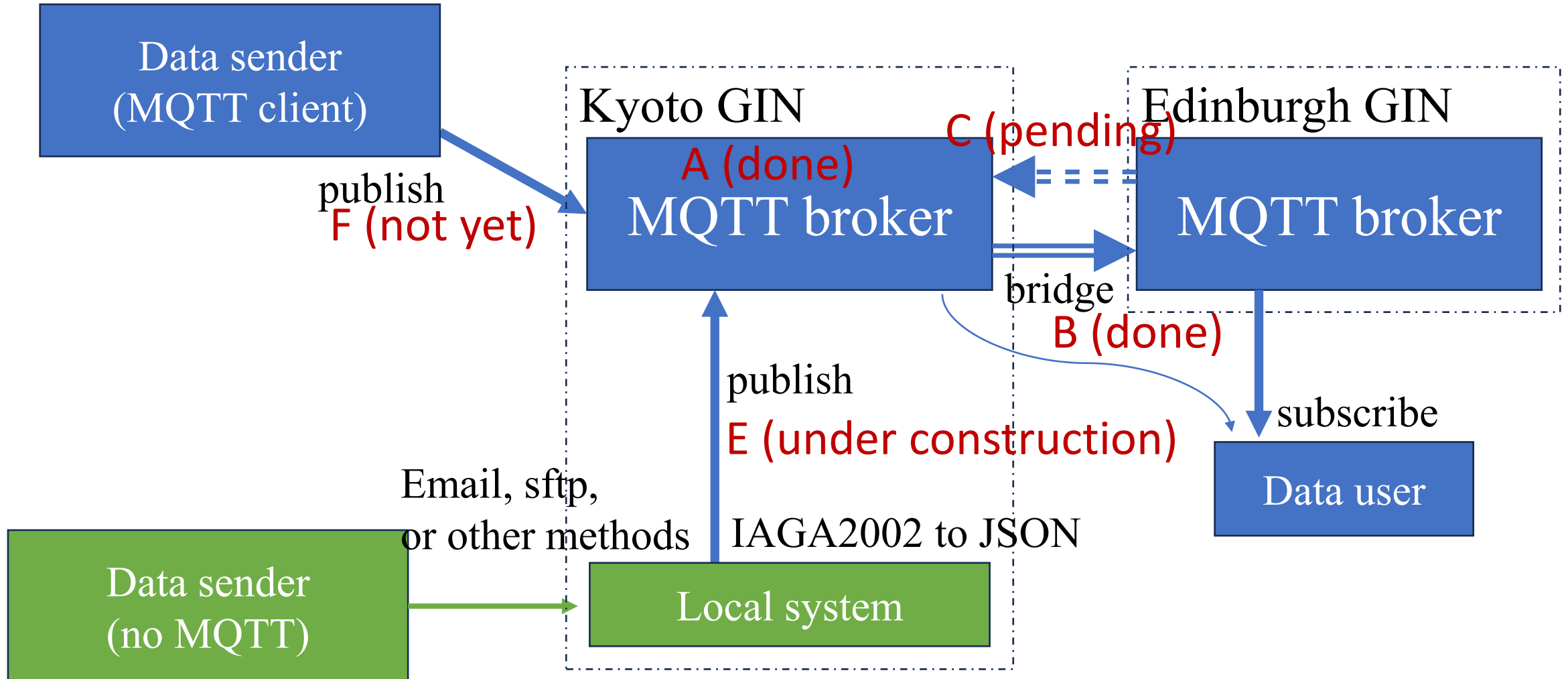# Preparation Status for Sending/Receiving INTERMAGNET Data via MQTT in Kyoto GIN

Shun Imajo

Current status

- **(A)** Configure the MQTT broker in Kyoto → Done
  - Subscription allows anonymous access
  - Publishing is limited to pre-created users (currently only "geomag")
  - Both ports 1883 and 8883 are listening.
- **(B)** Set up a bridge (outgoing) to transfer data published to the Kyoto broker to the Edi broker → Done
  - Tested with Edi's test broker (not yet tested with the production broker)
  - QoS is set to Level 1
  - Tested using manual commands mosquitto_{pub,sub}
- **(C)** Prepare a system to subscribe to data published on the Edi broker and save it locally in Kyoto → pending
  - Tried configuring an incoming bridge but it did not work successfully
  - Considering methods like running the mosquitto_sub command periodically
- **(E)** Prepare a system to publish data sent by ways other than MQTT (e.g., email) from observatories using MQTT → In progress
  - We have created a standalone program for conversion from IAGA2002 format to MQTT-compatible JSON format.
    - Handles header keys case-insensitively.
    - Automatically determines the timestamp format by detecting the data interval (1-second or 1-minute).
- **(F)** Create accounts so that each sender can publish to the Kyoto broker → Not yet, but we plan to start with Kakioka Observatory as the first case.

