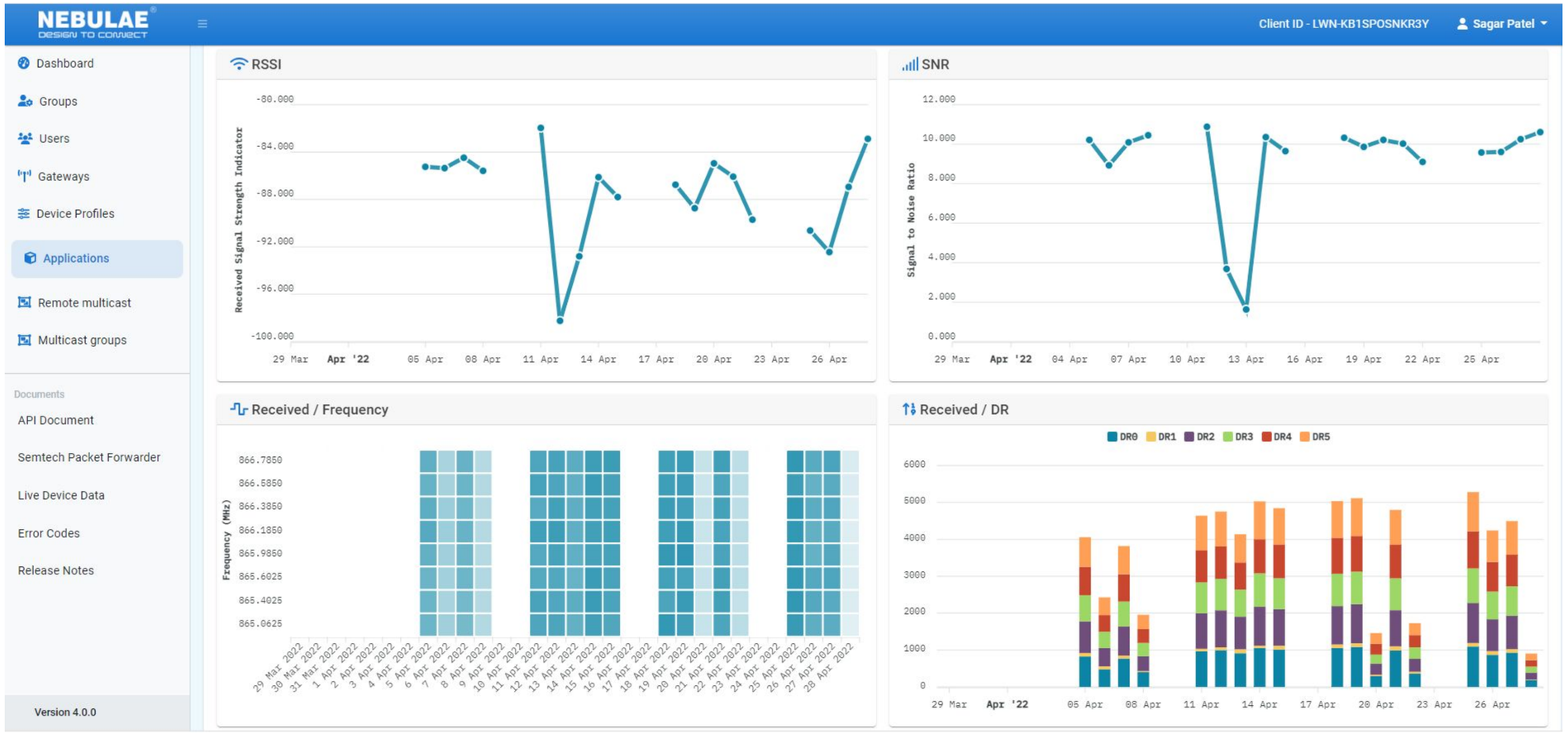
Developing the proper KPIs is a whole project in itself since it requires a careful evaluation of the various goals of a business. Once they are set, KPIs can be monitored regularly and used to define new strategies that will help improve performance.

