WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Supporting historical data exchange via the WIS2.0

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WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

Evolution of WMO international data exchange

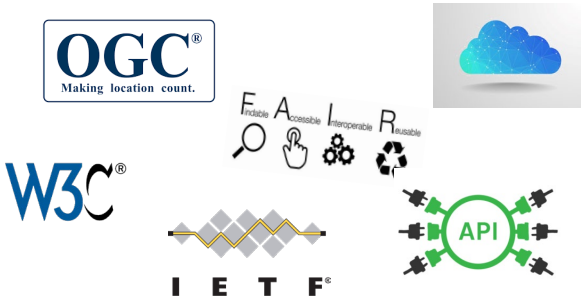
1963 World Weather Watch

1970s Global Telecommunication System (GTS)

2007 WMO Information System (WIS)

2019 WMO Reform (Earth System Approach)

2021 WMO Unified Data Policy (Core, Recommended)



WIS 2.0

… collaborative 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, …)
- Free and Open Source tooling
- Data sharing through Web and real-time notifications with publication/subscription (pub/sub) protocols
- Cloud ready (turn-key solutions)
- Web services and APIs (Application Programming Interface)

WORLD METEOROLOGICAL ORGANIZATION

WIS 2.0 – key concepts

WIS2 node: data publisher, publishing metadata records, notifications of new data and providing access to the data. Includes National Centres (NCs) and Data Collection or Processing Centres (DCPCs) publishing to the WIS2.0.

WIS2 discovery metadata (WMO Core Metadata Profile v2): WIS2 discovery, access and retrieval metadata. Based on OGC-API Records.

WIS2 notification message: MQTT notification published by a WIS2 node, alerting subscribers to the availability of new data and where to download from (Global Cache for core data). Used for low latency and (near-)real-time data exchange.

Global Discovery Catalogue(s): High availability global catalogue of all the datasets registered in the WIS2.0.

Global Broker(s): High availability, scalable MQTT broker that republishes notifications from WIS2 nodes.

Global Cache(s): High availability, scalable cache of WMO 'core' data published on the WIS2.0.

