WMO WIS2 Notification Message Encoding

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**i. Abstract**

WIS2 real-time data sharing is based on a message queuing protocol (MQP) supporting a publication/subscription (PubSub) mechanism. A user can subscribe to an MQP broker to receive real-time notifications of the existence of new data. The notification message received from the MQP broker contains a URL to download the data. In addition, the MQP broker offers a range of topics organised in a hierarchy. The users can select their topics of interest and subscribe to them to receive notifications and download data relevant to their work.

The standard notification message format ensures that the WIS2 ecosystem (data publisher, data user, and global services) is a robust, effective, and unified exchange platform for weather, climate, and water data.

This document defines the content, structure, and encoding for the WIS2 Notification Message Encoding. This standard is an extension of the OGC API - Features standard [[3]](#footnote-24). WIS2 Notification Message documents are provided as MQP payloads by WIS2 nodes, Global Broker services, as well as Replay API services (optional OGC API - Features services for data notifications).

WIS2 Notification Message documents shall be encoded in GeoJSON (RFC7946 [[4]](#footnote-26)) as defined in this specification and shall be made available as MQP payloads. Additionally, they can be provisioned as defined by OGC API - Features.

Weather/climate/water data is by nature geospatial and temporal. The W3C Data on the Web Best Practices [[5]](#footnote-28) and Spatial Data on the Web Best Practices [[6]](#footnote-30) publications provide guidelines on how to best enable spatiotemporal data to lower the barrier for users, search engine optimization, and linked data. This also aligns with the FAIR data principles (Findable, Accessible, Interoperable, Reusable) [[7]](#footnote-32).

**ii. Keywords**

The following are keywords to be used by search engines and document catalogues.

wmo, wis 2.0, weather, climate, water, metadata, pubsub, mqp, message queuing protocol, GeoJSON

**iii. Security Considerations**

Based on the WMO Unified Data Policy for the International Exchange of Earth System Data (Resolution 1 (Cg-Ext(2021) [[8]](#footnote-34), exchanged data are classified as core or recommended. Core data is considered fully open and unrestricted with no security considerations. Recommended data may have access control defined.

No security considerations have been made for this standard.

# Scope

This document defines the content, structure, and encoding of a notification message published as part of a WIS2 Global Broker or a Replay API service.

The WIS2 Notification Message Encoding standard defined herein is an extension of the International Standard *GeoJSON*.

WIS2 Notification Message documents shall be encoded as GeoJSON as defined in *OGC API - Features - Part 1: Core*.

The primary purpose of WIS2 Notification Messages are to notify subscribers or clients of new data being published.

This specification defines the conformance requirements for the WIS2 Notification Message Encoding. Annex A defines the abstract test suite.

# Conformance

Conformance with this standard shall be checked using the tests specified in Annex A (normative) of this document.

*GeoJSON* provides an encoding for encoding geographic features (geometry, attributes). This standard is an extension of *GeoJSON*.

Data providers are required to comply with all conformance classes of this specification in support of providing MQP services.

WMO shall publish guidance material to assist data providers in constructing WIS2 Notification Messages.

This standard identifies one Requirements Class which defines the functional requirements.

The mandatory Requirements Class for this specification is:

* "WIS2 Notification Message Encoding Core"

# References

* OGC: OGC 17-069r, OGC API - Features - Part 1: Core 1.0.1 (2022) [[9]](#footnote-39)
* IETF: RFC-7946 The GeoJSON Format (2016) [[10]](#footnote-41)
* IETF: RFC-8259 The JavaScript Object Notation (JSON) Data Interchange Format (2017) [[11]](#footnote-42)
* IETF: RFC 3339: Date and Time on the Internet: Timestamps (2002) [[12]](#footnote-44)
* IETF: RFC 4122: A Universally Unique IDentifier (UUID) URN Namespace (2005) [[13]](#footnote-46)
* W3C/OGC: Spatial Data on the Web Best Practices, W3C Working Group Note (2017) [[14]](#footnote-48)
* W3C: Data on the Web Best Practices, W3C Recommendation (2017) [[15]](#footnote-49)
* W3C: Data Catalog Vocabulary, W3C Recommendation (2014) [[16]](#footnote-50)
* IANA: Link Relation Types (2020) [[17]](#footnote-52)
* IETF: JSON Schema (2022) [[18]](#footnote-54)
* WMO: WIS2 Topic Hierarchy (2022) [[19]](#footnote-56)

# Terms and definitions

This document uses the terms defined in [OGC Policy Directive 49](https://portal.ogc.org/public_ogc/directives/directives.php), which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this Standard and OGC documents do not use the equivalent phrases in the ISO/IEC Directives, Part 2.