- Total Uplinks and Downlinks
- Average RSSI and SNR Metrics
- Uplinks Received per frequency
- Uplinks Received per data-rate
- Confirm Downlinks per ack status
- Device Errors Reporting



Device Level – RSSI and SNR

NebuLink LoRaWAN Network Server allows seamless monitoring of RSSI and SNR under one platform for ease of use



Remote Multicast Group

Nebulae LoRaWAN Network Server supports next Generation Multicast. Remote Multicast is advanced feature fully compliant with the LoRa Alliance LoRaWAN Specification. Our solution has been designed to enable our customers to setup and operate large long-range LoRaWAN networks with ease and reduce potential pain points when scaling up their solution.
It allows the Application to define in advance the time of a multicast downlink message transmission to devices in 'Class-C' mode, thus preventing gateways interference and ensuring greater reliability in areas with high gateway density.

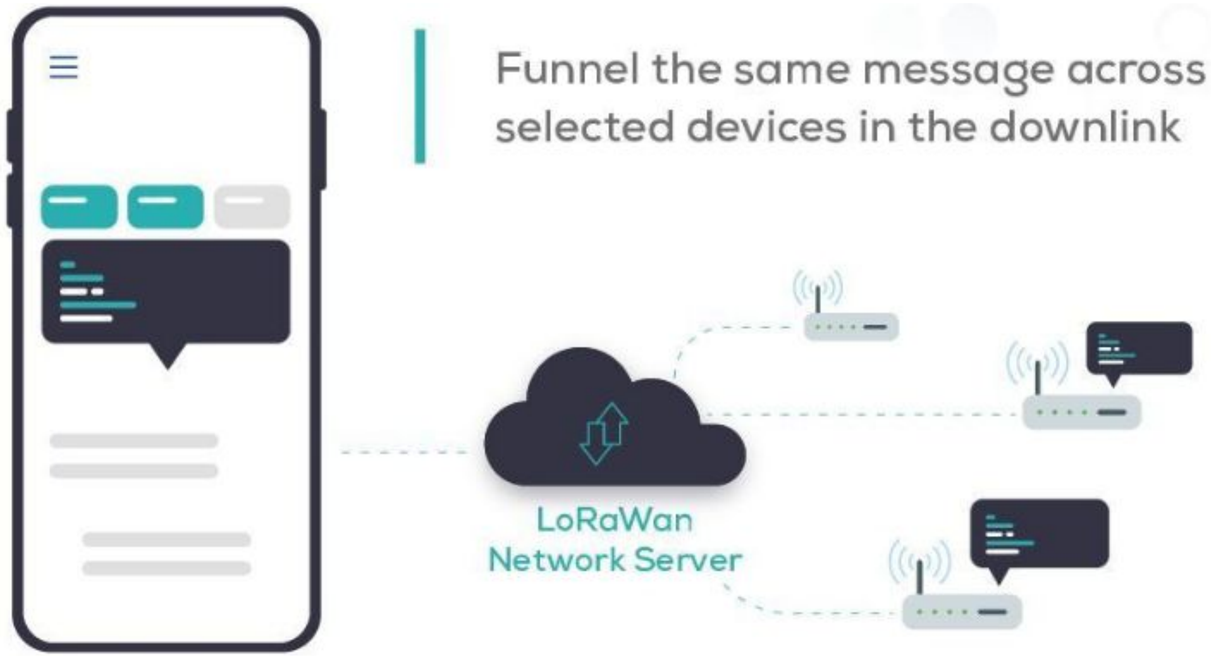
This feature is ideal for applications like street lighting, metering solutions or any solution benefiting from the remote control of many devices at the same time with a single command.

- Programmed Remote Multicast
- Higher Efficiency
- Ideal for high Density
- Large Deployments

Local Multicast Group

Nebulae LoRaWAN Network Server supports local Multicast. Local multicast group is a virtual ABP device (i.e., shared session keys), does not support uplink, confirmed downlink nor MAC commands Devices in a multicast group share the same multicast address, session keys, and frame counter.

