

OFFENBACH WIS2 TRAINING WORKSHOP · October 2026

Publishing data and monitoring data-flow in wis2box

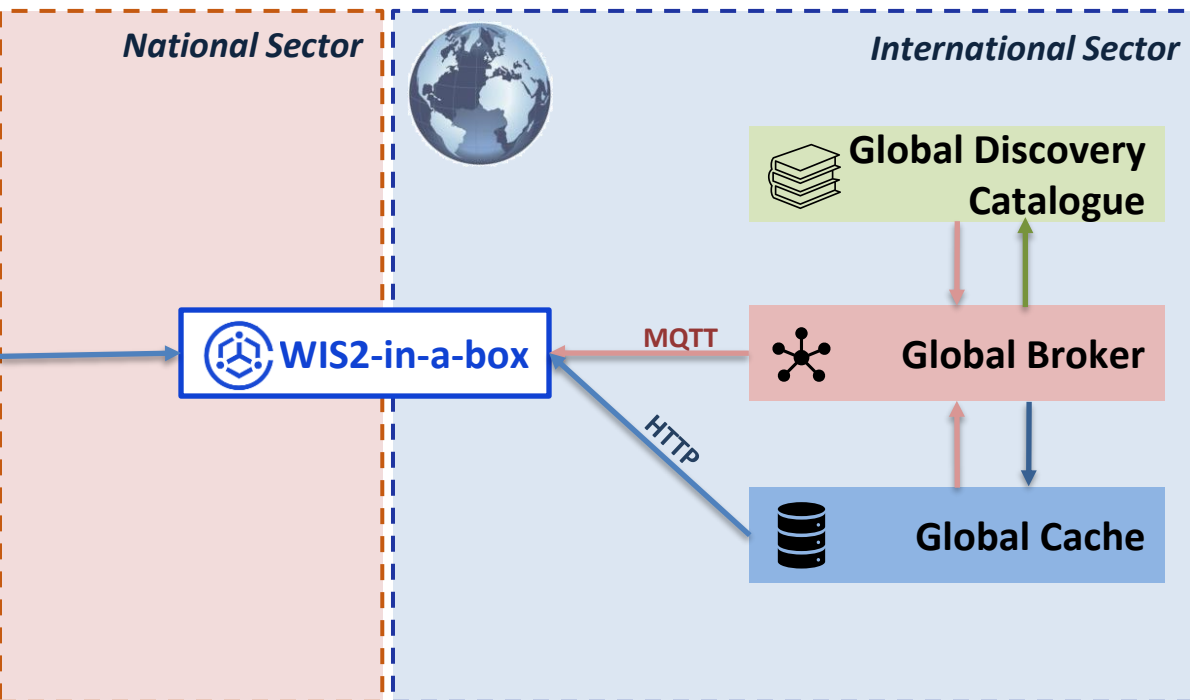
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Reminder: What is WIS2-in-a-box ?

WIS2-in-a-box (wis2box) is an open-source software stack that can be installed on a server to setup a WIS2 Node

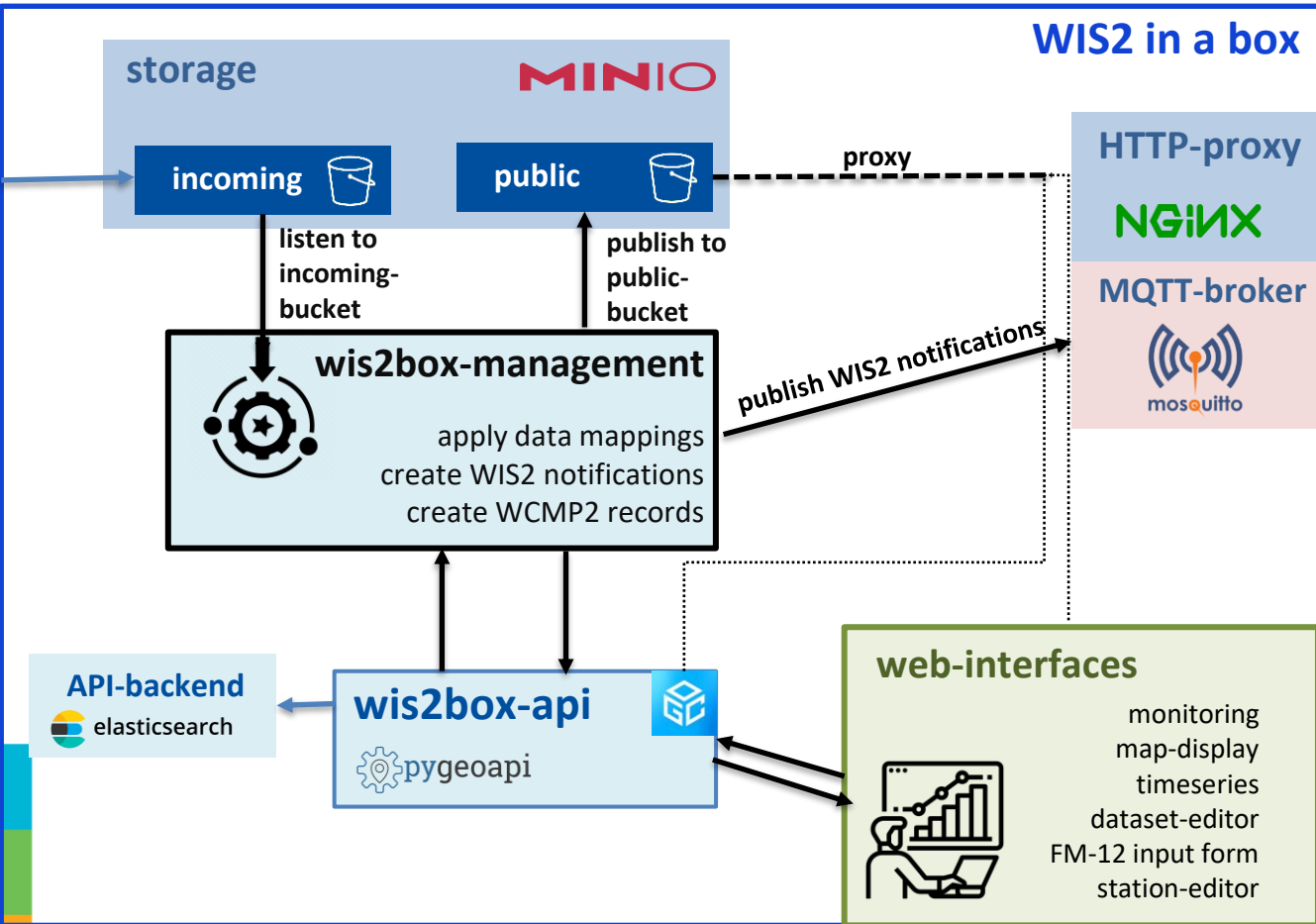
The wis2box-software includes all services required to run a WIS2 Node ... *and more !*