This document also uses terms defined in the OGC Standard for Modular specifications ([OGC 08-131r3](https://portal.opengeospatial.org/files/?artifact_id=34762)), also known as the 'ModSpec'. The definitions of terms such as standard, specification, requirement, and conformance test are provided in the ModSpec.

The following additional terms and definitions also apply.

## Abbreviated terms

Symbols and abbreviated terms

|  |  |
| --- | --- |
| Abbreviation | Term |
| API | Application Programming Interface |
| DCPC | Data Collection and Production Centres |
| GDC | Global Discovery Catalogue |
| GIS | Geographic Information System |
| GISC | Global Information System Centre |
| HTML | Hypertext Markup Language |
| HTTP | Hypertext Transfer Protocol |
| HTTPS | Hypertext Transfer Protocol Secure |
| IANA | Internet Assigned Numbers Authority |
| IETF | Internet Engineering Task Force |
| ISO | International Organization for Standardization |
| JSON | JavaScript Object Notation |
| MQP | Message Queuing Protocol |
| MQTT | Message Queuing Telemetry Transport |
| NC | National Centre |
| NWP | Numerical Weather Prediction |
| OGC | Open Geospatial Consortium |
| PubSub | Publish / Subscribe |
| URI | Uniform Resource Identifier |
| URL | Uniform Resource Locator |
| UUID | Universally Unique Identifier |
| W3C | World Wide Web Consortium |
| WCMP | WMO Core Metadata Profile |
| WIS | WMO Information System |
| WMO | World Meteorological Organization |
| WNM | WIS2 notification message |

# Conventions

This section provides details and examples for any conventions used in the document. Examples of conventions are symbols, abbreviations, use of JSON schema, or special notes regarding how to read the document.

## Identifiers

The normative provisions in this Standard are denoted by the URI:

<http://wis.wmo.int/spec/wnm/1>

All requirements and conformance tests that appear in this document are denoted by partial URIs which are relative to this base.

## Examples

Examples provided in this specification are encoded as GeoJSON.

Complete examples can be found at <https://schemas.wmo.int/wnm/1.0.0/examples>

## Schemas

The WIS2 Notification Message schema can be found at <https://schemas.wmo.int/wnm/1.0.0/schemas/wis2-notification-message-bundled.json>

## Schema representation

JSON Schema [[20]](#footnote-70) objects are used throughout this standard to define the structure of metadata records. These schema objects are also typically represented using YAML [[21]](#footnote-71). YAML is a superset of JSON, and in this standard are regarded as equivalent.

Metadata record instances are always defined as JSON.

### Properties

A JSON **property** represents a key-value pair, where the key is the name of the property and the value is a standard JSON data type.

"myPropertyName": "test123"

# Introduction

A WIS2 Notification Message (WNM) provides descriptive information about data or metadata made available through WIS 2.0. The standard notification message format ensures that the WIS2 ecosystem (data publisher, data user, and global services) is a robust, effective, and unified data exchange platform for weather, climate, and water.

WIS2 Notification Message documents are provided as MQP payloads by WIS2 nodes, Global Broker services, as well as Replay API services.

A WNM provides notification metadata about data or metadata published to WIS2, including when the data was published, its spatial and temporal characteristics, and where to access and download.

## Motivation

MQP brokers provide "push" based services, supporting event-driven workflows, maximizing efficient use of network, bandwidth, and rapid response to time-sensitive events (e.g. severe weather events). However, MQP brokers do not specify a payload encoding. Using GeoJSON as a baseline for this specification provides broad interoperability, lowering the barrier and extending the reach of data in the WIS2 ecosystem and beyond.

## Scenarios

The following scenarios are useful in understanding the drivers and principles that were used in the development of this specification:

### Publish, Subscribe, Download

Event driven (PubSub) workflow involves a client connecting to a MQP broker, subscribing to one or more topics and receiving relevant notifications. Notifications provide information to ensure data integrity and spatiotemporal extents of a data granule.

### Replay API workflow

API workflow involves a client connecting to an OGC API - Features services in order to query for messages in the past using spatial, temporal, or attribute predicates. A Replay API workflow is valuable in situations where connections to MQP brokers may drop, thereby allowing a given subscriber to gather past messages.