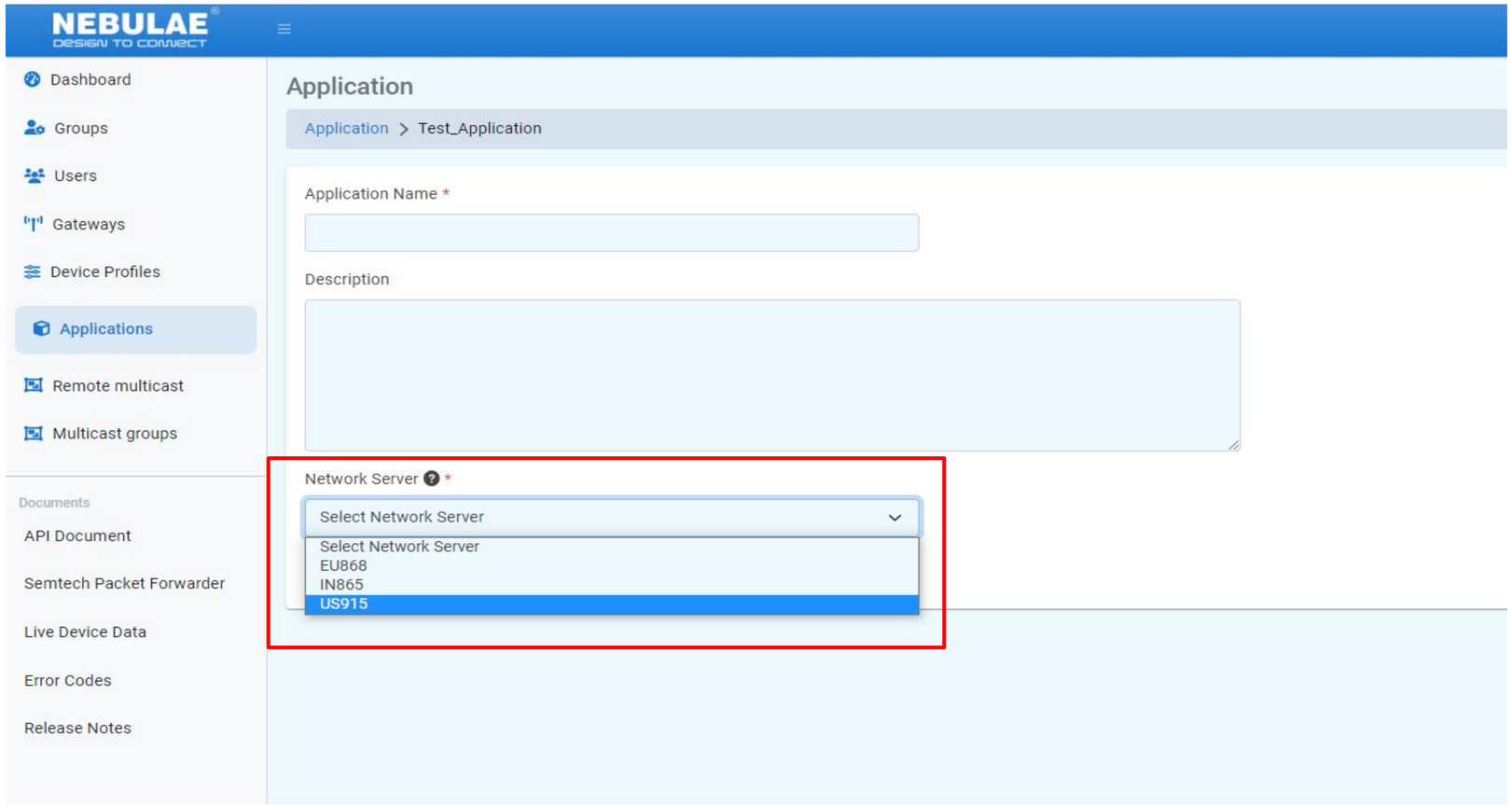
By using the same session keys, devices in a multicast group can decrypt the message when a downlink transmission is initiated. A multicast group only supports downlink. It doesn't confirm whether the downlink payload has been received by the devices.