How to turn on wis2box-instance into a WIS2 Node:

- HTTP and MQTT traffic on the server hosting the wis2box-stack must be routed to the public internet
- MQTT-endpoint and centre-id to be shared with Global Brokers through the *WIS2 Node Registration process**

WIS2 in a box notifications



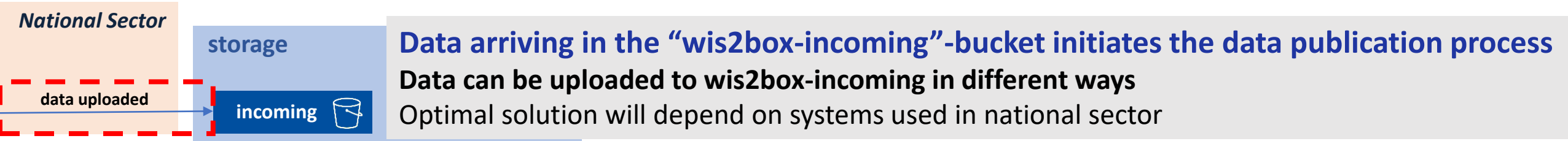
When uploaded data is successfully processed by wis2box, MQTT notifications are published
Message-payload contains a *metadata_id* corresponding to the dataset and a URL pointing to *WIS2BOX_URL/data*

```
{
  "id": "a0dd30f1-fae6-4811-8c3d-dc5d5a153a94",
  "type": "Feature",
  "conformsTo": [
    "http://wis.wmo.int/spec/wnm/1/conf/core"
  ],
  "geometry": {
    "coordinates": [
      -58.66472,
      -62.23778,
      11
    ],
    "type": "Point"
  },
  "properties": {
    "data_id": "ar-smn:slt0ci/WIGOS_0-20000-0-89053_20261006T060000",
    "datetime": "2026-10-06T06:00:00Z",
    "pubtime": "2026-10-06T06:26:53Z",
    "integrity": {
      "method": "sha512",
      "value": "26r/Qz1h+W8QQK18AldIKkx10L1FfzYcxNpFTeOxbhQajdVUo7IsEUaSBR2hiarWmdm67svqd4wE/W3AiB"
    },
    "metadata_id": "urn:wmo:md:ar-smn:slt0ci",
    "content": {
      "encoding": "base64",
      "value": "Q1VGUGAA+gQAABYAAP8AAAAAIAHAAH6goGBgAAAAALAAABgMGWx1AAAM0ABOIAAAODkwNTMAAAAAA",
      "size": 250
    }
  }
}
```

```
"links": [
  {
    "rel": "update",
    "type": "application/bufr",
    "href": "http://w2b.smn.gov.ar/data/2026-10-06/wis/urn:wmo:md:ar-smn:slt0ci/WIGOS_0-20000-0-89053_20261006T060000.bufr4",
    "length": 250
  }
],
```

WIS2BOX_URL/data is a proxy to wis2box-public bucket in the wis2box-minio storage

How to upload data to wis2box

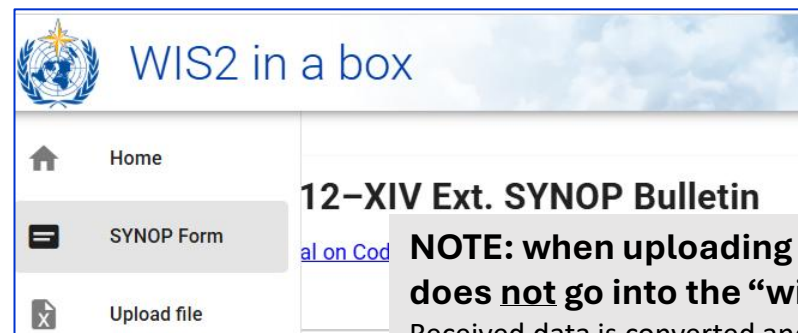


Manual upload methods:

- [Interfaces in wis2box-webapp](#): manual submission using FM-12 form or file upload
- [Using MinIO UI](#): manually create path and upload data, useful for testing data-workflow

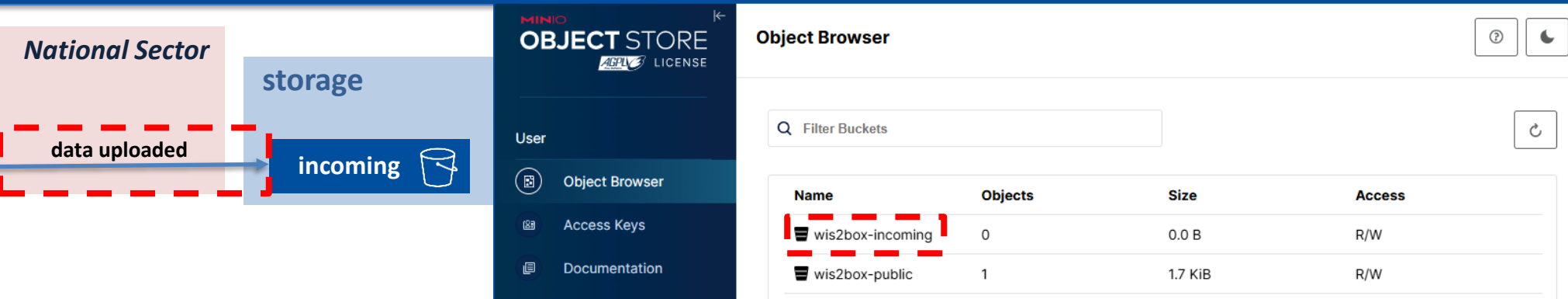
Automating data upload:

- [Scripts](#): write code to upload data using MinIO client software
- [Using SFTP protocol](#): forward data to MinIO SFTP-endpoint



NOTE: when uploading data in wis2box-webapp, received data does not go into the "wis2box-incoming" bucket
Received data is converted and output is stored in "wis2box-public" bucket directly

MinIO User Interface



The diagram on the left shows a flow from 'National Sector' to 'storage', with 'data uploaded' entering an 'incoming' bucket. The screenshot on the right shows the MinIO Object Browser interface. The 'wis2box-incoming' bucket is highlighted with a red dashed box in the table below.