# WIS2 Notification Message

Note: This section of working draft document is the same as Appendix E in the [*Manual on the WMO Information System*](https://library.wmo.int/idurl/4/68731) (WMO-No. 1060), Volume II

The WIS2 Notification Message (WNM) is an extension of the OGC API - Features standard and shall be encoded in GeoJSON. The normative provisions in this standard are denoted by the base URI (http://wis.wmo.int/spec/wnm/1) and requirements are denoted by partial URIs relative to this base. Property names, values and examples are represented with shaded text in this document.

## 1. Requirements Class "Core"

|  |  |
| --- | --- |
| URI | <http://wis.wmo.int/spec/wnm/1/req/core> |
| Target type | Notification metadata |
| Dependency | The JavaScript Object Notation (JSON) Data Interchange Format ([IETF RFC8259 (2017)](https://datatracker.ietf.org/doc/html/rfc8259)) |
| Dependency | [JSON Schema](https://json-schema.org/) (2022) |
| Dependency | The GeoJSON Format ([IETF: RFC-7946 (2016)](https://datatracker.ietf.org/doc/html/rfc7946)) |
| Dependency | OGC API – Features – Part 1: Core corrigendum ([OGC: OGC 17-069r](https://docs.opengeospatial.org/is/17-069r4/17-069r4.html)) |
| Pre-conditions | The record conforms to GeoJSON (RFC7946) |

### 1.1 Overview

The table below provides an overview of the set of properties that may be included in a WNM.

WNM core properties

|  |  |  |
| --- | --- | --- |
| Property | Requirement | Description |
| id | **Required** | A universally unique identifier (UUID) of the message (see [1.4 Identifier](#X74cc74bc02f757de14b8deb0a232013febf3650)) |
| type | **Required** | A fixed value denoting the record as a GeoJSON Feature (see [1.3 GeoJSON compliance](#Xa869681d85fd7706ea5b98def01c440bfbe35ed)) |
| conformsTo | **Required** (one of conformsTo or version) | The version of WNM associated that the record conforms to (see [1.5 Conformance](#X27aaf728e63e69f79a0a3b6cc036a0206f9026d)). |
| version | **Required** (one of conformsTo or version) | **DEPRECATED** Please use conformsTo (see [1.5 Conformance](#X27aaf728e63e69f79a0a3b6cc036a0206f9026d)) |
| geometry | **Required** | Geospatial location associated with the data or metadata (see [1.7 Geometry](#Xf64c755b306fc29233c94309f21a962fcccdc2e)) |
| properties.pubtime | **Required** | The date and time of when the notification was published, in RFC3339 format, UTC (see [1.8 Properties / Publication time](#Xde44da0093c53a744ce00b6f22ab13334013d9d)) |
| properties.data\_id | **Required** | Unique identifier of the data as defined by the data producer (see [1.9 Properties / Data identification](#X32b566b8ff75c508f951c00666ea625b34d8468)) |
| properties.metadata\_id | Optional | Identifier for associated discovery metadata record to which the notification applies (see [1.10 Properties / Metadata identification](#Xea8877ccaede6afe0fedc39843f37a1761c0cf6)) |
| properties.producer | Optional | Identifies the provider that initially captured and processed the source data, in support of data distribution on behalf of other Members (see [1.11 Properties / Producer](#Xd350613b06dbee8bee9f5c6463e57b5694ab63c)) |
| properties.datetime | Optional | Identifies the reference date and time of the data instance to which the notification is relayed, in RFC3339 format, UTC (see [1.12 Properties / Temporal description](#Xb08759cc6803586e227f957d68f6820813636dc)) |
| properties.start\_datetime | Optional | Identifies the start date and time of the data being published, in RFC3339 format (see [1.12 Properties / Temporal description](#Xb08759cc6803586e227f957d68f6820813636dc)) |
| properties.end\_datetime | Optional | Identifies the end date and time of the data being published, in RFC3339 format (see [1.12 Properties / Temporal description](#Xb08759cc6803586e227f957d68f6820813636dc)) |
| properties.cache | Optional | Indicates whether the data in the notification should be cached (if not specified, the default value is true) (see [1.13 Properties / Cache](#Xc98c596425173215afe8bced63510c3d0814255)) |
| properties.integrity | Optional | Specifies a checksum to be applied to the data to ensure that the download is accurate (see [1.14 Properties / Integrity](#X5c1fe51a8fc4cc9f917ed22ebadbf84390c14ed)) |
| properties.content | Optional | Used to embed small products inline within the message (see [1.15 Properties / Content](#X982afbb6a200262a4b3ab05e0b9440ff91cfa08)) |
| links | **Required** | Online linkages for data retrieval or additional resources associated with the dataset (see [1.16 Links](#X3caa111b54983126b84da96b0e81deae1357b85)) |