Supported Regional Parametres

Nebulae LoRaWAN Network Server supports three primary channels across the globe in India 865-867 MHz (IN865), Europe 863-867 MHz (EU868), USA 902-928 MHz (US915) and five virtual channels in India region.

Our enterprise-grade solution enables our clients to build, operate, and manage their respective IoT infrastructure with ease all under one platform.

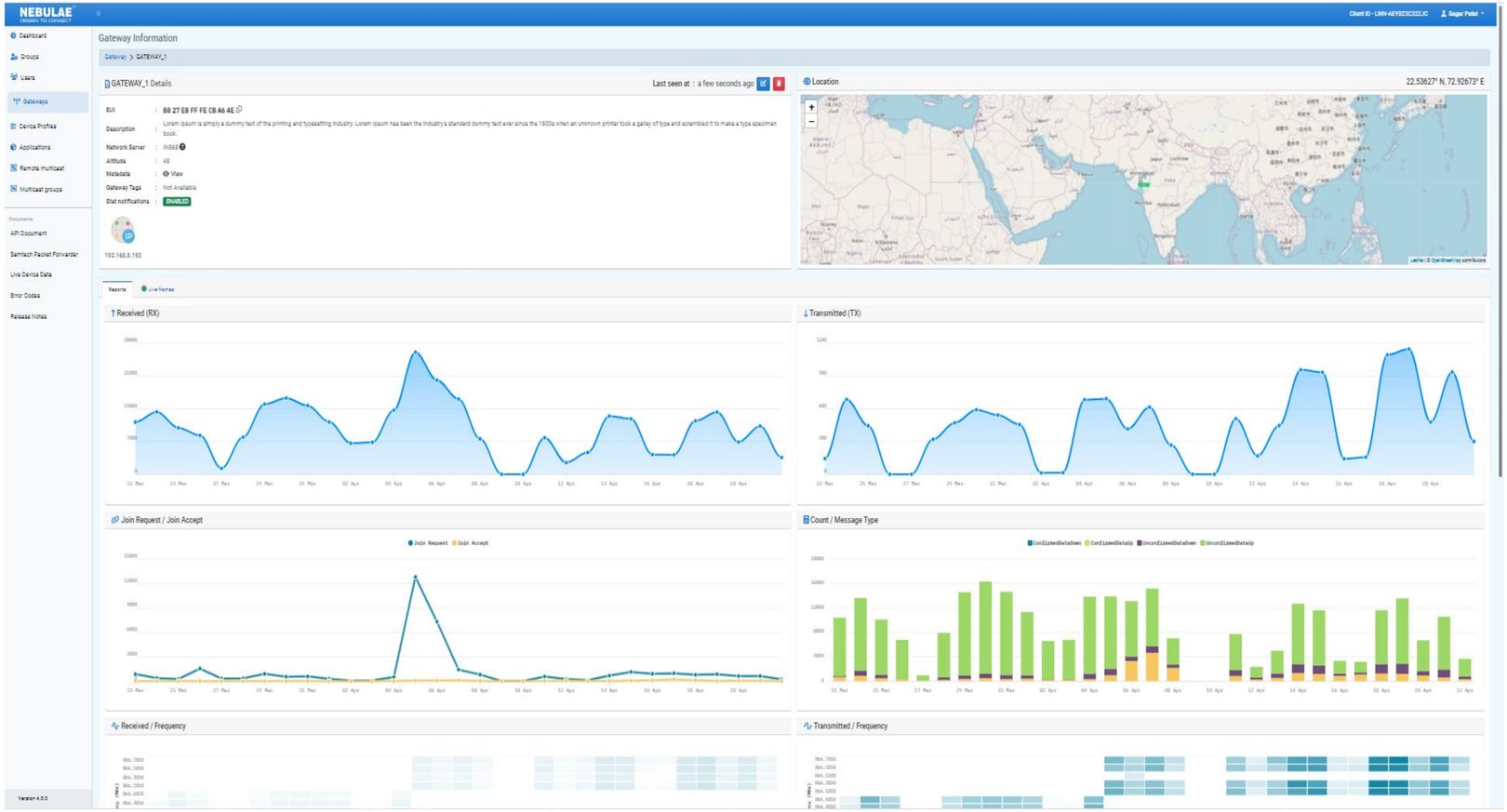


Gateway Management

Nebulae LoRaWAN Network Server supports to help manage LoRaWAN gateways at scale. These