Kai Wirt
Introduction to WIS2

JMA WIS – Workshop
28. – 30.11.2023
Tokyo / Japan

Background / Resolution Cg-19

THE WORLD METEOROLOGICAL CONGRESS,

Recognizing:

(1)	The compelling need of implementing a WMO Information System 2.0 able to support the WMO Unified Data Policy (Resolution 1 Cg-Ext-2021) and the establishment of the Global Basic Observing Network (Resolution 2 Cg-Ext-2021),

(2)	The urgent need of developing the required technical and regulatory framework for enabling the international data exchange by all the disciplines and domains as required by the WMO Unified Data Policy (Resolution 1 Cg-Ext-2021),

(3) The importance of providing to Members guidance for an effective technical
	implementation and timely transition to the WIS 2.0 (INF 6.3.1(4)),

Adopts: the changes to the Manual on the WMO Information System provided in the Annex

WIS 2.0 - principles

No.	WIS 2.0 Principles
7	WIS 2.0: will require all services that provide real-time distribution of messages (containing data or notifications about data availability) to cache/store the messages for a minimum of 24-hours, and allow users to request cached messages for download
8	WIS 2.0: will adopt direct data-exchange between provider and consumer
9	WIS 2.0: will phase out use of routeing tables and bulletin headers
10	WIS 2.0: will provide a Catalogue containing metadata that describes both data and the service(s) provided to access that data
11	WIS 2.0: encourages data providers to publish metadata describing their data and Web services in a way that can be indexed by commercial search engines

Background / WIS 2.0 technical regulations

Volume I
WIS 1.0

Volume II
WIS 2.0

- Guidance on Technical Specifications of WIS 2.0
  https://community.wmo.int/WIS2_Technical_Specification_Guidance

- Guidance on Transition from GTS to WIS 2.0
  https://community.wmo.int/GTS_WIS2_Transition_Guidance

WIS 2 Architecture

Global Services

WIS2 node

WIS 2 Node

❑ WIS2 node is the platform for data exchange instead of GTS

❑ NCs / DCPCs are going to implement a WIS2 Node to exchange data in WIS2

❑ The WIS2 Node shares data from an HTTPS service and sends notifications to MQTT subscribers

❑ No need to provide access to all the users in the world, only to some WIS2 Global Services

Global Services

Downloads data

Subscribes to

Receives notifications of new data
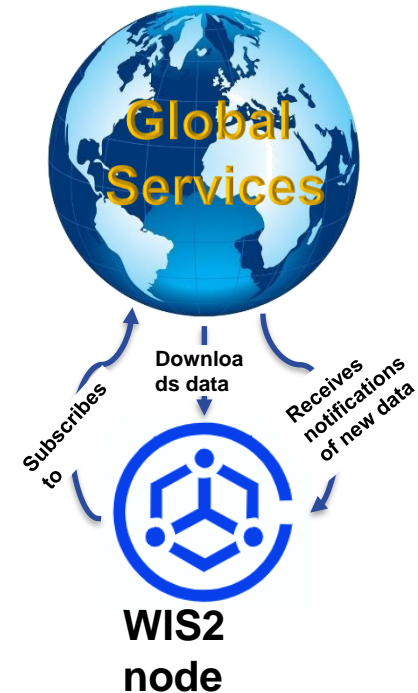
WIS2 node

WIS 2 Concept

- Central to WIS 2.0 are **WIS2 Nodes**. These are used by National Centres (NC) and Data Collection and Production Centres (DCPC) to publish their **Core** and **Recommended Data**.

- Principal 1: WIS 2.0 adopts **Web technologies** […] and **open standards**.

- … so, that means WIS 2.0 is can be implemented using freely-available components (like **WIS2box**) and common industry practices.

- Simply – WIS2 Nodes publish data as files on a Web server or using an interactive Web Service.

- And because security and access control is 'baked-in' to Web technologies, **you can decide how you want to control access to your data**.

Data Consumer

download

WIS2 Node

Core Data

Recommended

7
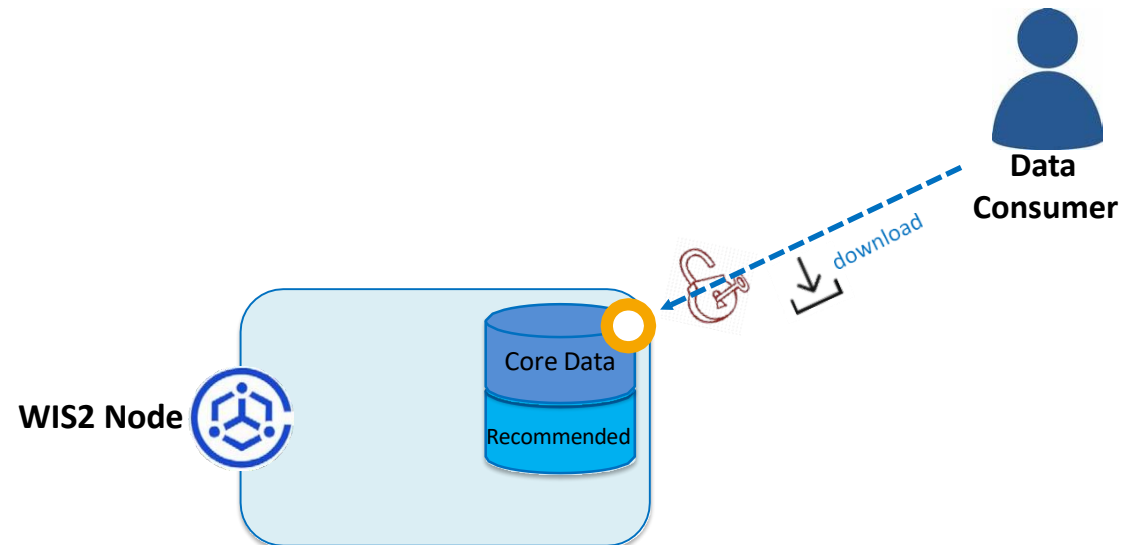
WIS 2 Concept

- Recognising the potential high-demand placed on a **WIS2 Node** to serve data to a global audience, WIS2 provides highly-available, high-performance **Global Services** to ensure that WIS2 meets required performance levels.

