



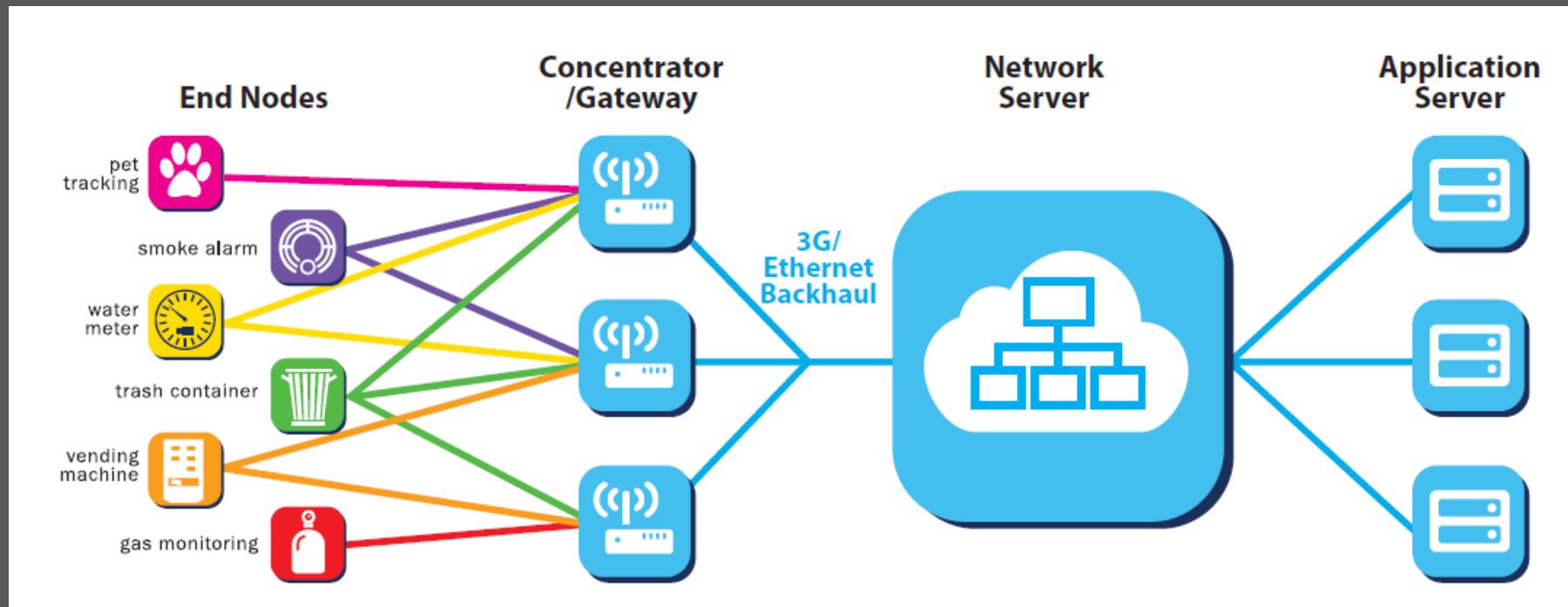
IoT Sensordaten in Karten integrieren

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Internet of Things - IoT





Datenübertragung

- Kabel, lokales WLAN, Bluetooth, ...
- GPRS/3G/LTE
- LoRaWAN
- Zigbee (Mesh-Netzwerk)



- **Reichweite: 2 km (Stadtgebiete) bis 15 km (ausserhalb)**
- **Gute Durchdringung von Gebäuden**
- **Lo-Power**
- **Keine Datenübertragungskosten**
- **Verschlüsselte Übertragung**
- **Kleine Datenmengen**
- **Übertragungsintervalle typischerweise 2-5 Minuten**



LoRaWAN-Netzwerke

- Community-Netzwerke
 - The Things Network (TTN)
 - Helium Network
- Netzwerk-Software
 - ChirpStack
- Kommerzielle Netzwerke

