



MySense data flow diagram (Sept 2020)

- **MySense sensor kit (TTN LoRa Device ID)** ↔ **LoRa TTN gateway** ↔ **The Things Network (TTN)**:
 - A MySense sensor kit uses the TTN **LoRa Device ID** key from the MySense firmware as data label for the encrypted data (**LoRa shared encryption key** from MySense firmware) transport to TTN server via LoRa wireless to LoRa TTN gateway which forwards encrypted data via internet to The Things Network (TTN) server.

LoRa Device ID and *LoRa shared encryption key* are registered with The Things Network within the *LoRa Application ID* section for MySense measurement kits. The unique Device ID will initially be compiled from the *Sensor kit Serial Number*.

 - For administrative reasons each MySense sensor kit has a unique *Sensor kit Serial Number* which number is initially based on the kit CPU Serial Number . This number is also used for the sensor kit WiFi AP SSID for firmware access.
 - The LoRa gateway is in fact a dumb data forwarder from LoRa radio network to a fixed internet server specialized for LoRa data record handling e.g. The Things Network. The data record (compressed payload) remains hidden to the gateway.

- The radio package may be picked up by several TTN gateways. The radio data package will be converted to an Internet data record and forwarded to The Things Network TTN server via Internet.
- *The Things Network (DevID) ↔ MySense server (MQTT AppID and TopicID):*
 - Administrative access to The Things Network is provided via a user/password Behoud de Parel account at TTN. A collaborator list is used to provide others also access.
 - The Things Network decrypts the data record, add some gateway and other information and identifies from *LoRa Device ID* key in the data record received and forwards the data record (as a JSON data record) to the TTN Mosquitto server part: The JSON data record is labeled with the Mosquitto MySense **LoRa TTN Application ID** and **TTN Topic ID**. These 2 ID's are used as subscription key by the TTN Mosquitto server for the MySense MQTT subscription client.
 - MySense server data collector uploads the data record labeled with the *LoRa Application ID* and the *TTN Topic ID* and adds measurement kit meta information to the JSON data record from the MySense MySQL information tables.

MySense Data Collector (Python): From the 2 TTN ID's (*App ID and Topic ID*) the MySense **Region/Project ID** and **MySense sensor kit ID** are looked up in the MySense MySQL database Meta Info tables (the tables: *Sensors* and *TTNtable*) and checked for sensor kit validity. The data record and data payload is converted to an internal JSON record format. The *Region/Project ID* and *Sensor Kit ID* are keys for further processing by the *MySense Data Collector*.

- **Event notices** with lokation details are sent via email and/or Slack to administrators if a new kit, kit error messages and a kit seems to be silent for a long time or is malfunctioning is detected.
- **Data Storage:** The MySense **MySQL database** (SQL interface) is used by the *Data Collector* as central meta information (tables *Sensors* with Sensor Kit information and *TTNtable* with measurement forwarding information) and measurement record storage (every measurement kit has an own table identified by **Region/Project ID** and **Sensor Kit Serial ID**).
- **Data Forwarding:** The *MySense Data Collector* can be configured to forward data records to various backend modules as e.g. CSV data files, Mosquitto and/or InfluxDB data streams, and HTTP servers like *Luftdaten.info*.
- **Data Checks:** Several MySense processes operating on the MySense MySQL database will periodical provide updates and checks on the MySQL database:
 1. Every hour a *correction and validation* of measurements. Identifying persistent static values of e.g. meteo sensors of a kit during some period (last 3 weeks).

2. Every hour *HighChart graphs* are produced on the Behoud de Parel website (CMS Drupal): overviews, individual measurement graphs, etc.
 3. Every 24 hours *checks for kit operation function* with sending event notices to owners of the measurement kits.
 4. Every hour *regional official measurement stations* (8 regional stations in Limburg and NRW) are visited to upload pollutant record data into the MySQL database.
 5. Every 24 hours an update is done on the *official station RRD (high performance round-robin database) graphs* on the website. The governmental data portal website pages are parsed to obtain the hourly air quality pollutant data. This data is used as reference to background pollutant levels in the MySense measurement graphs.
 6. Every 24 hours the data validity of the regional governmental measurement stations is checked. Missing data is search for completion.
 7. Every 7 days a *data rebuild* is done of the RRD graphs of official stations to avoid RRD data stream errors.
- **MySense server (*RegionID* and *SerialID*) ↔ Luftdaten server (HTTP POST *LuftdatenID*):**
 - **Data forwarding to Luftdaten.info:** Administrative access to Luftdaten is provided by an individual user/password account. Data HTTP Post (JSON data record) are only accepted via the provided (internal) *LuftdatenID* at this account. Location of the measurement kit is maintained via the Luftdaten.info user account. Data records are time stamped by time of postage. This may involve a time shift in the data record. The LuftdatenID is not exposed to the public.
 - The *MySense Data Collector* looks up with the *Region/Project ID* and *Sensor Kit Serial ID* in the MySense database table *TTNtable*. If a data record is enabled to be forwarded to Luftdaten map server the ***Luftdaten ID*** (TTN-number) is looked up. If no *Luftdaten ID* is defined the *Sensor Kit Serial ID* will be used as *Luftdaten ID* for the record.
 - The data record is sent via an HTTP POST to Luftdaten server and an acknowledge is awaited. If needed a resend of the data record is retried for 60 seconds. On a persistent failure an event is sent only once to the MySense system administrator.