feature enable you to query gateway connection status, customize gateway configuration with the desired frequency sub-bands for devices-to-gateway (uplink) communication, and filter messages at the gateway locally to control gateway backhaul connectivity costs.

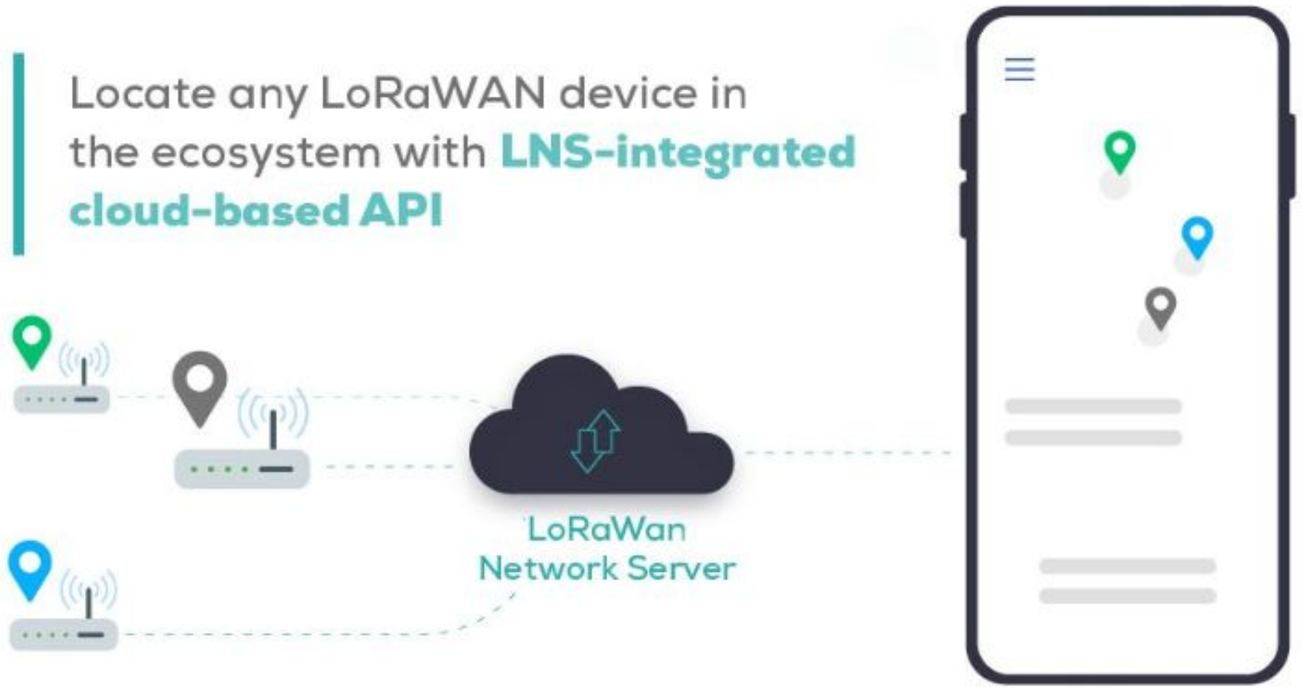
It provide KPI's such as:

- Total Uplinks and Downlinks
- Uplinks and downlinks per frequency
- Uplinks and downlinks per data-rate
- Downlinks per ack status
- LoRaWAN Message Type Metrics
- Join Request and Accept Metrics