- A Global Cache is used to distribute copies downloaded from WIS2 Nodes of **real-time** and **near real-time Core Data** with free and unrestricted access - as per Unified Data Policy.

- **Data Consumers** <u>SHOULD</u> download data from the **Global Cache** if possible.

- To ensure that a Global Cache can meet its service-level expectations, it may **restrict access during periods of high demand** in accordance with its fair usage policy.
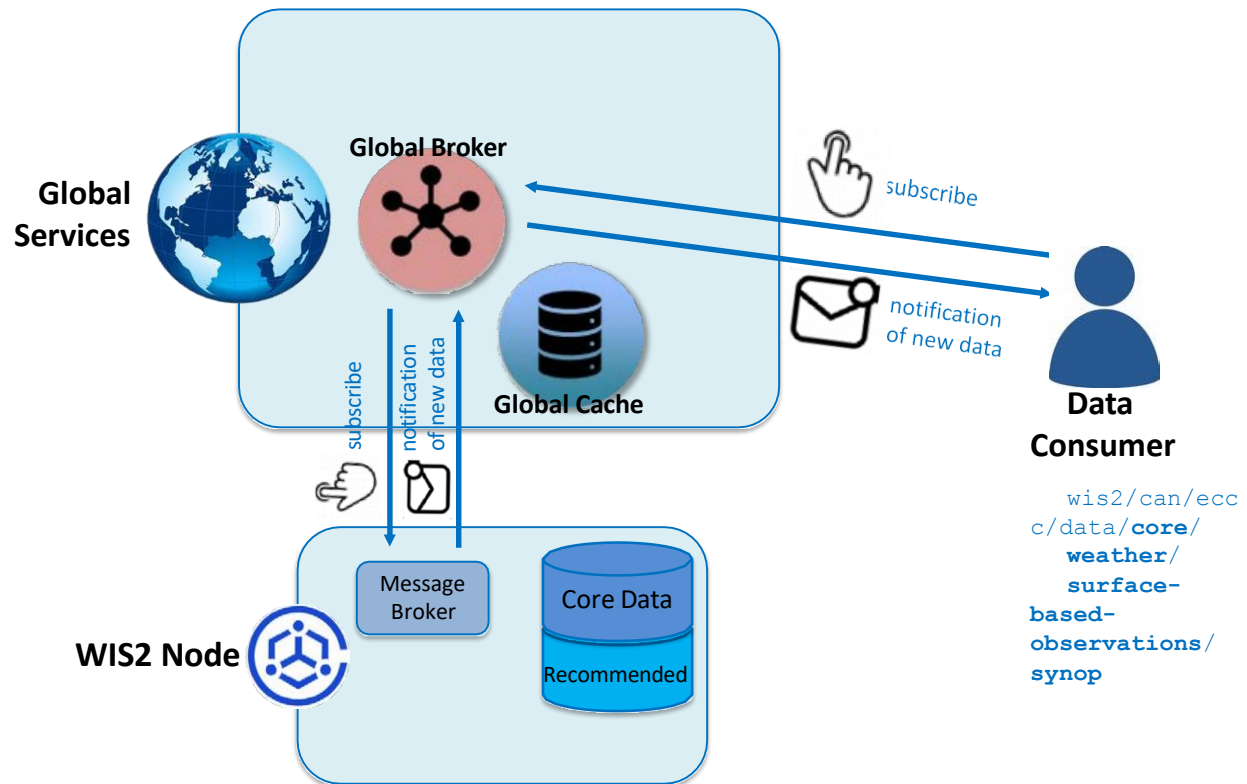
Global Services

Global Cache

WIS2 Node

Core Data

Recommended

download

download

download

Data Consumer

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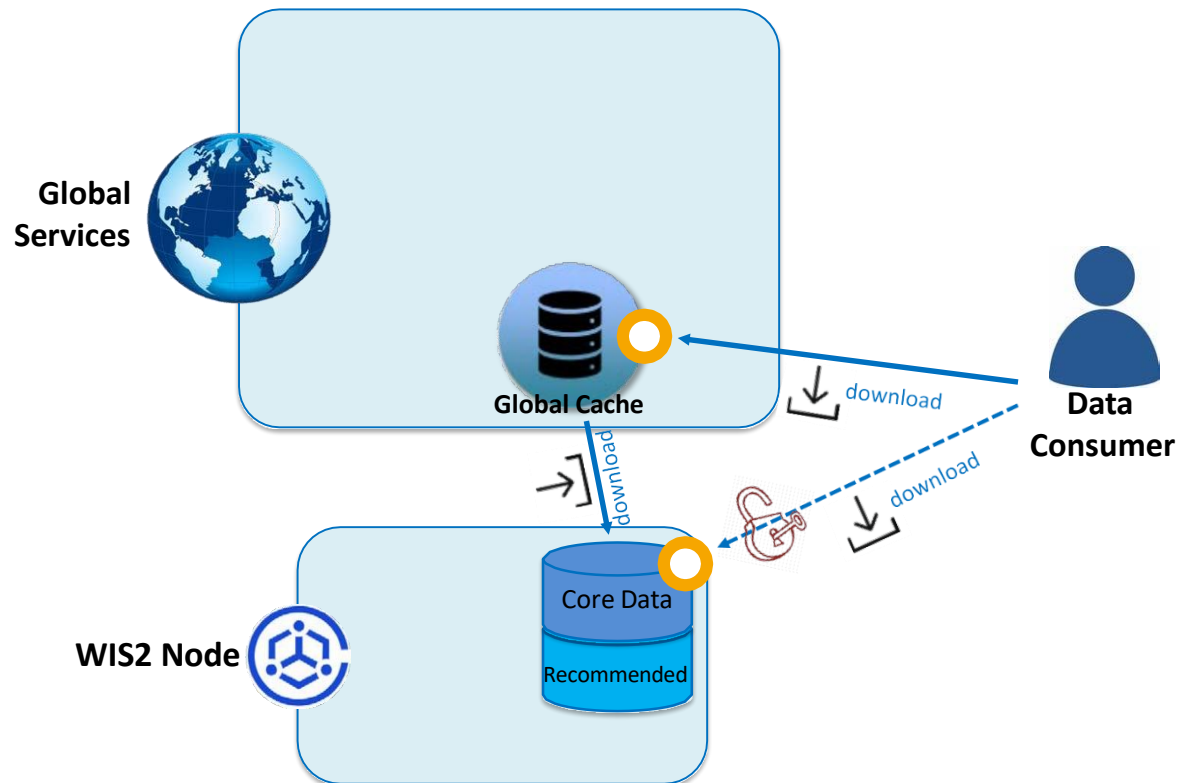
WIS 2 Concept