The screenshot shows the 'THE THINGS STACK Community Edition' interface. The top navigation bar includes 'Overview', 'Applications', 'Gateways' (selected), and 'Organizations'. A sidebar on the left lists 'Overview', 'Live data', 'Location', 'Collaborators', 'API keys', and 'General settings'. The main content area displays the gateway details for 'TTN-Goslar-Steinberg-Lorix-One' (ID: ttn-goslar-steinberg-lorix-one). It shows the last seen activity (6 seconds ago, 8,873 uplinks, 4 downlinks, 1 collaborator, 0 API keys), general information (Gateway ID: ttn-goslar-steinberg-lorix-one, Gateway EUI: FC C2 3D FF FE 0B 63 4C, description: None, created at: May 31, 2021 17:06:53, last updated at: May 31, 2021 17:52:09, server address: eui.cloud.thethings.network), LoRaWAN information (Frequency plan: EU_863_870_TTN), and a live data log with recent events. A map on the right shows the location of the gateway in Goslar, Germany.



- AWS IoT
- Azure IoT
- Google Cloud IoT
- Cisco, IBM, SAP, Oracle, Siemens, ...



- **Netzwerk**
- **Datenspeicherung**
- **Visualisierung**
- **Steuerung**

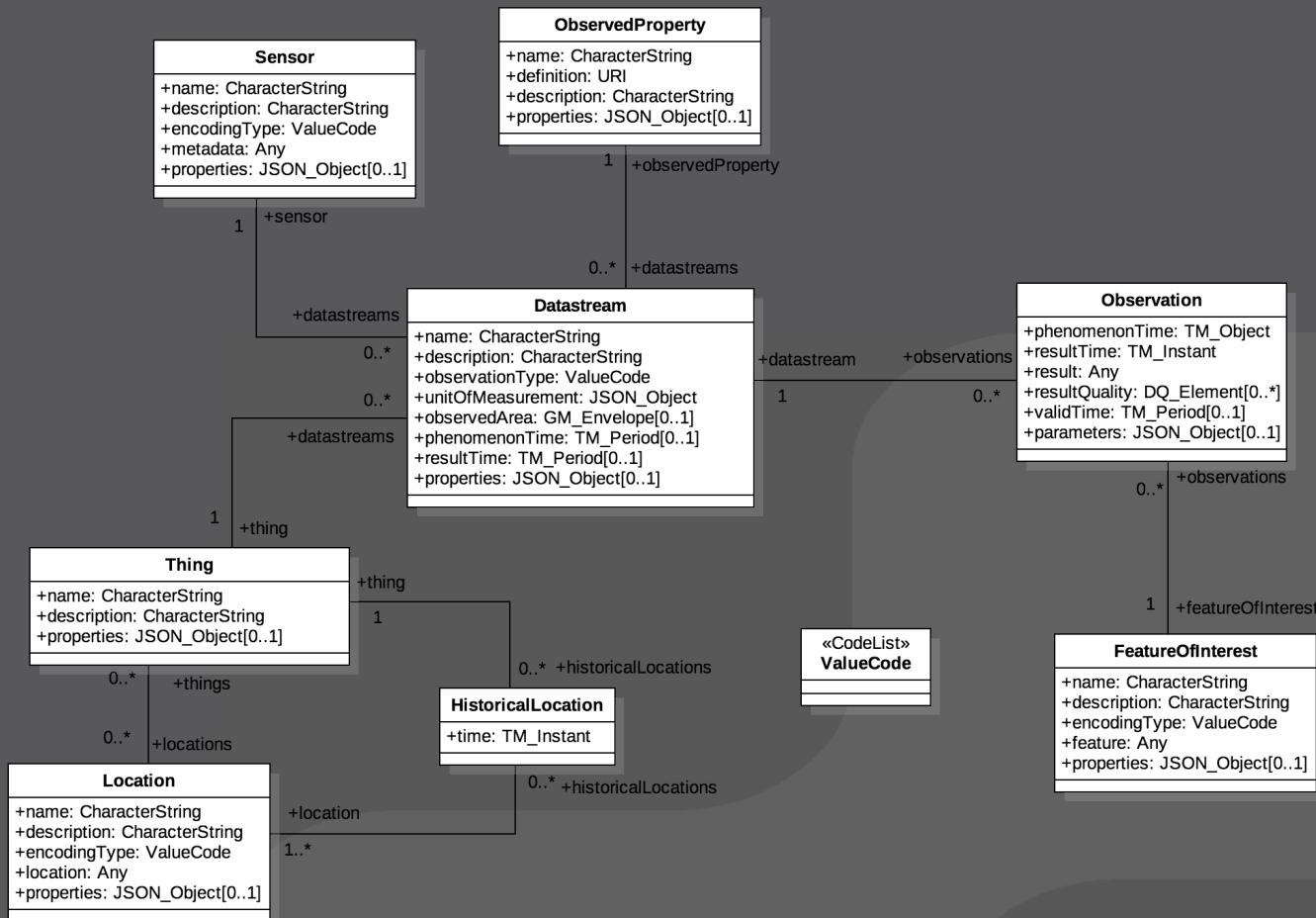


OGC Standards

- **OGC Sensor Observation Service (SOS)**
- **OGC Moving Features**
 - Handle geometries of many features that move, especially trajectories
- **OGC SensorThings**
 - Sensing + Tasking



OGC SensorThings API





- **Weitere OGC APIs**
 - OGC API - Features - Part 3: Filtering and the Common Query Language (CQL) draft
 - WMS-T
- **Provider / Custom REST APIs**
- **Steuerlogik**
 - MQTT-Protokoll z.B. mit Node-RED



Datenhaltung: PostgreSQL / TimescaleDB

- **SQL-Query letzte Messungen:**

```
SELECT DISTINCT ON (sensor)
  *
FROM
  measurements
ORDER BY
  sensor, ts DESC;
```

- **Sehr viele Records, Zeitserien → langsam**

- **TimescaleDB Postgres Extension:**

```
CREATE EXTENSION timescaledb;
SELECT create_hypertable('measurements', 'ts');
```



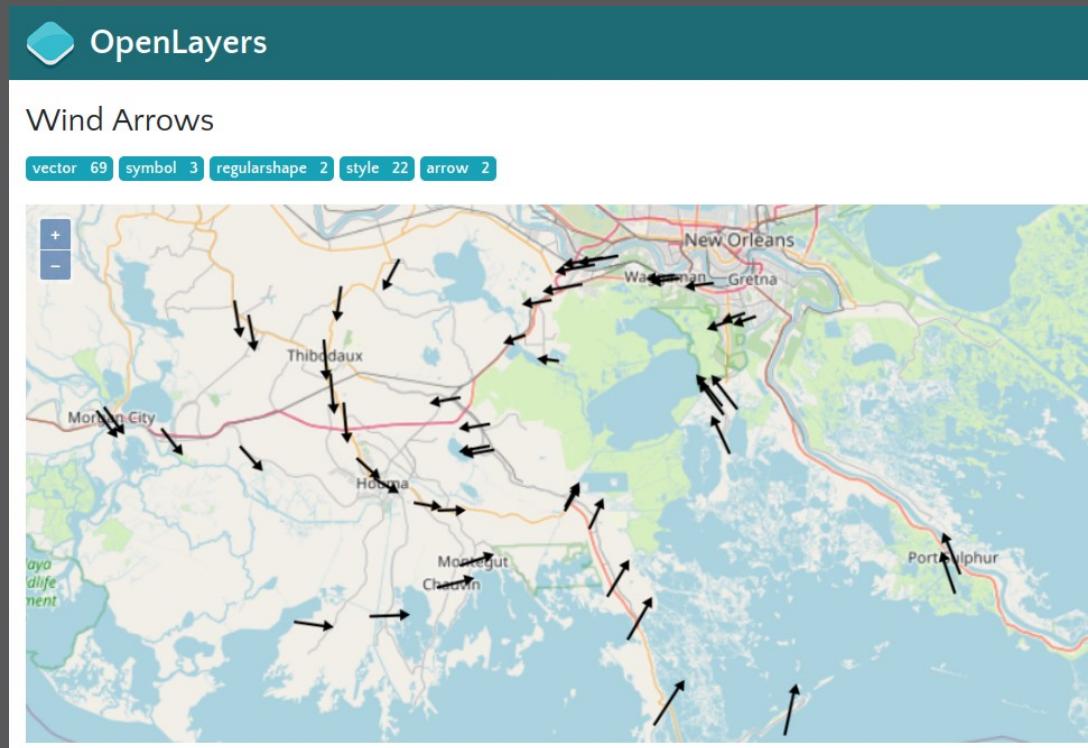
Dashboards



› Grafana (Prometheus, PostgreSQL, ...)