Name	Objects	Size	Access
wis2box-incoming	0	0.0 B	R/W
wis2box-public	1	1.7 KiB	R/W

Data can be uploaded manually using the **MinIO web interface at `http://<your-host>:9001`**

- **Useful for testing** your data mappings before setting up an automated workflow
- Login with `WIS2BOX_STORAGE_USERNAME` / `WIS2BOX_STORAGE_PASSWORD` defined in `wis2box.env`
- Create new path in `wis2box-incoming` bucket matching metadata-id and upload your file



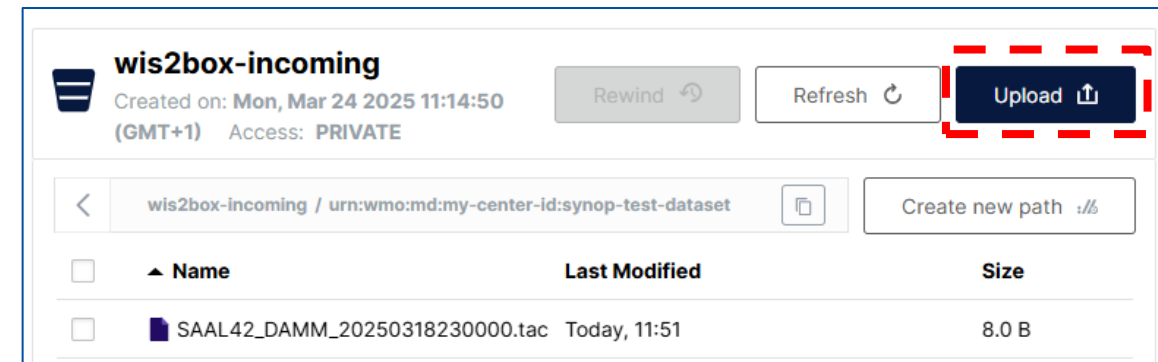
The dialog shows the current path as 'wis2box-incoming' and a new folder path being entered: 'urn:wmo:md:my-center-id:synop-test-dataset'. The 'Create' button is highlighted.

Choose or create a new path

Current Path: wis2box-incoming

New Folder Path* urn:wmo:md:my-center-id:synop-test-dataset

Clear Create



The bucket view for 'wis2box-incoming' shows the 'Upload' button highlighted with a red dashed box. Below, a file 'SAAL42_DAMM_20250318230000.tac' is listed with a size of 8.0 B.

wis2box-incoming

Created on: Mon, Mar 24 2025 11:14:50 (GMT+1) Access: PRIVATE

Upload

wis2box-incoming / urn:wmo:md:my-center-id:synop-test-dataset

Name	Last Modified	Size
SAAL42_DAMM_20250318230000.tac	Today, 11:51	8.0 B

For security do not enable external access on port 9001 nor share wis2box-storage credentials

Data ingestion script



Data can be uploaded using a minio client library

- Useful to setup custom data workflow:
 - Cronjob running Python script uploading files from local server
 - Query local database to extract CSV and upload result
- <https://min.io/docs/minio/linux/developers/minio-drivers.html>

```
import glob
import sys
from minio import Minio
```

Python example to upload a file using the MinIO client module:

```
filepath = '/home/wis2box-user/local-data/mydata.bin'
```

```
endpoint = 'http://wis2box-host:9000'
WIS2BOX_STORAGE_USERNAME = 'wis2box'
WIS2BOX_STORAGE_PASSWORD = 'XXXXXXXXXX'
```

```
client = Minio(
    endpoint=endpoint,
    access_key=WIS2BOX_STORAGE_USERNAME,
    secret_key=WIS2BOX_STORAGE_PASSWORD,
    secure=is_secure=False)
```

```
filename = filepath.split('/')[-1]
# path should match the metadata-id for corresponding dataset
minio_path = 'urn:wmo:md:my-center-id:synop-test-dataset'
client.fput_object('wis2box-incoming', minio_path+filename, filepath)
```

SFTP



Data can be uploaded using SFTP

- Useful for automating data-flow from vendors supporting SFTP

File protocol:
SFTP

Host name: mlimper.wis2.training Port number: 8022

User name: wis2box Password:

MinIO access over SFTP is enabled on port 8022

Login with WIS2BOX_STORAGE_USERNAME/WIS2BOX_STORAGE_PASSWORD

For security: restrict network access on port 8022 to known source-IP

/				
Name	Size	Changed	Rig...	Ow...
 ..				
 wis2box-public		3/24/2025 11:14:50 AM	---	0
 wis2box-incoming		3/24/2025 11:14:50 AM	---	0

/wis2box-incoming/urn:wmo:md:my-center-id:synop-test-dataset/				
Name	Size	Changed	Rig...	Ow...
 ..				
 SAAL42_DAMM_20250318230000.tac	1 KB	3/24/2025 11:51:36 AM	rw...	0

Use directory matching metadata-id or topic to trigger data ingestion workflow

Data publishing checklist



Once datasets and stations are configured, upload data to “wis2box-incoming”-bucket to start the wis2box publishing process