- **Data Consumers subscribe** to **Topics** at the Global Broker so that notification messages for that topic are immediately sent to them.
- There is a unique **Topic** for each dataset.
- **Topic Structure** organised according to Annex 1 of the Unified Data Policy to make it easy to find the topic associated with the data you want.

```
wis2
  country
    centre-id
      resource-type
        data-policy
          earth-system-discipline
            discipline-subcategory
              …
```

- Same mechanism and topic structure used by Global Broker so that it can re-publish notification messages from WIS2 Nodes.

Global Services

Global Broker

Global Cache

subscribe

notification of new data

Data Consumer

```
wis2/can/ecc
c/data/core/
  weather/
  surface-
  based-
  observations/
  synop
```

subscribe

notification of new data

WIS2 Node

Message Broker

Core Data

Recommended

10

WIS 2 Concept

- When new data becomes available at the **WIS2 Node**, it generates a **notification message** to advertise data availability and publishes it on a **Message Broker**.

- The notification message gets pushed to a highly-available, high-performance **Global Broker** that re-publishes the message for global consumption.

- (Note: the **Global Cache** uses the notification message to trigger download of a data copy for highly-available, high-performance distribution. The Global Cache also publishes it's own data-availability notification message.)

- The information in the notification message(s) tells the **Data Consumer** where to download the data from.
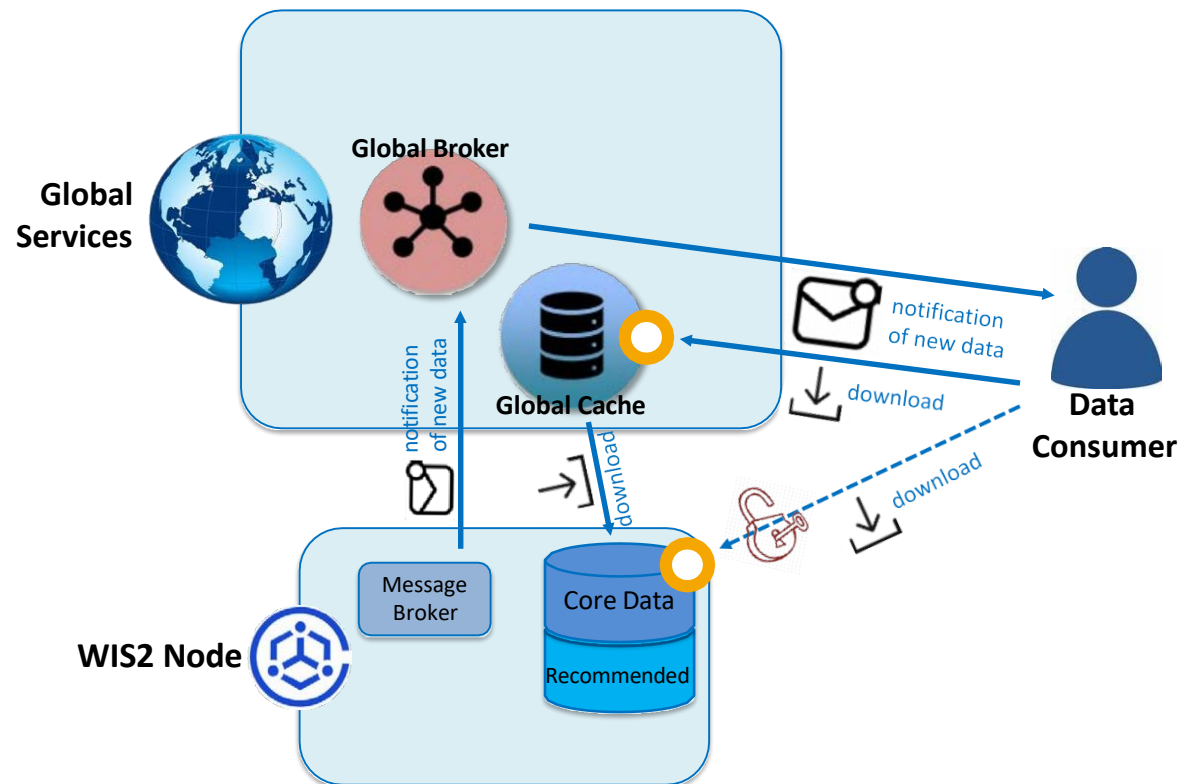
WIS 2 Concept

- Data Publishers create **Discovery Metadata** to describe the datasets they make available from their WIS2 Node.

- These metadata records are collected and published at the **Global Discovery Catalogue** (GDC).

- Data Consumer can search/browse the GDC to find the datasets they need.

- GDC organises datasets according to the same standard scheme used in the **Topic Hierarchy**.

- Discovery Metadata records tell Data Consumers where they can **download** data and **subscribe** to notifications.

