Global Broker setup for WIS2

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WIS2 Principles

WIS 2.0

❝ *WIS 2.0 is a collaborative system of systems using Web-architecture and open standards to provide simple, timely and seamless sharing of trusted weather, water and climate data and information through services.*❞
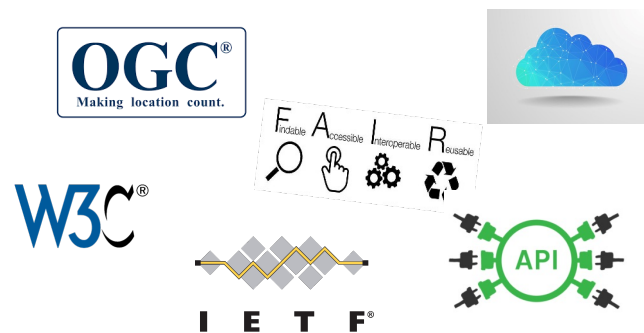
WMO Information System (WIS 2.0)

1963 World Weather Watch

  1970s Global Telecommunication System

  2007 WMO Information System (WIS)

   2019 WMO Reform (Earth System Approach)

   2021 WMO Unified Data Policy / GBON

WIS 2.0

… system of systems using Web-architecture and open standards to provide simple, timely and seamless sharing of trusted data and information …

- Open Standards (OGC, W3C, IETF, …)
- Open Source (use off the shelf tools)
- Data sharing through Web and publication/subscription (pub/sub) protocols
- Cloud ready (turn-key solutions)
- Web APIs (Application Programming Interface)

- On the GTS and the WIS, available data is <u>pushed</u> by the producing centre as soon as it is available to a <u>static</u> list of recipients.

- In turn, those <u>push</u> again that same data to subsequent users, etc.

- Resulting in many hops (delays and availability risks) and many changes to adapt the manually maintained routing tables.

- The WIS 2.0 solution by using <u>off the shelf</u> software aims at:
  - Moving from a <u>static push model</u> to a <u>dynamic pull model</u>
  - Improving the reliability of the distribution of real time data
  - Reducing the number of hops between the producer and the user
  - Allowing a dynamic selection for the user of the required data
  - Allowing the producer to provide new data rapidly and easily
  - Using the same solution for data from all WMO Programmes

- Using MQTT 3.1.1 or 5.0 protocols National Center will publish a short message describing the available data and the method (URL) to access it

- Global Brokers are subscribing to these announcements and Global Cache download the data for further redistribution

- This solution will:

  – Gradually replace the GTS for weather data

 – Provide a solution for all WMO programs

- The planned Global Services:

  – Global Brokers: using off the shelf MQTT Broker will allow distribution of messages announcing availability of new data

  – Global Cache: following reception of message from the broker, it will download data from National Center (if data of global interest) and make it available for downstream consumers

  – Global Catalog: will keep a record of all metadata. Through API, search engines, dedicated portal, datasets will be discoverable

  – Global Monitoring: using OpenMetrics (Prometheus) all WIS2 services will be monitored and KPI will be produced