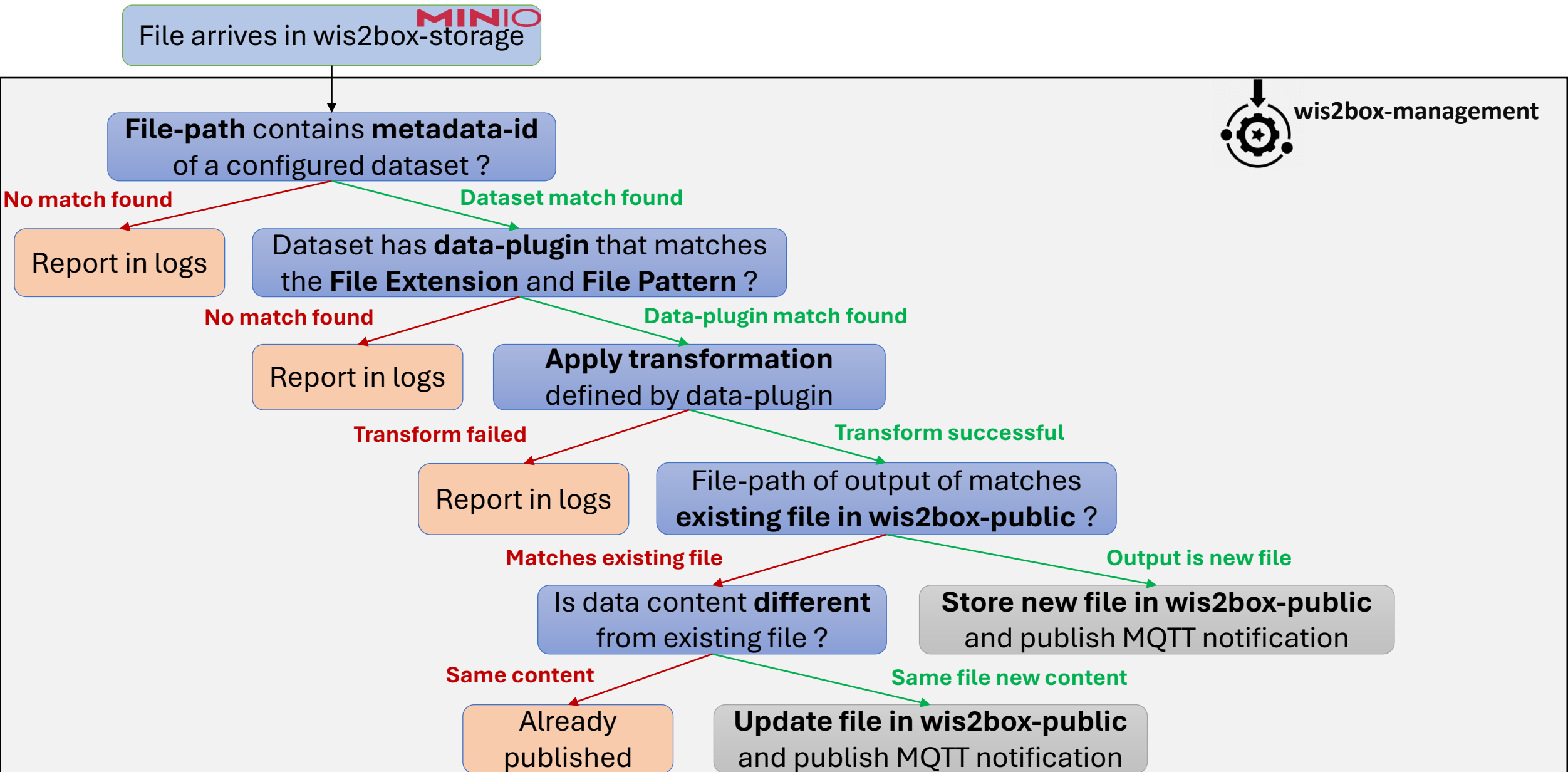
wis2box is correctly configured if:

- A WIS2 notification is published on your MQTT-endpoint after you upload (new) data
- The data-URL in the WIS2 notification enables you to download the (transformed) data over HTTP
- The content of the published data after transformation is as intended

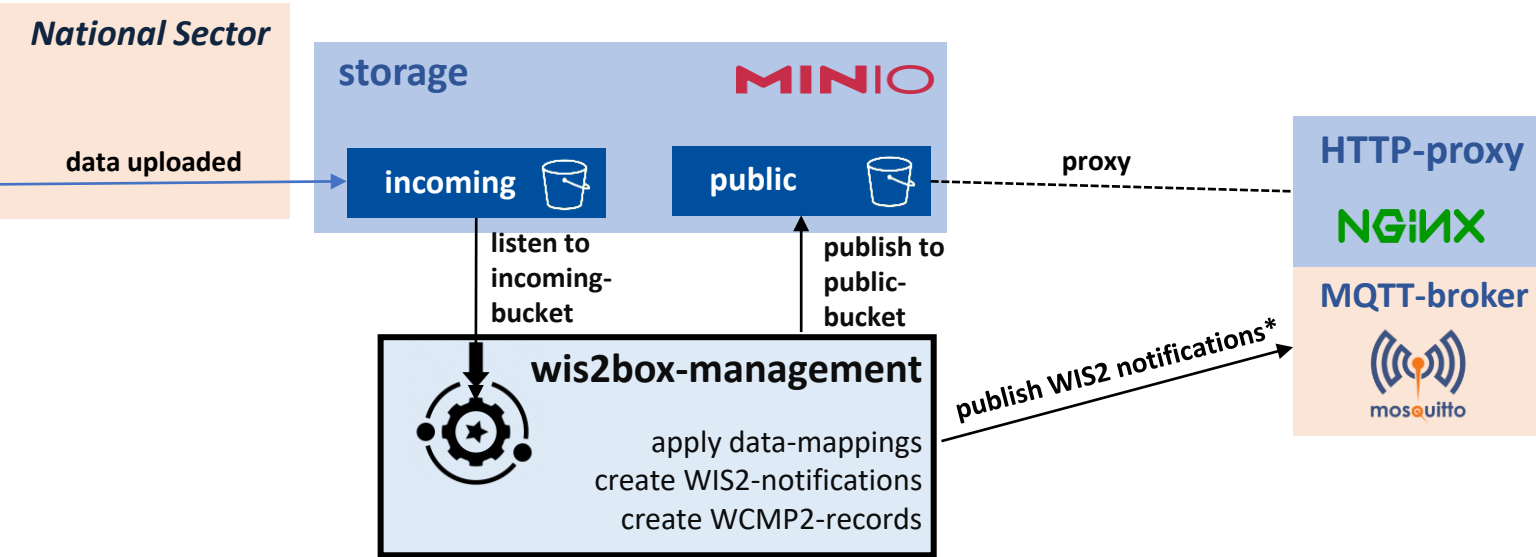
Always check if MQTT and HTTP functions from an external network (outside your internal network)