Global Services

Global Discovery Catalogue

Global Broker

Global Cache

search/browse

{ ... }
metadata

Data Consumer

WIS2 Node

Message Broker

Core Data

Recommended

{ ... }
metadata

11
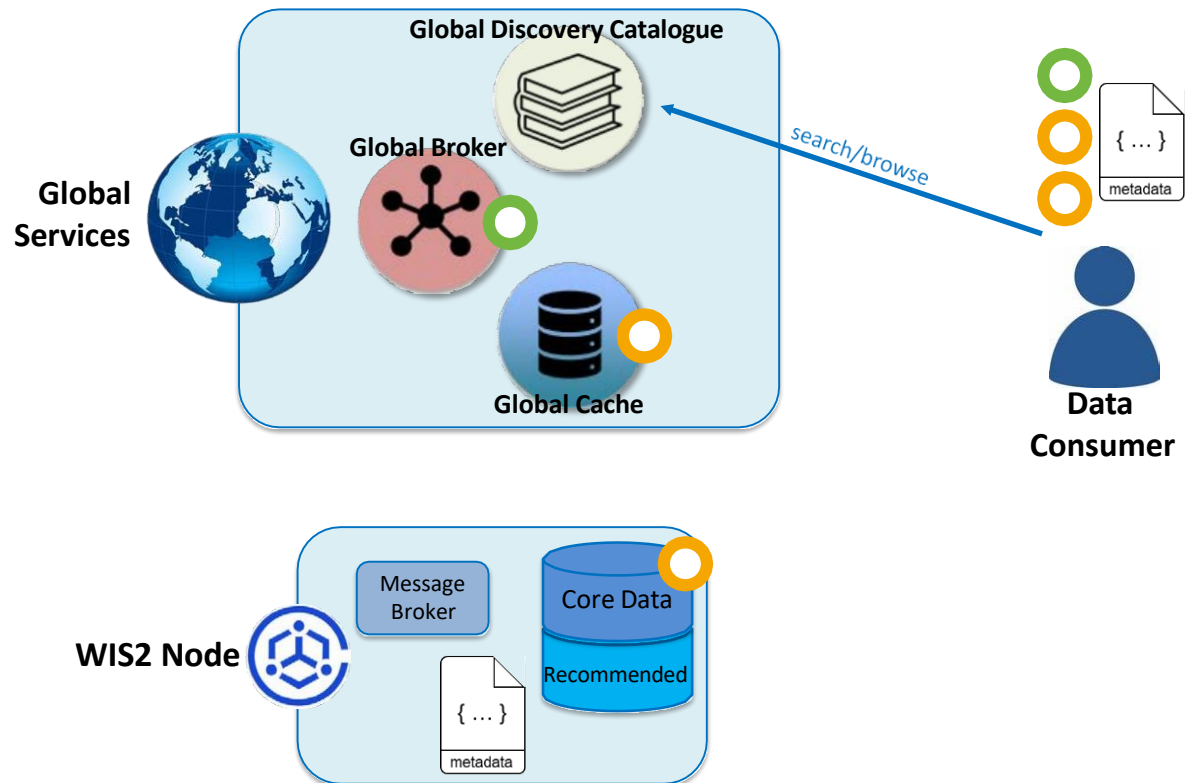
WIS 2 Concept

- Discovery metadata also tells Data Consumers about the terms and conditions associated with use of the data …

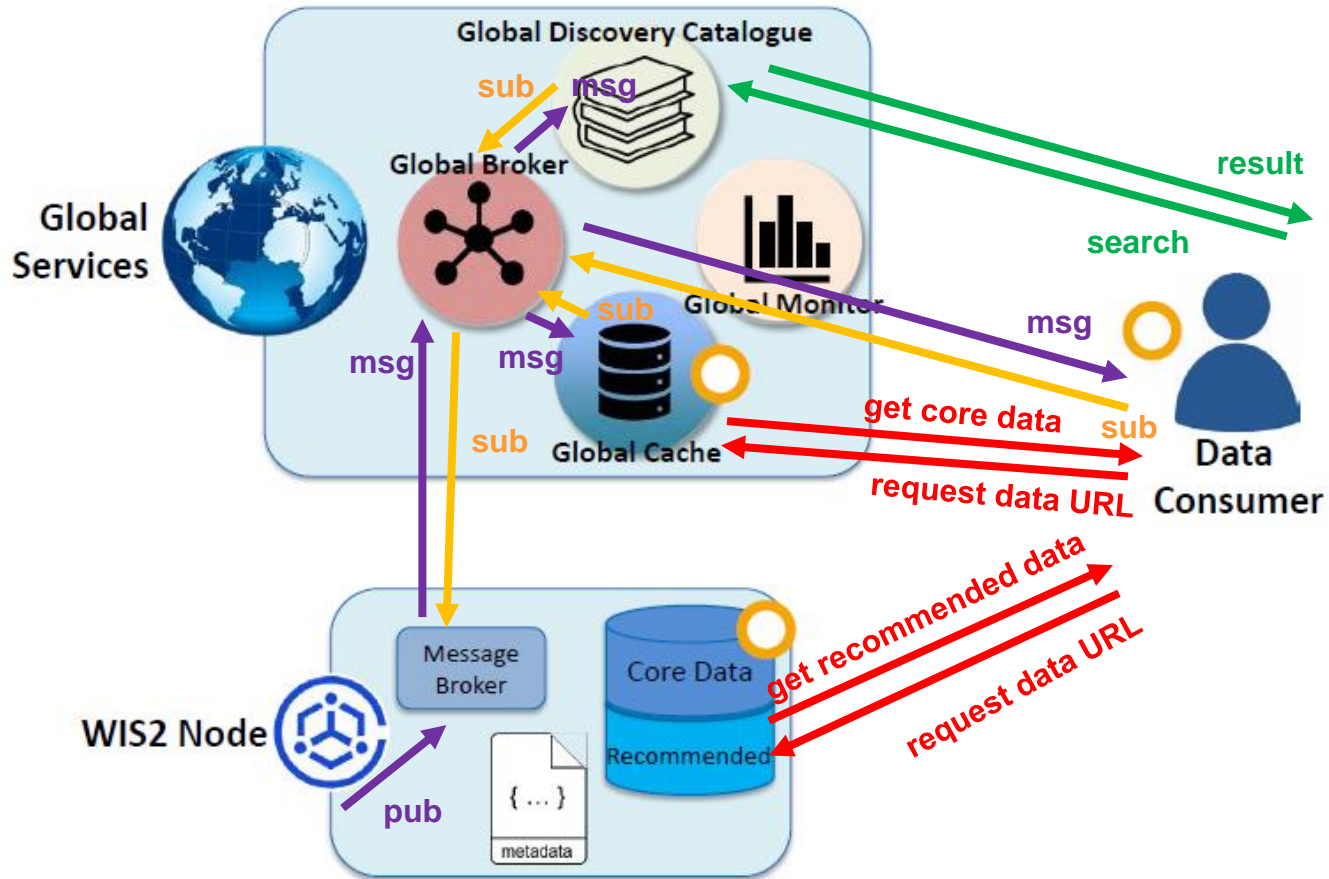- … in the form of a license (e.g. CC-BY-4.0) or, for 'free and unrestricted' **Core Data**, attribution instructions …