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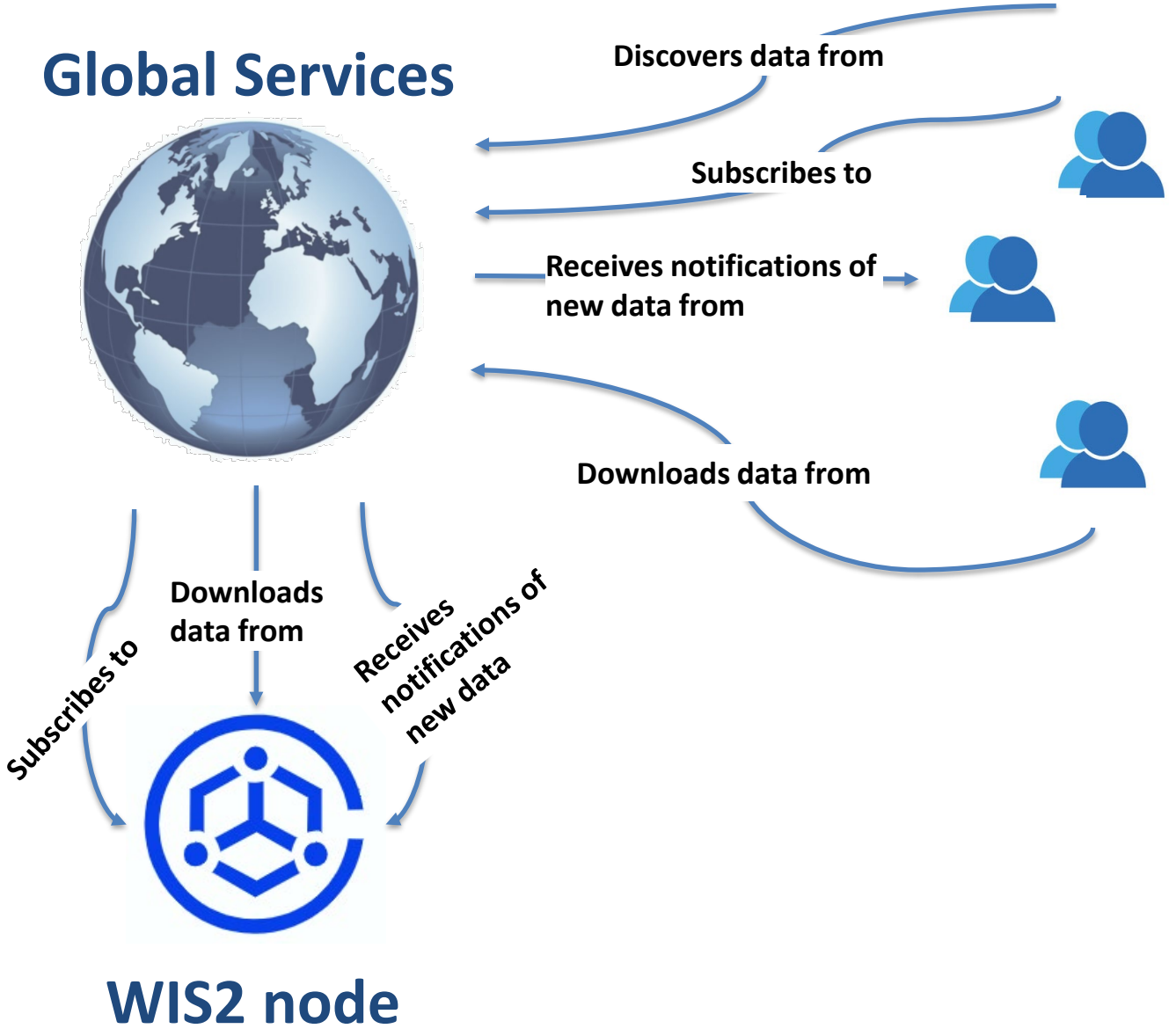
- Each WMO Member shall implement at least one WIS2 node to share data in WIS2
- A WIS2 node replaces the GTS Message Switching System
- Data and metadata are shared through a WIS2 node
- A WIS2 Node shares data via an HTTPS service and sends notifications to MQTT subscribers



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Sharing data in WIS 2.0 – dataset centric

A dataset groups all data items into a single, conceptual resource:

- The dataset has an identifier (metadata-id) associated to all data items
- Statements about the dataset (i.e. metadata) apply to the entire collection

The dataset concept is central for WIS 2.0:

- Publish *Discovery Metadata* for datasets using **WMO Core Metadata Profile 2 (WCMP2)**
- Search for datasets that contain relevant data using the **Global Discovery Catalogue**
- Subscribe to notifications about updates for a dataset via a **Global Broker**

Three different data access mechanisms:

- Providing data in (near-)real-time (via MQTT notifications)
- Providing data as files
- Providing interactive access to data via APIs

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[1] Guide to WIS (WMO No. 1061), Vol II, §1.1.4 Why are datasets so important [draft]

Sharing data in WIS 2.0 – WCMP2

WMO Core Metadata Profile version 2 (WCMP2)

- Discovery, access and retrieval metadata based on OGC-API Records standard
- Simplified GeoJSON encoding compared to previous WCMP version (based on ISO 19115/ISO 19139 standards)
- WCMP2 records published by WIS2 nodes for their datasets
- These are then harvested and collated by the Global Discovery Catalogue(s):
  - https://wis2-gdc.weather.gc.ca/collections/wis2-discovery-metadata
  - https://gdc.wis.cma.cn/dataService
  - https://wis2.dwd.de/gdc/
- Consumers search for data of interest and subscribe for updates via MQTT or access data directly (using file-based or API driven methods)

Description of the Dataset
Identifier
Geometry (extent)
Time (extent)
Title
Description
Keywords / themes

Who to contact
Publisher contact

How to access
Data access (files)
Data access (API)
Data access (notifications)

