



## MySense data flow diagram (Sept 2020)

- *MySense sensor kit ↔ LoRa TTN gateway ↔ The Things Network (TTN):*
  - MySense uses TTN **LoRa Device ID** key from firmware as data label for encrypted data (*shared encryption key* from firmware) for data transport to TTN server via LoRa wireless to LoRa TTN gateway which forwards encrypted data via internet to TTN server.
  - MySense sensor kit uses for administrative reasons a unique *Sensor kit Serial Number* which is initially based on the kit CPU serial number and used for WiFi SSID 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 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 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. The 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 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** 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.
- **Data Storage:** The MySense **MySQL database** (SQL interface) is used 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/InfluxDB data streams, and/or HTTP servers like *Luftdaten.info*.
- **Data Checks:** Several MySense processes operating on the MySense MySQL database will periodical provide updates and checks:
  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 *producing HighChart graphs* on the Behoud de Parel website: overviews, individual measurements, 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 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 data stream graphs* on the website. The website pages with data are parsed for 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 official measurement stations is checked.
  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.