- Example: *You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.*[1]

- Example: SPIRE radio occultation data (a **Recommended** dataset) purchased by NOAA and EUMETSAT for global use is published under CC-BY-4.0 license.
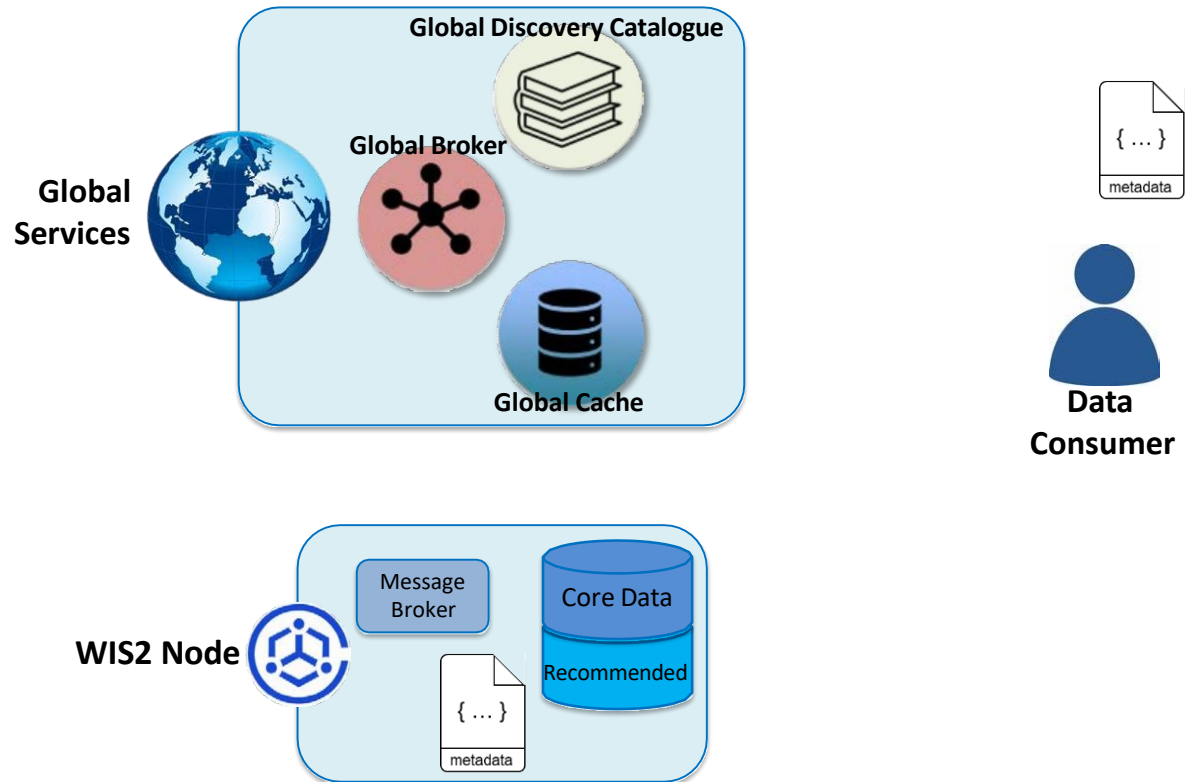
[1] Source: Creative Commons CC-BY-4.0 attribution statement
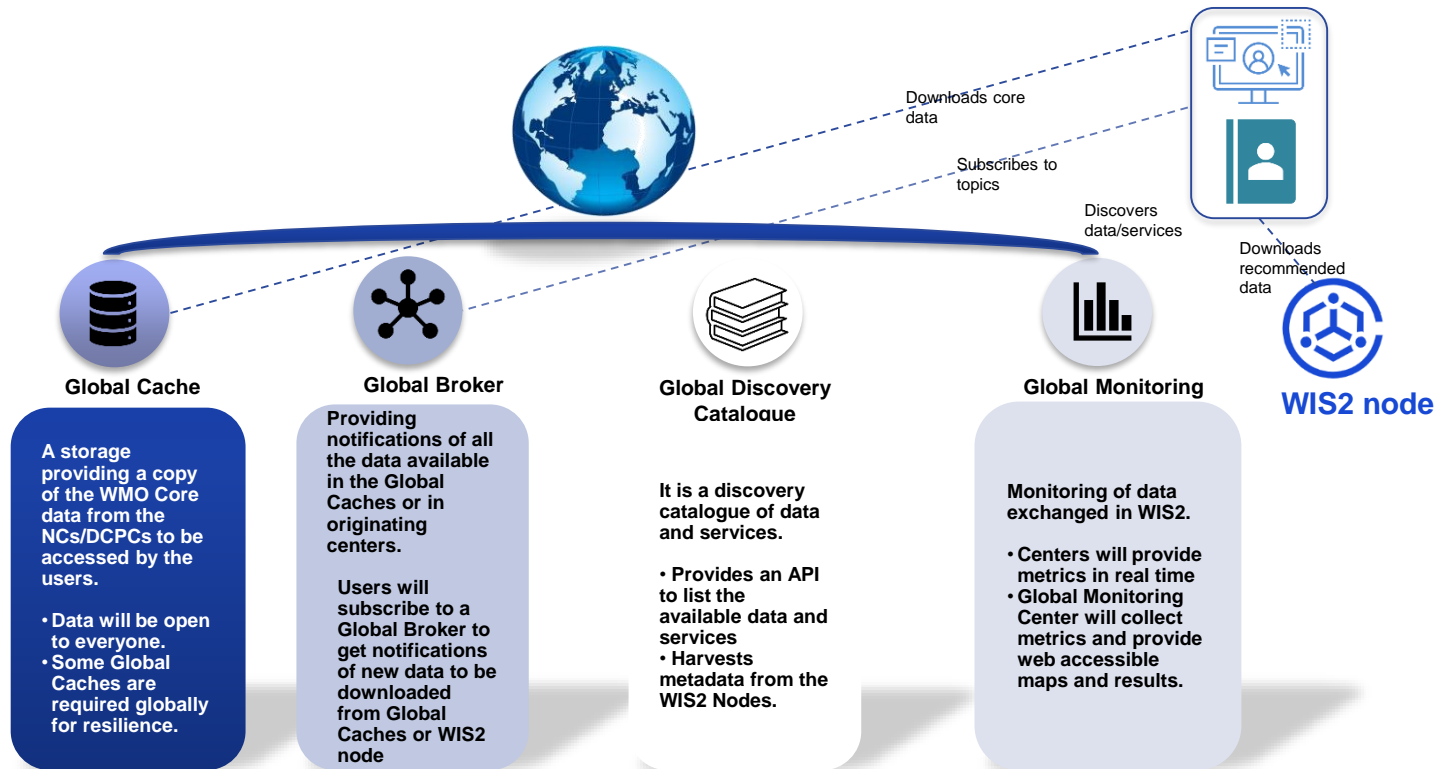
Global Discovery Catalogue