Conditions of use
Data policy
Rights
License

How to attribute
Citation

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Sharing data in WIS 2.0 – WCMP2


```
{
  "id": "urn:wmo:md:ca-eccc-msc:climate.climate-daily",
  "conformsTo": [...],
  "type": "Feature",
  "geometry": {"type": "Polygon"...},
  "time": {"resolution": "P1D"...},
  "properties": {
    "title": "Daily Climate Observations",
    "description": "Daily climate observations are derived from two sources ...",
    "themes": [
      {
        "concepts": [...],
        "scheme": "https://canada.multites.net/cst"
      },
      {
        "concepts": [...],
        "scheme": "https://codes.wmo.int/wis/topic-hierarchy/earth-system-discipline"
      }
    ],
    "contacts": [...],
    "wmo:dataPolicy": "core",
    "language": "en",
    "type": "dataset",
    "created": "2018-01-01T21:11:12Z",
    "updated": "2022-06-17T18:43:39Z"
  },
  "links": [...]
}
```


Description of the Dataset

- Identifier
- Geometry (extent)
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- Description
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Who to contact

- Publisher contact

How to access

- Data access (files)
- Data access (API)
- Data access (notifications)

Conditions of use

- Data policy
- Rights
- License

How to attribute

- Citation

Sharing data in WIS 2.0 – WCMP2

```
"links": [
    {"rel": "stations"...},
    {
        "rel": "data",
        "href": "https://dd.weather.gc.ca/climate/observations/daily/csv",
        "type": "text/html",
        "title": "Raw data download (CSV files)"
    },
    {
        "rel": "items",
        "href": "https://api.weather.gc.ca/collections/climate-daily/items",
        "type": "application/geo+json",
        "title": "Climate daily data access API interface"
    },
    {
        "rel": "license",
        "href": "https://open.canada.ca/en/open-government-licence-canada",
        "type": "text/html",
        "title": "Open Government Licence - Canada"
    },
    {"rel": "related"...},
    {"rel": "items"...}
]
```

Description of the Dataset

- Identifier
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Sharing data in WIS 2.0 – WCMP2

- Whilst simplified compared to ISO19115/ISO19139 metadata, a WCMP2 record can point at a more complete ISO19115/ISO19139 record via the links or extended by inclusion of additional properties

1.20 Additional properties

A WCMP record can be extended as required for organizational purposes by adding properties (of any type) in the record. Additional properties do not break compliance to WCMP.

Example:

JSON

```
"properties": {
  ...
  "approvalStatus": "approved"
  "_comment": {
    "validationErrors": [
      "error 1",
      "error 2"
    ]
  }
  ...
}
```

Permission 11	/per/core/additional_properties
A	A WCMP record MAY provide additional properties of any type in any part of the document as needed.

Description of the Dataset
- Identifier
- Geometry (extent)
- Time (extent)
- Title
- Description
- Keywords / themes

Who to contact
- Publisher contact

How to access
- Data access (files)
- Data access (API)
- Data access (notifications)

Conditions of use
- Data policy
- Rights
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How to attribute
- Citation