WIS2 architecture with redundancy

Global Services
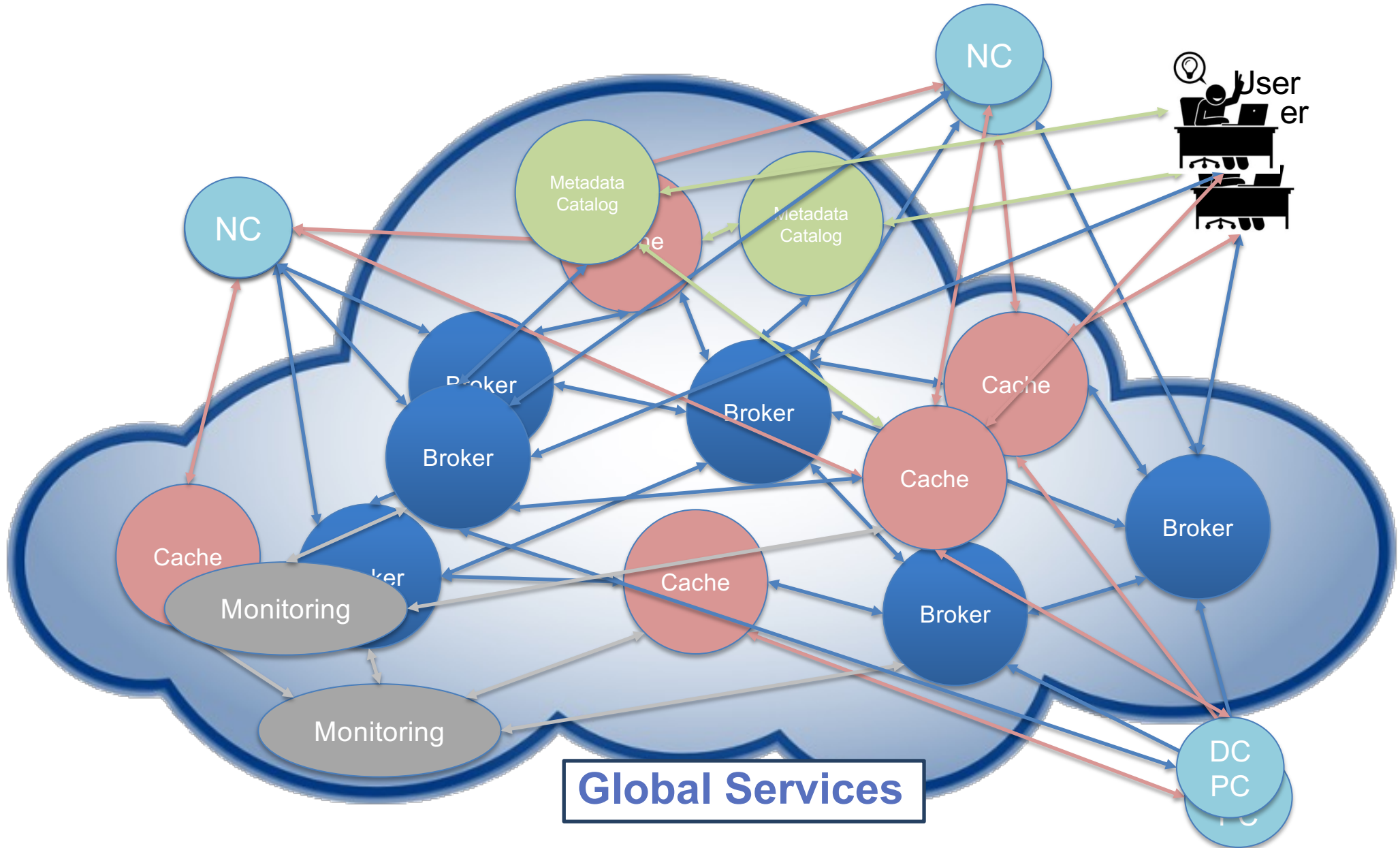
Message distribution
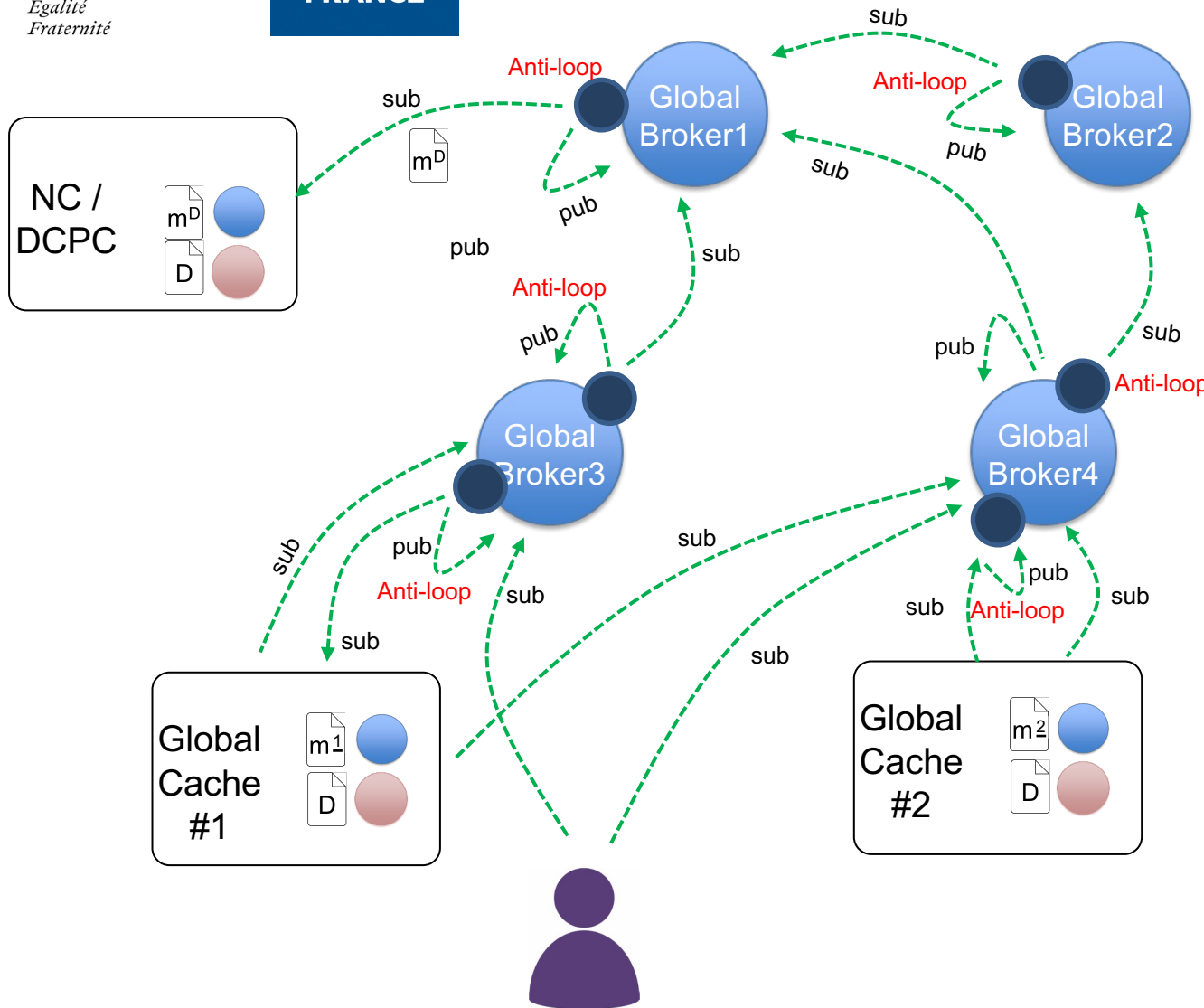
The anti-loop tool:
- Subscribes to as many brokers as needed. The brokers might be "linked" to a WIS2node, a Global Cache or another Global Broker
- Publishes only to its Global Broker