Global Broker

Global Services

Global Cache

{ … }
metadata

Data Consumer

WIS2 Node

Message Broker

Core Data

Recommended

{ … }
metadata

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Global Services and WIS2 Node

Source 1

Global Services

Downloads core data

Subscribes to topics

Discovers data/services

Downloads recommended data

Global Cache

Global Broker

Global Discovery Catalogue

Global Monitoring

WIS2 node

A storage providing a copy of the WMO Core data from the NCs/DCPCs to be accessed by the users.

- **Data will be open to everyone.**
- **Some Global Caches are required globally for resilience.**

Providing notifications of all the data available in the Global Caches or in originating centers.

Users will subscribe to a Global Broker to get notifications of new data to be downloaded from Global Caches or WIS2 node

It is a discovery catalogue of data and services.

- **Provides an API to list the available data and services**
- **Harvests metadata from the WIS2 Nodes.**

Monitoring of data exchanged in WIS2.

- **Centers will provide metrics in real time**
- **Global Monitoring Center will collect metrics and provide web accessible maps and results.**

Tasks of a Global Broker (GB)

- Providing mqtt(s) - version 3.1 and version 5
- Subscribe to WIS2 Nodes
  - getting data availability messages from WIS2 Nodes
- Allowing users to subscribe
  - so that users will get data availability messages
- Forwarding of messages from Nodes to Users
- Verification of messages - for compliance with WIS2 message format
- Prevention from sending duplicate messages (anti-loop feature)

GB Beijing
GB Toulouse
GB Washington

Tasks of a Global Cache (GC)

Function:

– Provides reliable and low latency access to data made available by WIS2 Nodes through the internet

– GC shall provide the download service of WMO core data without authentication

– subscribing to all WMO-Core and publishing notifications (with the new URL of the cache)

– WIS2 Nodes can override this behaviour by asking GC **NOT** to cache some data that they will provide from their storage.

> GC Tokyo
> GC Offenbach
> GC Synoptic (NOAA + UKMO)
> GC Seoul

Tasks of a Global Discovery Catalogue (GDC)