Sharing data in WIS 2.0 – MQTT notifications

WIS2 Notification Message (WNM) via MQTT

- JSON object containing basic information on newly published or updated data (including WCMPv2 records)
- Notifications typically at the observation level but depends on the publisher
- Limited metadata to enable filtering of notifications
  - Spatial coverage
  - Temporal coverage
  - Record and dataset identifiers
- Actionable link to the data – 'Core' data cached by the Global Caches, 'Recommended' direct from the WIS2 node, with or without access control
- Notifications are published to specified channel / topic via MQTT and republished by the Global Brokers


```
{
    "id": "31e9d66a-cd83-4174-9429-b932f1abe1be",
    "conformsTo": [
        "http://wis.wmo.int/spec/wnm/1/conf/core"
    ],
    "type": "Feature",
    "geometry": {
        "type": "Point",
        "coordinates": [
            6.146255135536194,
            46.223296618227444
        ]
    },
    "properties": {
        "pubtime": "2022-03-20T04:50:18Z",
        "datetime": "2022-03-20T04:45:00Z",
        "integrity": {
            "method": "sha512",
            "value": "A2KNxvks...S8qfSCw=="
        },
        "data_id": "dataset/123/data-granule/UANT01_CWAO_200445___15103.bufr4"
        "metadata_id": "urn:wmo:md:ca-eccc-msc:observations.swob",
        "content": {
            "encoding": "utf-8",
            "value": "encoded bytes from the file",
            "size": 457
        }
    },
    "links": [
        {
            "href": "https://example.org/data/4Pubsub/92c557ef-d28e-4713-91af-
2e2e7be6f8ab.bufr4",
            "rel": "canonical",
            "type": "application/x-bufr"
        },
        {
            "href": "https://example.org/oapi/collections/my-dataset/items/my-data-granule",
            "rel": "item",
            "type": "application/json"
        }
    ]
}
```

Sharing data in WIS 2.0 – historical data

Publishing historical data via WIS2.0

- Set up MQTT notification workflow (if applicable)
- Create basic WCMP2 record describing the historical data to be exchanged:
  - Add link to web accessible folder or other file-based access
  - Add link to API for API driven workflows (if supported)
  - Add license, usage and citation information via links
  - Add link to additional information, e.g. full ISO 19139 XML record, using “describedBy” link relation
  - Extend by adding additional properties as required
- Publish record on the WIS2.0 via the Global Discovery Catalogue and either a NC or DCPC

```
"links": [
    {"rel": "stations"...},
    {
        "rel": "data",
        "href": "https://dd.weather.gc.ca/climate/observations/daily/csv",
        "type": "text/html",
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        "type": "text/html",
        "title": "Open Government Licence - Canada"
    },
    {"rel": "related"...},
    {"rel": "items"...}
]
```

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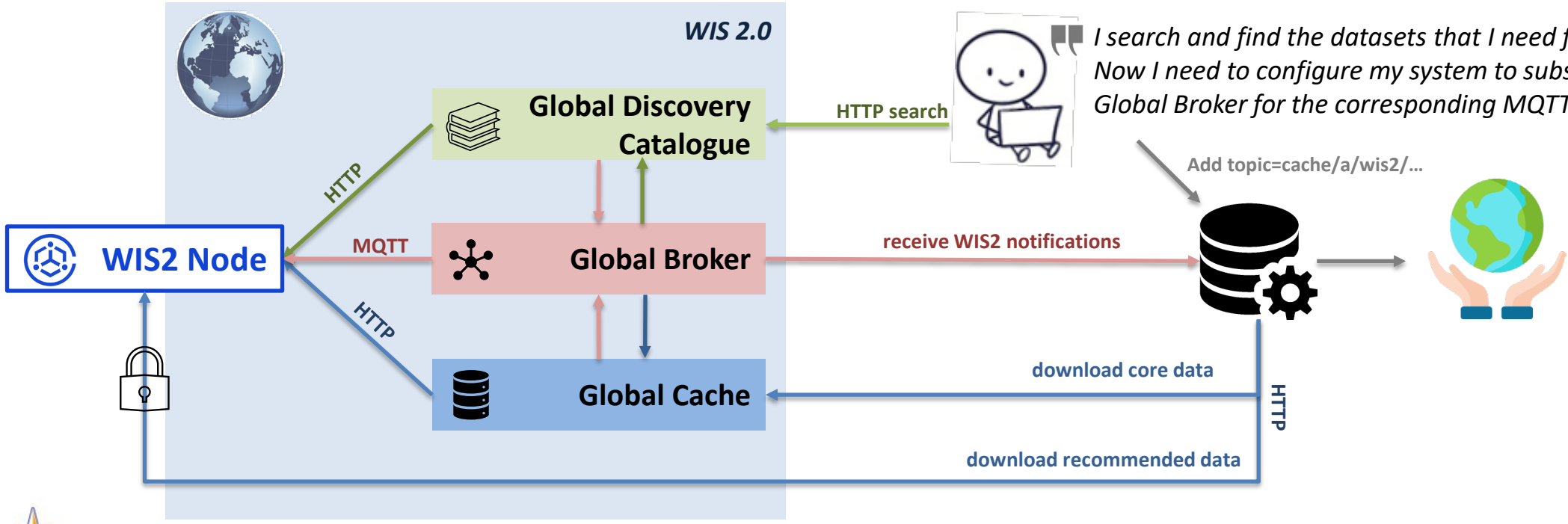
Accessing data in (near-)real-time