Check your setup using manual input first, before proceeding with setting up an automated data ingestion process

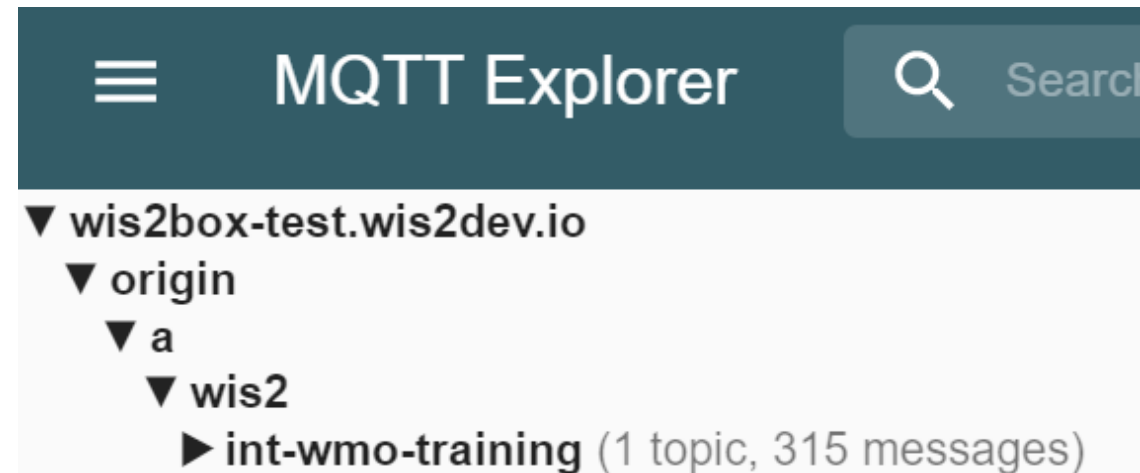
wis2box data publishing workflow



Check MQTT Notification

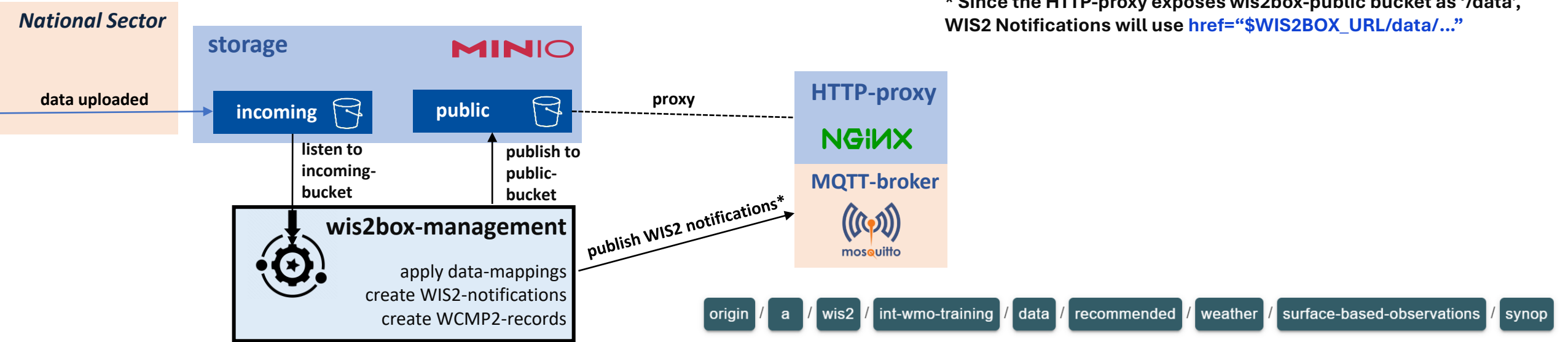


Use an MQTT client to verify your MQTT-broker is accessible over the public internet and check to see the WIS2-notifications for your data



Check data can be downloaded

* Since the HTTP-proxy exposes wis2box-public bucket as '/data', WIS2 Notifications will use `href="$WIS2BOX_URL/data/..."`



Find the **data-URL** in your notification and check it enables you to download the data over the public internet

Value

10/01/2026 4:13:03 PM QoS: 0

```
{
  "method": "sha512",
  "value": "6JWj+6WH9o3s7yNTbT9nRiPakOL54W2CtyCYLKgCNLVbQ8tsjcpebwUfBG8CRjeU5Xk01u9d1A7iE+khsOAaw=",
},
{
  "metadata_id": "urn:wmo:md:int-wmo-training:access-controlled-dataset-example",
  "wigos_station_identifier": "0-1234-5-TEST1"
},
{
  "links": [
    {
      "rel": "canonical",
      "type": "application/bufr",
      "href": "https://wis2box-test.wis2dev.io/data/2026-10-01/wis/urn:wmo:md:int-wmo-training:access-c",
      "length": 384,
    }
  ]
}
```

Check data publication history

You may need to check if your data was published retroactively
(without having had an active MQTT-subscription at the time...)