- Provides a cataloguing and discovery capability of WMO dataset collections
- Web-based API facilitating search/browse data published via WIS
- Harvests WIS 2 discovery metadata
- Yellow pages (discovery metadata) gateway into WIS data and services
- Provides indexing capability to mass market search engines
- Provides quality assessment services of discovery metadata in support of continuous improvement in alignment with WIS 2 metadata Key Performance Indicators (KPIs)
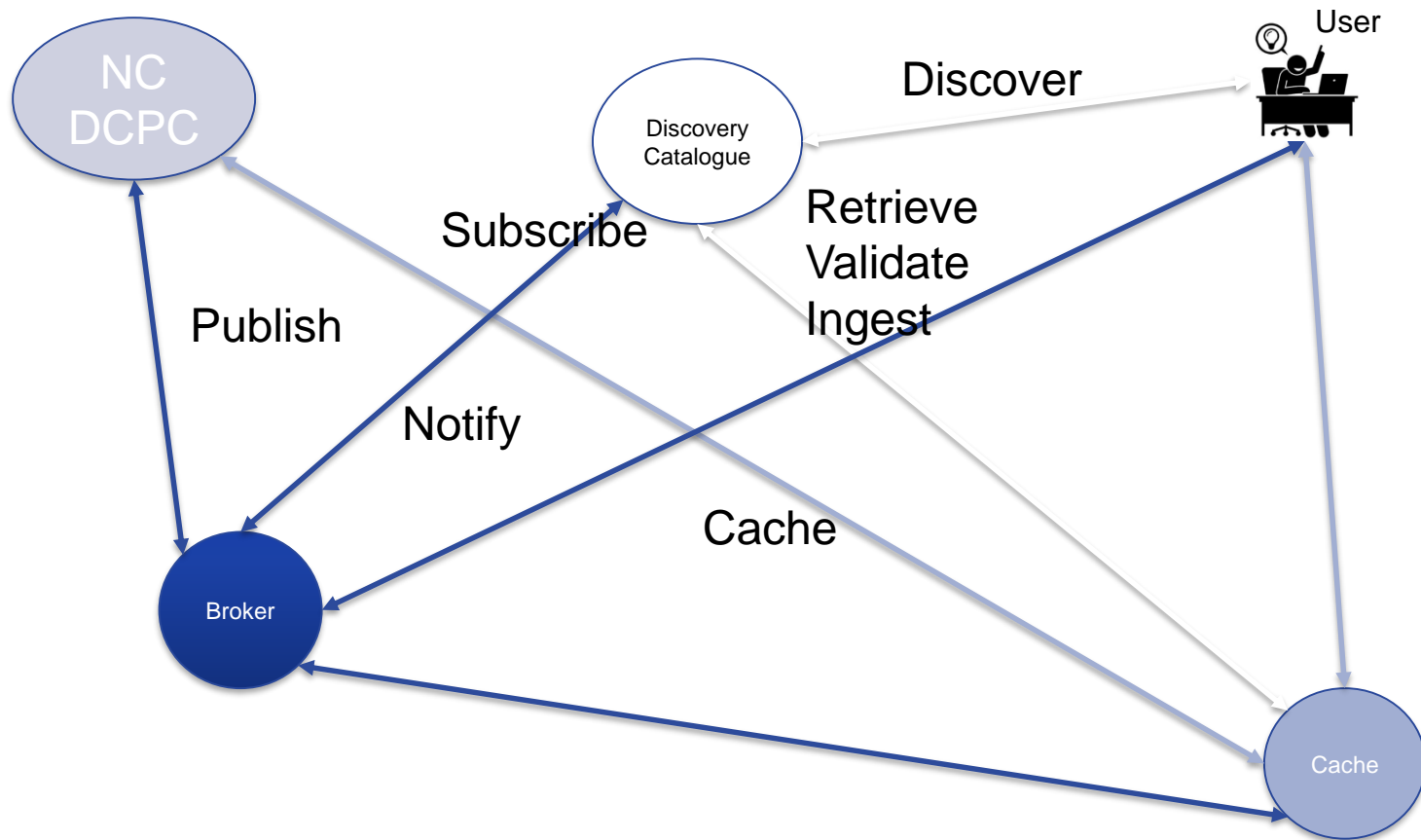
GDC Toronto
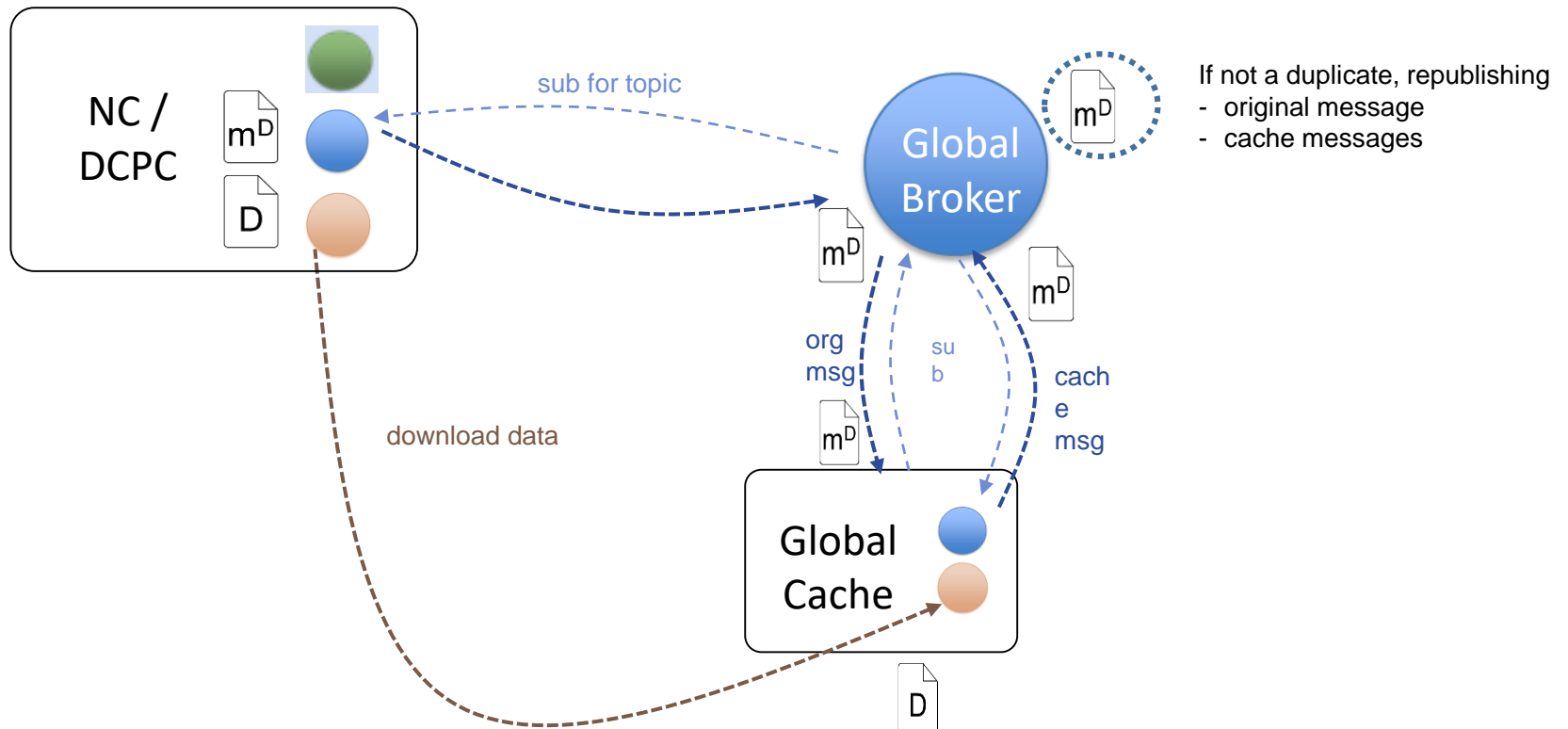GDC Beijing

Tasks of a Global Monitoring

- Monitoring will be **based on OpenMetrics**

- OpenMetrics is a draft standard based on the **working principles of Prometheus**

- **Prometheus** queries and stores the metrics as time series

- Typically, a tool like **Grafana** can query the Prometheus database **to present graphically** values from the database

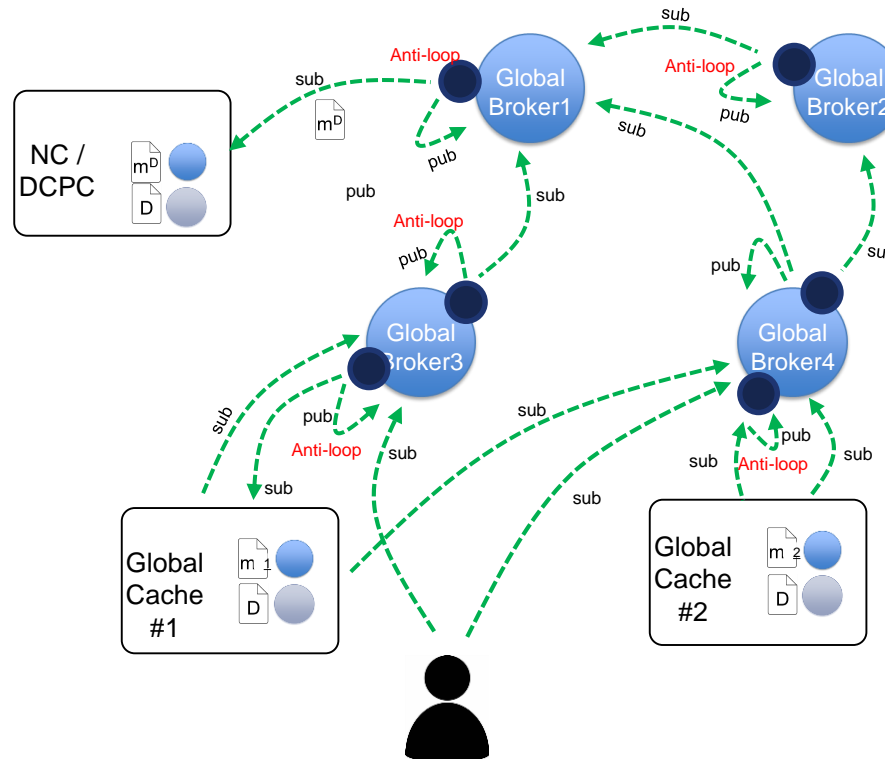- The Global Monitoring is similar to the WCD