Geo-location

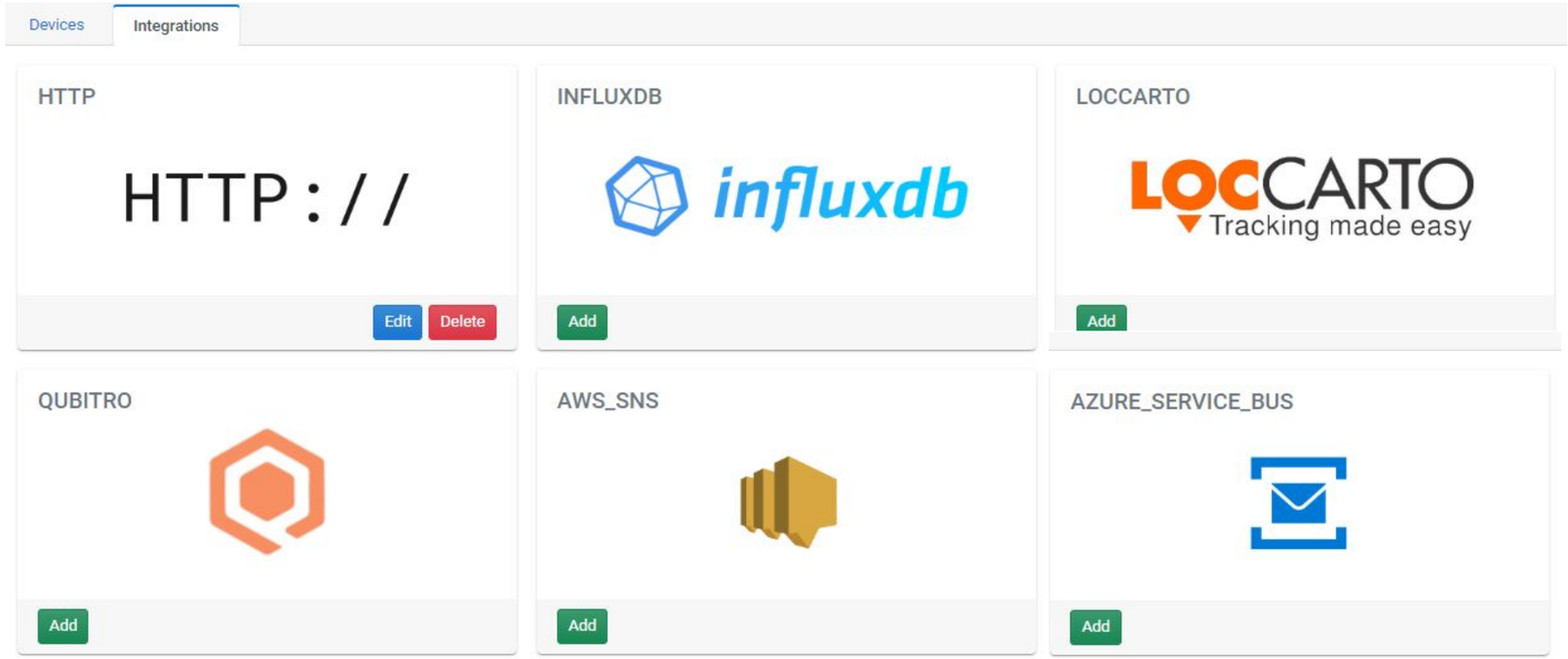
Cloud-based API integrated with Nebulae LoRaWAN Network Server enables the estimated location of any LoRaWAN device.
Thus it allows for Geo-location with no additional power consumption in the device and without GPS system.



Supported Integrations

Nebulae LoRaWAN Network Server allows seamless interoperability and integration with third-party entities, guaranteeing smooth and unhindered access to mission-critical use cases.

Nebulae LoRaWAN Network Server provides REST APIs for integration with external services. By default all application data is published to a MQTT broker, however integrations are available for various cloud-providers, databases and visualization platforms.