Kartendarstellung



› <https://openlayers.org/en/latest/examples/wind-arrows.html>

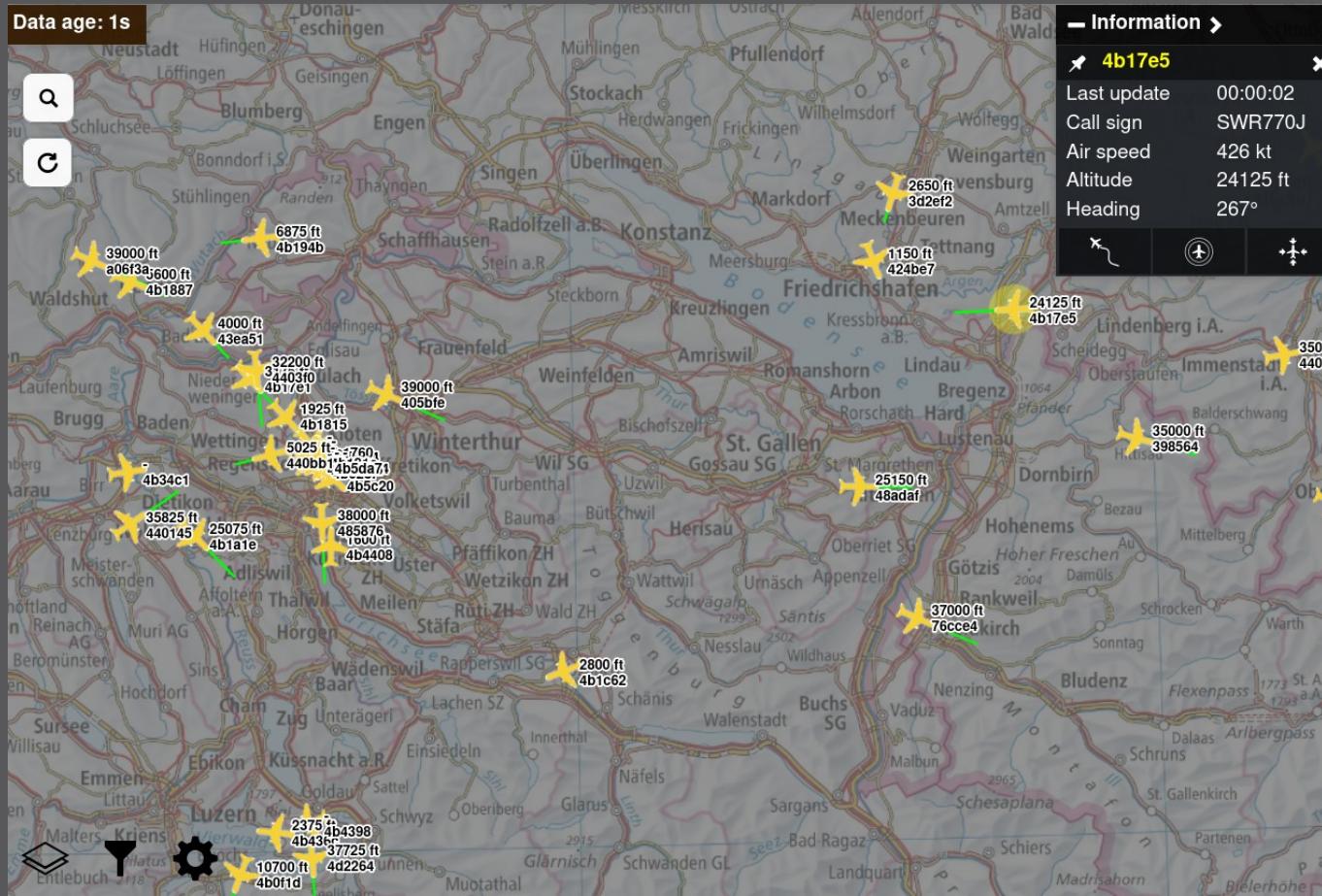


Demo #1: Autonome Bojen





Demo #2: Flight tracking





Interesse?

- **Austausch**
 - IoT / SmartCity Projekte
 - Welche API's?
 - Welche Viewer?
- **Wo**
 - 13:30 Netzwerkwelt Forum Bühne 2



Danke!



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