wis2box stores the published notification for each dataset in the API-backend

Check messages using monitoring page in wis2box-webapp

Check messages using the link to the
oapi-endpoint on the wis2box homepage

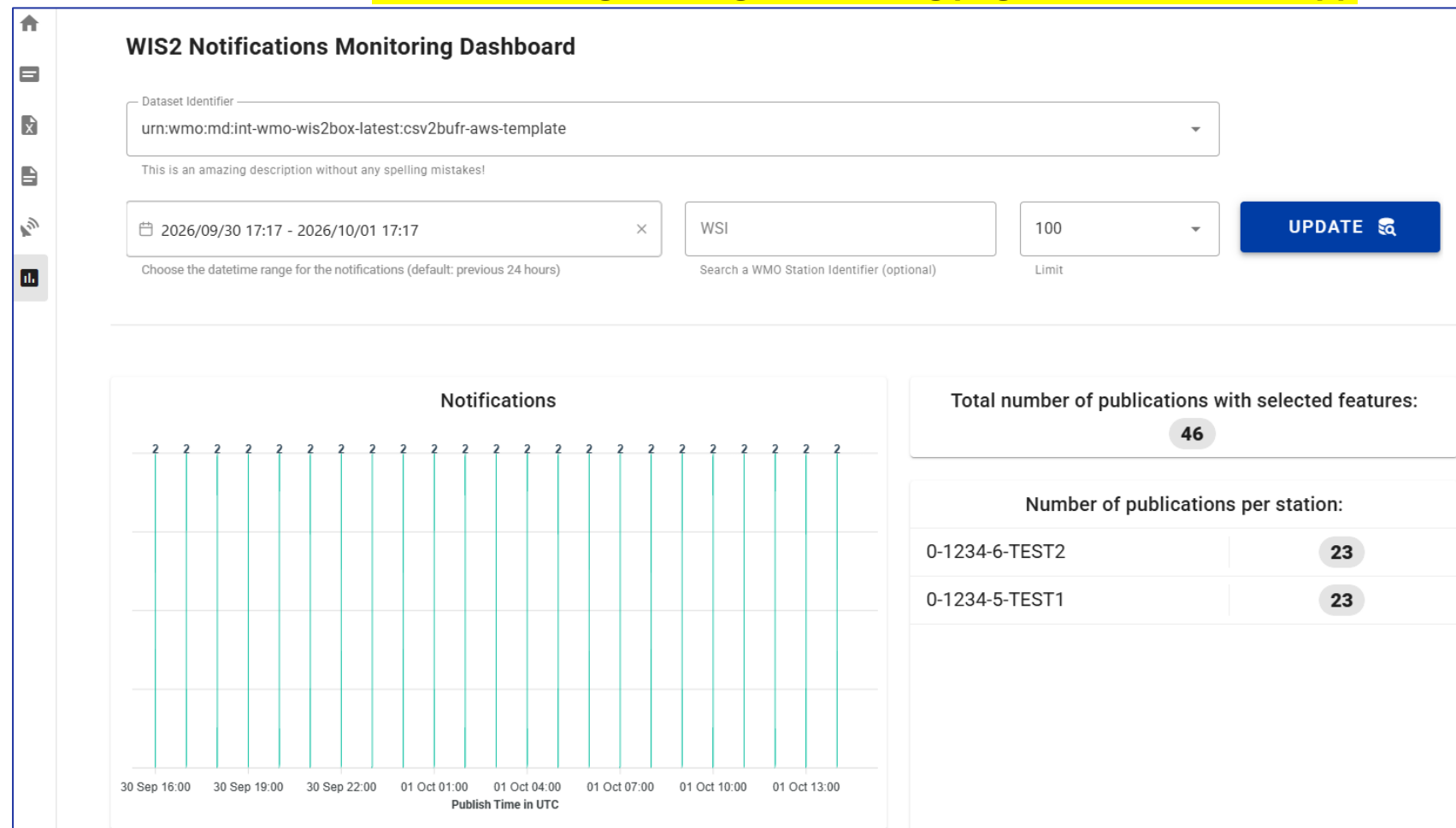
Maaike's test dataset for for wis2box-training

Topic: origin/a/wis2/maaike-
test/data/recommended/weather/experimental/wis2box-training
Metadata Identifier: urn:wmo:md:maaike-test:wis2box-training

LICENSE

METADATA

MESSAGES



Debugging issues

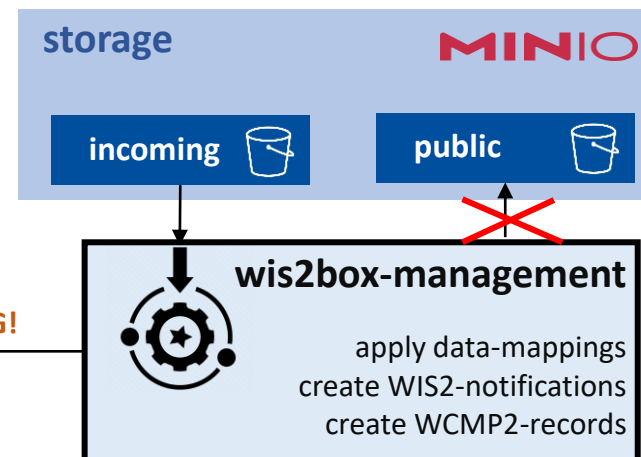
If no MQTT notifications are made after you ingested some (new) data, something it is going wrong !

Various issue may prevent wis2box from successfully publishing data ...

- One or more docker containers in the wis2box-stack are unhealthy or down
- Incorrect credentials are used when uploading data to MinIO
- File-path of incoming data can not be matched with any configured dataset
- Filename of incoming data does not match file-pattern for any configured data plugin
- Transformation of incoming data fails, for example:
 - synop2bufr: FM-12 invalid, or TSI not found in station-list, or can not parse year/month from file-pattern
 - csv2bufr: input CSV does not match columns in mapping-template, or value out of bound, or location in data does not match location of station
 - for all BUFR-plugins: the station is not associated to topic of the dataset in station metadata
 - bufr2bufr: input BUFR can not be decoded, or station-id missing, or location missing
 - CAPMessageData: input data does not match CAP v1.2 schema
 - UniversalData: can not parse datetime from file-pattern
- Same data is uploaded twice, discarded as duplicate



WARNING!
ERROR!