Firmware Over-the-Air Updates

Firmware update over the air makes it possible to push firmware updates to one or multiple devices, making use of multicast. It is standardized by the LoRa® Alliance Specifications

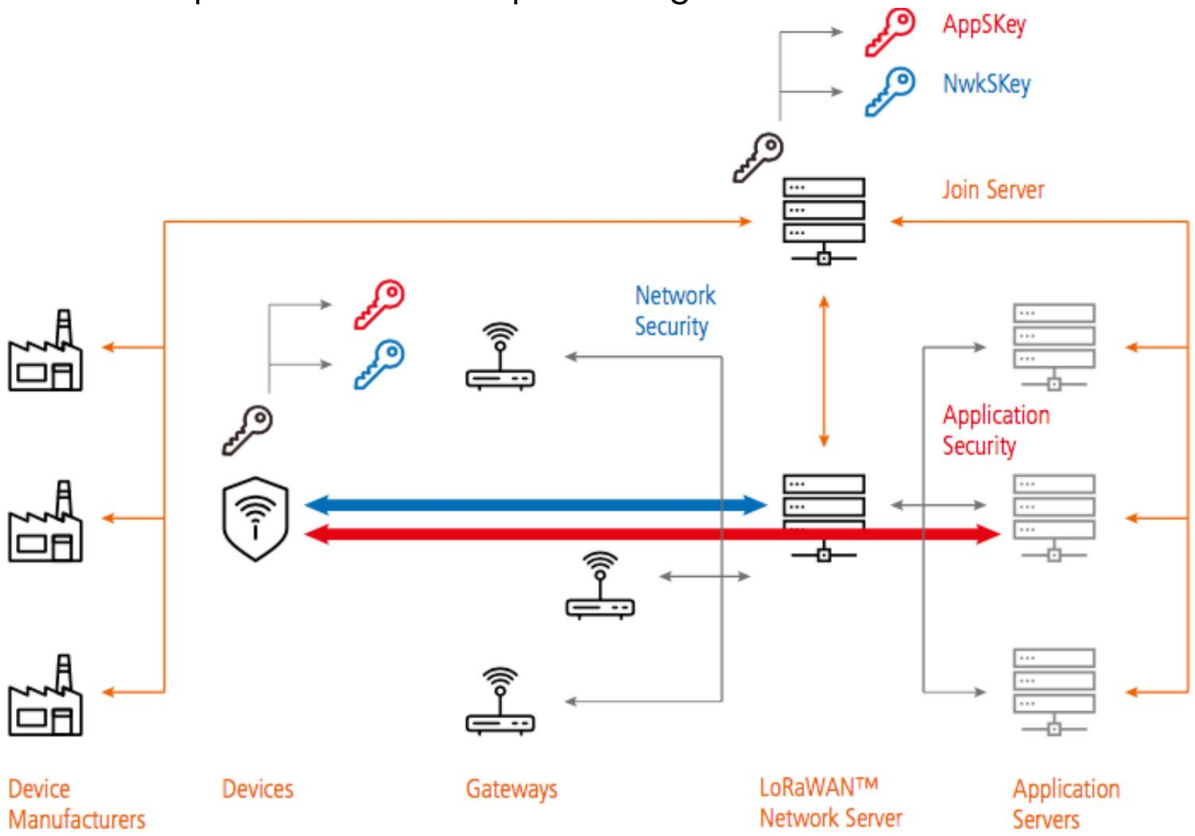
- The FOTA server is responsible for fragmenting the firmware and transmitting it to multiple end devices.
- The FOTA device application is responsible for the assembly of the firmware fragments and updating the end device firmware.

The basic requirements for the FOTA update are addressed from the **server side** (FOTA server) and the other from the **device side** (Update client)

Data Security

Outstanding security at every stage, from device to end client application. LoRaWAN security uses the AES cryptographic primitive combined with several modes of operation: CMAC2 for integrity protection and CTR3 for encryption. LoRaWAN networks are identified by a 24-bit globally unique identifier assigned by the LoRa Alliance™.