GM Casablanca

Workflows WIS2

NC
DCPC

Discovery
Catalogue

User

Discover

Subscribe

Retrieve
Validate
Ingest

Publish

Notify

Broker

Cache

Cache

Workflows WIS2

NC / DCPC

m^D

D

sub for topic

Global Broker

m^D

If not a duplicate, republishing
- original message
- cache messages

m^D

m^D

org msg

su b

cach e msg

download data

m^D

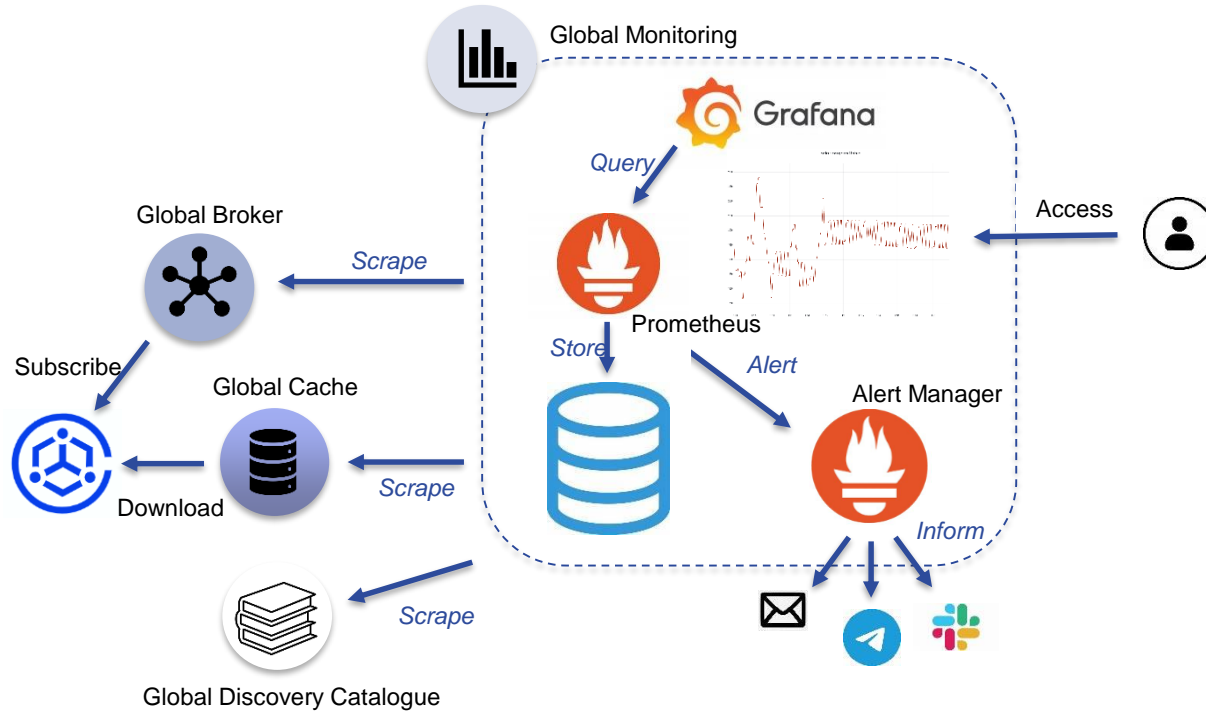Global Cache

D

Workflows WIS2

- MQTT for notifications

- Direct http(s) Downloads
  - From GC
  - From Originator

- Redundant Brokers and Caches combined with deduplication

Monitoring architecture

Global Monitoring

Grafana

Query

Global Broker

Scrape

Access

Prometheus

Store

Alert

Alert Manager

Subscribe

Global Cache

Download

Scrape

Inform

Scrape

Global Discovery Catalogue

WIS2 Messages Subscribe Code

```
mosquitto_sub -h globalbroker.meteo.fr -p 8883
-t 'cache/a/wis2/#'
-u everyone -P everyone
-v
```

WIS2 Messages

```
{
    "id": "6c87b296-ad08-11ed-bd70-e43d1a214824",
    "version": "v04",
    "type": "Feature",
    "geometry": null,
    "properties": {
        "data_id": "wis2/eue/eumetsat/data/core/weather/space-based-observations/satellite4nowcasting/Meteosat-11/ImageL1-5/H-000-M
SG4__-MSG4_____-WV_062___-000006___-202302150800-C_",
        "metadata_id": "urn:x-wmo:md:eue:eumetsat:msg:tobeset",
        "pubtime": "2023-02-15T08:12:01.0545153618Z",
        "integrity": {
            "method": "sha512",
            "value": "e1fc617752724d6101897b05cdc6edb8149ba653af80db0adfd75b11b3da3405060d7c5419922983622c46ae6e8d368bc2b8d00349f42
478a507c973c00f9e0b"
        }
    },
    "links": [
        {
            "href": "https://opendata.dwd.de/test/wis2/cache/eue/eumetsat/H-000-MSG4__-MSG4_____-WV_062___-000006___-20230215080
0-C ",
            "rel": "canonical",
            "type": "application/octet-stream",
            "length": 807634
        }
    ]
}
```

Thank you for your attention

Kai Wirt

Deutscher Wetterdienst

kai-thorsten.wirt@dwd.de

wis@dwd.de