The publication to the local Global Broker only occurs if the "msg_id" is unknown to the "anti-loop system" of the particular Global Broker.

This ensures that the subscribers to the Global Brokers will only see each message only once per Global Broker

The msg_id is positioned by the originating center or the cache after having downloaded and stored the data.

The msg_id is an identifier to enable the anti-loop mechanism

As a consequence the same data/file will be "linked" to various msg_id (origin and one per cache)

A user subscribing to two brokers will receive two messages with the same msg_id per data source holding the data (origin or cache). So potentially 2 messages on the topic …/origin/… and 2 x messages on the topic …/cache/… (x = number of caches having the data)

The bridging function of MQTT is not sufficient to interconnect the various brokers.

msg_id is a generic term to identify the message. Generating and comparing efficiently unicity of this id will be key for the performance of the anti-loop tool.

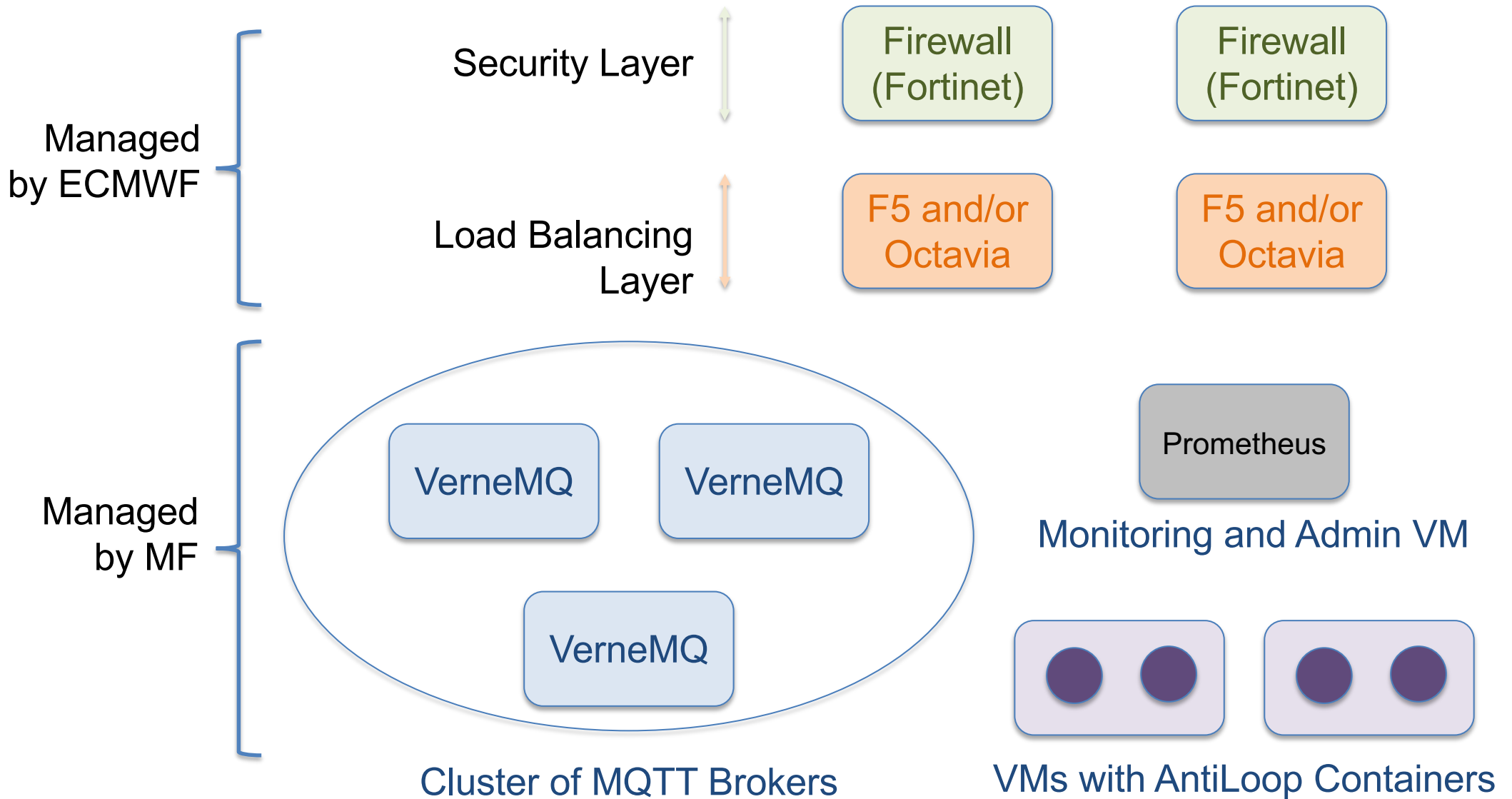# Meteo-France Global Broker – Pilot phase