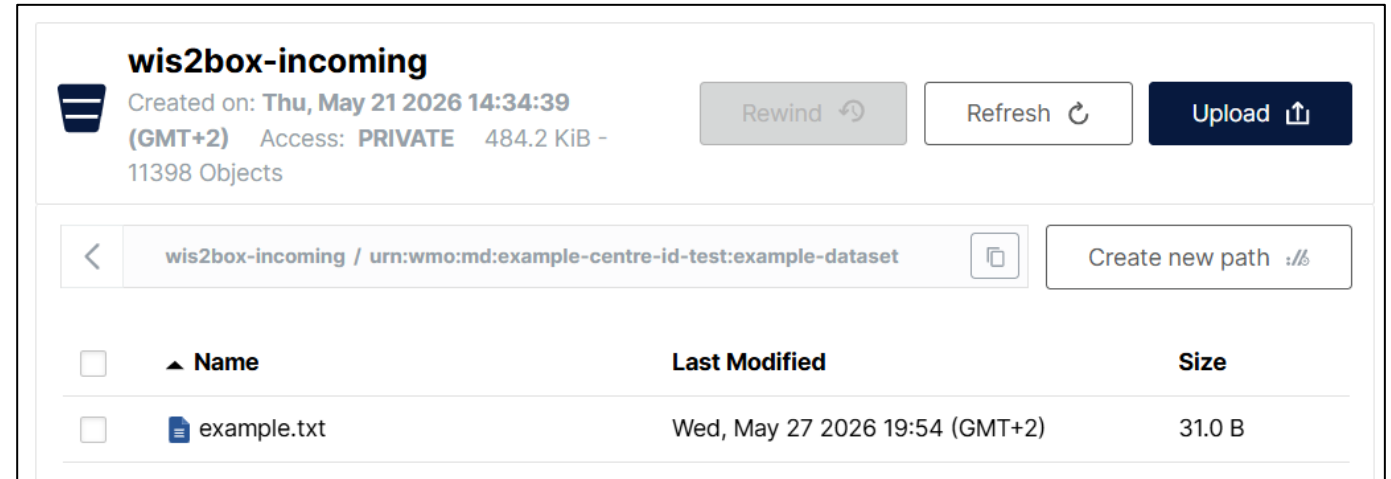
Debugging wis2box: the basics

Check that your container are running and healthy using “python3 wis2box-ctl.py status”

- If wis2box-management is not running no data uploaded in MinIO will be processed
- Watch out for containers that are restarting
- ElasticSearch container will become unhealthy when your host is low on disk-space

Be careful when editing wis2box.env manually as certain configuration changes can break the stack
Any changes in wis2box.env require a restart of the wis2box-stack before they take effect

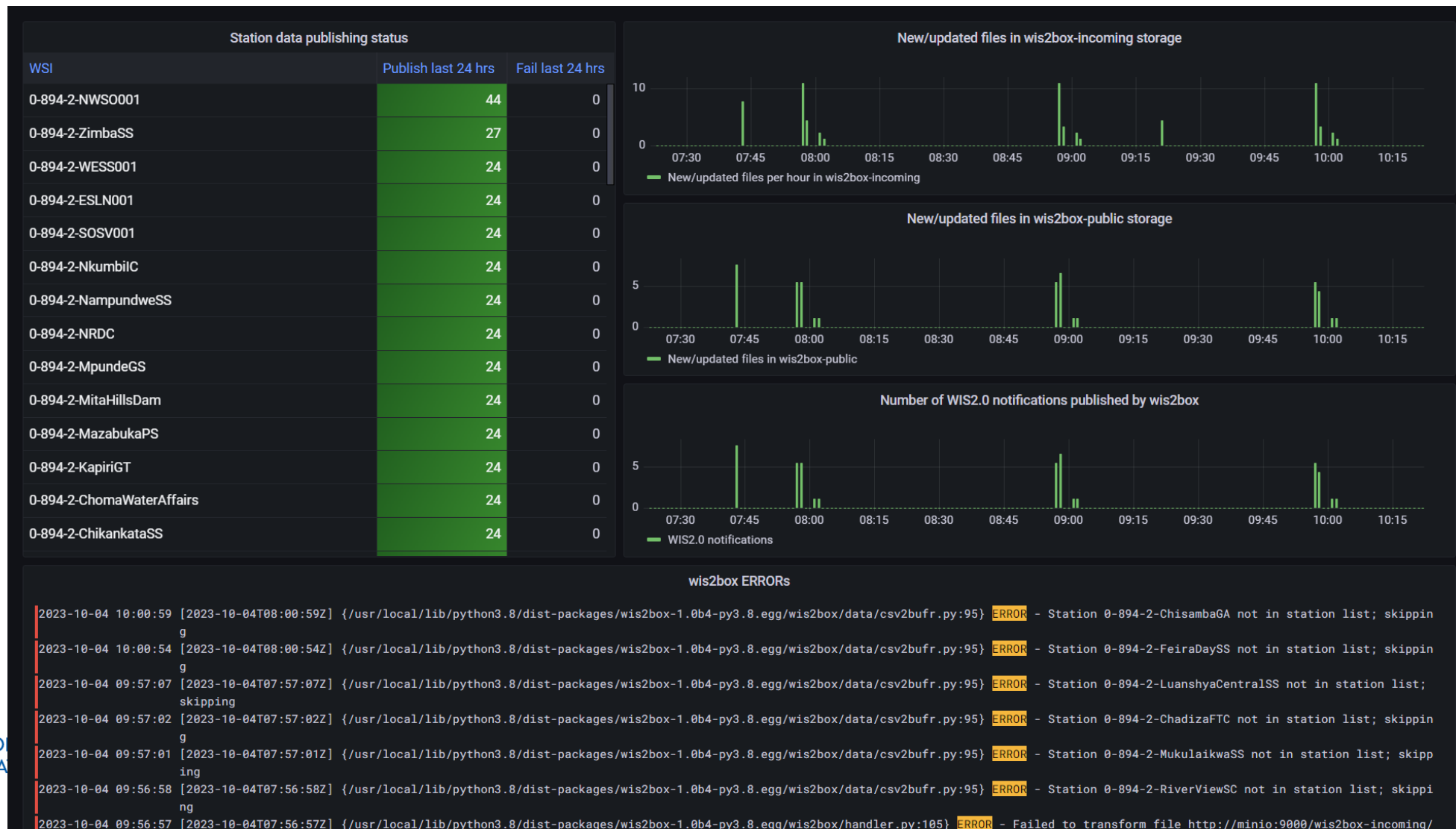
When uploading data to MinIO, **check that data arrived in “wis2box-incoming”**-bucket using the MinIO User Interface at *http://<wis2box-host>:9001* login using WIS2BOX_STORAGE_USERNAME and WIS2BOX_STORAGE_PASSWORD
If no data arrived check for errors reported on the sender side ..