MQTT broker in Kyoto GIN

Data sender
(MQTT client)

Kyoto GIN

C (pending)

Edinburgh GIN

publish
F (not yet)

A (done)
MQTT broker

MQTT broker

bridge

B (done)

publish
E (under construction)

subscribe

Email, sftp,
or other methods

IAGA2002 to JSON

Data user

Data sender
(no MQTT)

Local system

Simple program for converting IAGA2002 to JSON

Usage: (just input as [stdin])

```
$ python3 iaga2002_to_json.py < ykc20090127dmin.min > ykc20090127dmin.json
```



```
Format                 IAGA-2002
Source of Data         Geological Survey of Canada (GSC)
Station Name           Yellowknife
IAGA Code              YKC
Geodetic Latitude      62.483
Geodetic Longitude     245.518
Elevation              198
Reported               XYZF
Sensor Orientation     XYZF
Digital Sampling       0.125 seconds
Data Interval Type     Average 1-Minute (00:30-01:29)
Data Type              Definitive
Publication Date       2023-01-25
# D-conversion factor  10000
# K9-limit
# Format binary data.
# A complete set is available on the INTERMAGNET CD-ROM/DVD.
# Go to www.intermagnet.org for details on obtaining this product.
# CONDITIONS OF USE: The Conditions of Use for data provided
# through INTERMAGNET and acknowledgement templates can be found
# at www.intermagnet.org
# D conversion factor is a fixed value used to allow
# Declination to be converted from minutes of arc to equivalent
# nanoteslas. Set to H/3438*10000 where H is the annual mean
# value of horizontal intensity.
DATE       TIME         DOY      YKCX     YKCY     YKCZ     YKCF
2009-01-27 00:00:00.000 027      99999.00  3010.80  58352.90  59042.77
2009-01-27 00:01:00.000 027       8481.60  3012.10  58352.80  59042.86
2009-01-27 00:02:00.000 027       8482.70  3012.00  58352.90  59043.11
2009-01-27 00:03:00.000 027       8482.00  3012.10  58352.90  59043.02
2009-01-27 00:04:00.000 027       8481.90  3012.60  58352.40  59042.54
2009-01-27 00:05:00.000 027       8481.10  3012.00  58352.20  59042.19
2009-01-27 00:06:00.000 027       8478.90  3011.10  58352.10  59041.73
2009-01-27 00:07:00.000 027       8477.40  3009.90  58351.30  59040.66
2009-01-27 00:08:00.000 027       8478.40  3009.60  58350.70  59040.20
```
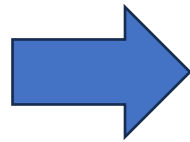
```
{
    "startDate": "2009-01-27T00:00",
    "institute": "Geological Survey of Canada (GSC)",
    "name": "Yellowknife",
    "latitude": 62.483,
    "longitude": 245.518,
    "elevation": 198,
    "sensorOrientation": "XYZF",
    "digitalSampling": "0.125 seconds",
    "dataIntervalType": "Average 1-Minute (00:30-01:29)",
    "publicationDate": "2023-01-25",
    "comments": [
        "D-conversion factor  10000",
        "K9-limit",
        "Format binary data.",
        "A complete set is available on the INTERMAGNET CD-ROM/DVD.",
        "Go to www.intermagnet.org for details on obtaining this product.",
        "CONDITIONS OF USE: The Conditions of Use for data provided",
        "through INTERMAGNET and acknowledgement templates can be found",
        "at www.intermagnet.org",
        "D conversion factor is a fixed value used to allow",
        "Declination to be converted from minutes of arc to equivalent",
        "nanoteslas. Set to H/3438*10000 where H is the annual mean",
        "value of horizontal intensity."
    ],
    "geomagneticFieldX":
[null,8481.6,8482.7,8482.0,8481.9,8481.1,8478.9,8477.4,8478.4,8478.1,8477.2,847
8.0,8476.6,8477.2,8482.1,8485.2,8484.3,8483.0,8484.1,8483.9,8480.7,8478.9,8478.
5,8478.0,8477.5,8476.7,8475.8,8475.6,8475.0,8474.0,8474.2,8475.0,8475.1,8475.2,
8475.5,8475.9,8474.7,8473.2,8473.7,8473.2,8470.9,8469.8,8469.6,8470.0,8469.1,84
69.3,8470.0,8469.9,8470.7,8472.4,8473.6,8473.6,8474.0,8473.6,8473.0,8472.8,8471
.8,8471.0,8471.8,8471.7,8471.0,8470.9,8470.2,8470.5,8471.2,8470.4,8469.8,8469.1
,8469.5,8470.1,8470.5,8472.5,8474.4,8472.6,8470.6,8470.0,8469.5,8469.0,8469.2,8
470.5,8471.6,8471.3,8473.3,8473.8,8474.7,8475.8,8476.9,8477.2,8474.0,8469.9,846
```

Future Outlook

- The highest priority work is preparation of the system for automatic format conversion and publication of data to Edi Broker via MQTT (task marked with E).

- Starting this month (September), our IT assistant's working hours will increase, and we aim to establish the system for sending data to Edinburgh via MQTT by the end of the year.

- It is expected to take considerable time to enable each station to use MQTT.
  - We plan to work with Kakioka as the first case.
  - We also need to build a system to store the data we receive via MQTT into our server.