- ## The Broker

  - ### A cluster of 3 instances of VerneMQ broker running on EWC
    - VerneMQ is one of the state of the art MQTT broker
    - Implemented in Erlang
    - Having clustering capabilities
    - MQTT 3.1.1 and MQTT 5.0 compliant

  - ### Only the anti-loop software is publishing to it

  - ### All interested clients are subscribing to the broker

- ## The anti-loop function

  - ### A prototype of the anti-loop system written using NodeRed:
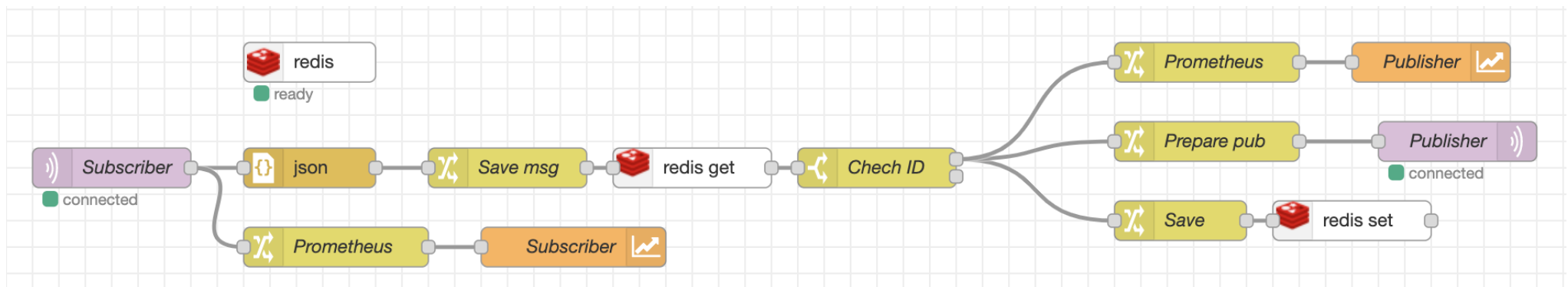
The Anti-Loop function

- The function is available as an open-source docker container:
  - https://hub.docker.com/repository/docker/golfvert/wis2globalbrokernode red

- The source code is availableon github:
  - https://github.com/golfvert/WIS2-GlobalBroker-NodeRed

- How does it work:
  - It is required to run one container per WIS2 Node client
  - The anti-loop container subscribes to announcement made by the WIS2 Node
  - Using a redis database it checks if the same message id has already been seen
  - If not, it publishes the message locally to the local cluster of broker
  - Metrics are published using the agreed solution (Prometheus)

- Thanks to the help of the EWC team at ECMWF the setup has been rather smooth nevertheless quite manual

- At the moment (on the test EWC hardware installed at Reading), part of the environment (load balancing and firewall) is managed by ECMWF

- With the target system in Bologna, it is expected that Météo-France will manage the system end to end and the deployed will be automated using horizon API or terraform

- An evolution toward Infrastructure as code