Monitoring the wis2box data workflow: Grafana

Grafana home dashboard available at <http://<wis2box-host>:3000>

Grafana data-sources: **Prometheus** (time-series metrics) and **Loki** (logs)



'explore' option In Grafana sidebar

Exploring logs stored in Loki

The screenshot displays the Grafana Explore interface for the data source 'wis2box-loki'. The interface is divided into several sections:

- Top Bar:** Includes the 'Explore' button, the data source selector 'wis2box-loki', and action buttons like 'Split', 'Add to dashboard', 'Last 1 hour', 'Run query', and 'Live'.
- Query Patterns:** A section with 'Query patterns', 'Raw query' toggle, and a 'Give feedback' link.
- Labels:** A section where a label 'container_name' is set to 'wis2box-management'. A '+ Operations' button is also present.
- Line contains:** A section with a 'Text to find' input field.
- Raw query:** A section showing the raw query: `{container_name="wis2box-management"} |= ''`.
- Options:** A section with 'Options' and 'Type: Range'.
- Log volume:** A bar chart showing log volume over time, with a peak around 13:00 and 13:55.
- Logs:** A section displaying log entries with various filters and options. The logs are sorted by 'Newest first'.

Yellow arrows point to the 'wis2box-loki' data source, the 'container_name' label, and the 'Run query' button. Text annotations indicate 'wis2box-loki as a data source', 'select container', and 'run query'.

Common labels: wis2box_project wis2box-management wis2box-management ip-172-31-33-112 stdout Line limit: 1000 reached, received logs cover 1.88% (1min 8sec) of your selected time range (1h) Total bytes processed: 500 kB

Log entries (excerpt):

```
> 2023-10-04 13:57:09 [2023-10-04T11:57:09Z] {/usr/local/lib/python3.8/dist-packages/wis2box-1.0b4-py3.8.egg/wis2box/pubsub/subscribe.py:46} INFO - Data processed
> 2023-10-04 13:57:09 [2023-10-04T11:57:09Z] {/usr/local/lib/python3.8/dist-packages/wis2box-1.0b4-py3.8.egg/wis2box/data/base.py:195} INFO - Publishing output data
> 2023-10-04 13:57:09 [2023-10-04T11:57:09Z] {/usr/local/lib/python3.8/dist-packages/wis2box-1.0b4-py3.8.egg/wis2box/data/csv2bufr.py:95} ERROR - Station 0-894-2-LuanshyaCentralSS not in station list; skipping
> 2023-10-04 13:57:09 [2023-10-04T11:57:09Z] {/usr/local/lib/python3.8/dist-packages/wis2box-1.0b4-py3.8.egg/wis2box/metadata/station.py:257} INFO - Validating WIGOS Station Identifier: 0-894-2-LuanshyaCentralSS
> 2023-10-04 13:57:09 [2023-10-04T11:57:09Z] {/usr/local/lib/python3.8/dist-packages/csv2bufr/_init_.py:909} INFO - 2023-10-04T11:57:09.335450+00:00{'id': 'WIGOS_0-894-2-LuanshyaCentralSS_20231004T115400', 'geometry': {'type': 'Point', 'coordinates': [28.41, -13.14]}, 'properties': {'md5': '272c3fedeaee11d6463e34afb0abd5d1', 'wigos_station_identifier': '0-894-2-LuanshyaCentralSS', 'datetime': datetime.datetime(2023, 10, 4, 11, 54), 'origin_ating_centre': 0, 'data_category': 0}, 'result': {'code': 1, 'message': '', 'errors': []}}
> 2023-10-04 13:57:08 [2023-10-04T11:57:08Z] {/usr/local/lib/python3.8/dist-packages/wis2box-1.0b4-py3.8.egg/wis2box/pubsub/subscribe.py:43} INFO - Processing http://minio:9000/wis2box-incoming/zmb/zambia_met_service/data/core/weathe
r/surface-based-observations/synop/CR1000X_48229_20231004T135500Z.csv
> 2023-10-04 13:57:08 [2023-10-04T11:57:08Z] {/usr/local/lib/python3.8/dist-packages/wis2box-1.0b4-py3.8.egg/wis2box/pubsub/subscribe.py:49} INFO - Public filepath: wis2box-public/2023-10-04/wis/zmb/zambia_met_service/data/core/weathe
r/surface-based-observations/synop/WIGOS_0-894-2-NWS0001_20231004T115400-105.geojson
```

Monitoring and debugging data-flow in wis2box

After configuring your wis2box, ingest data to test the data publication process

Check that your data is successfully published:

- Subscribe to our MQTT-endpoint using an MQTT-client (such as MQTT explorer)
- Check the data-URL enables you to download the data
- ... or check retro-actively by querying the messages-collection

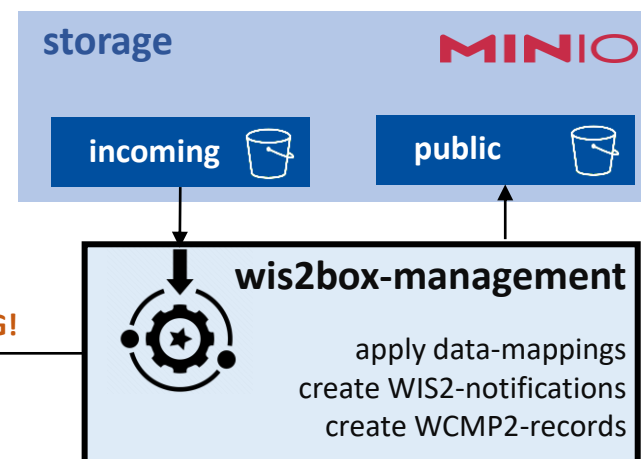
If no data is published:

- Check your wis2box stack is running correctly
- Check your data ingestion process
- Check for errors reported while sending the data
- Check data was received in MinIO
- Check for errors and warnings in Grafana

If all else fails ... contact your regional WIS2 support focal point !



WARNING!
ERROR!



Thank you.



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