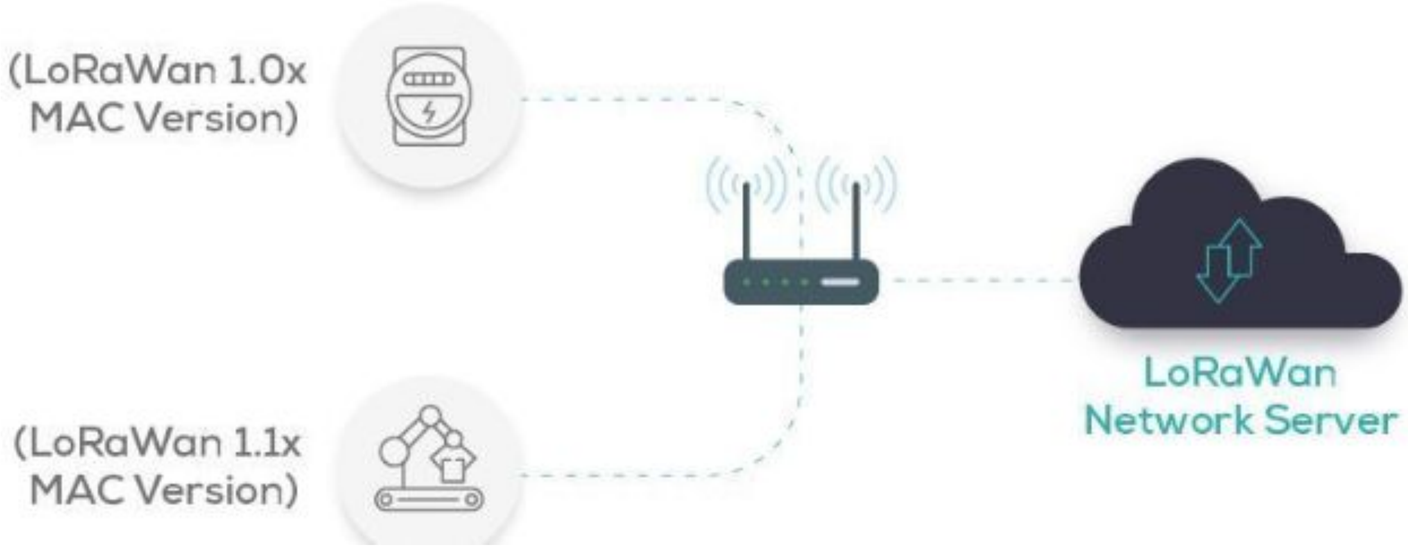
In LoRaWAN specifications, all security keys are 128-bits wide. Root keys are used only to derive session keys and in the JoinRequest and JoinAccept messages. Session keys are used to form Message Integrity Codes (MICs) and to encrypt and decrypt all messages other than the JoinRequest and JoinAccept messages.



LoRaWAN Mac Versions (1.0x and 1.1x)

Nebulae Network Server supports both LoRaWAN® 1.0.x and LoRaWAN 1.1 devices simultaneously. In the Device Profile you can define the implemented LoRaWAN version for the devices assigned to the given device-profile.

MAC layer is responsible for managing data frames that the PHY layer physically sends and receives. Part of each sent message contains a MAC layer data header that has addressing information and other packet info.



Supported Device Classes (Class A, B, and C)

Nebulae LoRaWAN Network Server has three different classes of end-point devices to address the different needs reflected in the wide range of applications:

- Class A – Lowest power, bi-directional end-devices
- Class B – Bi-directional end-devices with deterministic downlink latency
- Class C – Lowest latency, bi-directional end-devices

Public & Private Deployment

Nebulae LoRaWAN Network Server has various deployment models for its users

1. Public Cloud
2. Private Cloud (Managed and hosted in your own infrastructure)
3. Dedicated Cloud (Managed & Hosted by Nebulae)

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