Data Consumers search the Global Discovery Catalogue for datasets of interest and relevant channels

Consumers then use MQTT client- software to subscribe to specific channels

WIS2 Notifications indicate the HTTP endpoint where the data can be downloaded from



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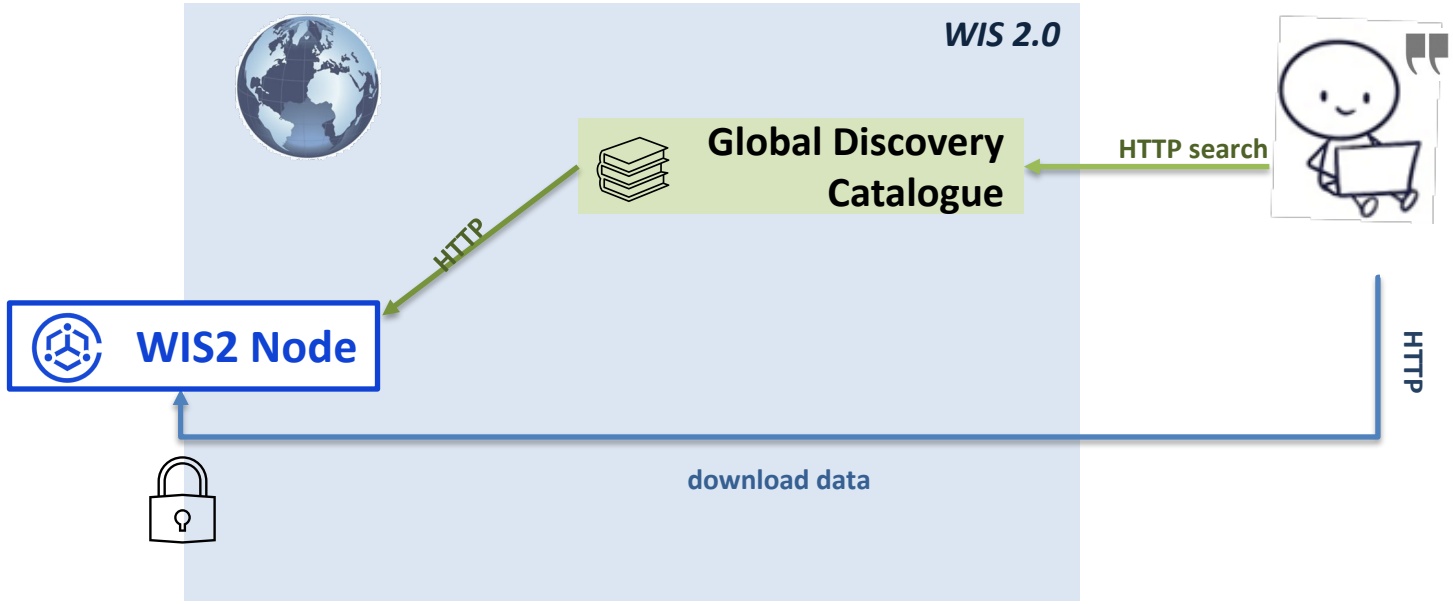
Accessing data in non-real-time

Data Consumers search the Global Discovery Catalogue for datasets of interest

The WIS2 metadata indicates the HTTP endpoint where the data can be downloaded from



*I search and find the datasets that I need for my use-case. I download the data directly via the **file-based access** or **interactive API based access***

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Thank you
Merci
Gracias
谢谢

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Organisation météorologique mondiale