### 1.2 Message size

The WIS2 Notification Message allows for the transmission of messages in a compact manner and includes the ability to embed content inline as required (see [1.15 Properties / Content](#X982afbb6a200262a4b3ab05e0b9440ff91cfa08)).

|  |  |
| --- | --- |
| **Requirement 1** | **/req/core/message\_size** |
| A | A WNM message SHALL NOT exceed 8192 bytes. |

### 1.3 GeoJSON compliance

The WIS2 Notification Message schema is based on *GeoJSON* (RFC7946) and its associated information model. Compliant messages are therefore compliant with *GeoJSON*.

|  |  |
| --- | --- |
| **Requirement 2** | **/req/core/validation** |
| A | Each WNM SHALL validate without error against the WNM schema. |
| B | Each WNM SHALL provide id, type, geometry and properties properties for GeoJSON compliance. |
| C | Each WNM record type property SHALL be set to a fixed value of Feature for GeoJSON compliance. |

### 1.4 Identifier

A universally unique identifier of the message using the UUID standard ([RFC4122](https://datatracker.ietf.org/doc/html/rfc4122)). The identifier is generated by the originator of the message. It provides the anti-loop feature that is needed to ensure that the message will be seen once by all Global Brokers. It remains the same throughout the lifetime of the message in the WIS2 ecosystem.

The data\_id is retained to ensure traceability and consistency of the same resource (see [1.9 Properties / Data identification](#X32b566b8ff75c508f951c00666ea625b34d8468)).

Example:

"id": "31e9d66a-cd83-4174-9429-b932f1abe1be"

|  |  |
| --- | --- |
| **Requirement 3** | **/req/core/identifier** |
| A | The id property SHALL be a Universally Unique Identifier (UUID). |

### 1.5 Conformance

The conformsTo property to identifies the version of the WNM standard that the notification conforms to. Conformance identification is valuable for version detection and handling of content.

**Example:.**

"conformsTo": [  
 "http://wis.wmo.int/spec/wnm/1/conf/core"  
]

|  |  |
| --- | --- |
| **Requirement 4** | **/req/core/conformance** |
| A | A WNM SHALL provide information on conformance via the OAFeat conformsTo property. |
| B | The conformsTo property SHALL advertise conformance to WNM. |

### 1.6 Version

**DEPRECATED** Please use conformsTo.

The version property provides the version of WNM that the message conforms to.

|  |  |
| --- | --- |
| **Requirement 5** | **/req/core/version** |
| A | A WNM SHALL provide information on version conformance via the version property. |
| B | The version property SHALL be fixed to v04 for this version of the specification. |

### 1.7 Geometry

The type of geometry in a notification message may be Point or Polygon. It can also be type null if the geometry cannot be derived.

**Example: Point.**

{  
 ...  
 "geometry": {  
 "type": "Point",  
 "coordinates": [  
 6.146255135536194,  
 46.223296618227444  
 ]  
 }  
 ...  
}

**Example: Point with elevation.**

{  
 ...  
 "geometry": {  
 "type": "Point",  
 "coordinates": [  
 6.146255135536194,  
 46.223296618227444,  
 392  
 ]  
 }  
 ...  
}

**Example: Polygon.**

{  
 ...  
 "geometry": {  
 "type": "Polygon",  
 "coordinates": [[  
 [-7.75,40.43],  
 [-7.75,78.46],  
 [71.91,78.46],  
 [71.91,40.43],  
 [-7.75,40.43]  
 ]]  
 }  
 ...  
}

**Example: null.**

{  
 ...  
 "geometry": null  
 ...  
}

|  |  |
| --- | --- |
| **Requirement 6** | **/req/core/geometry** |
| A | A WNM record SHALL provide one geometry property to convey the geospatial properties of a notification using a geographic coordinate reference system (World Geodetic System 1984 [WGS 84]) with longitude and latitude decimal degree units. |
| B | The geometry property SHALL only provide one of a Point or Polygon geometry, or a null value when a geometry value is unknown or cannot be determined. |

|  |  |
| --- | --- |
| **Permission 1** | **/per/core/geometry** |
| A | The geometry property MAY provide a third element (height) as per clause 4 of the GeoJSON specification. |

### 1.8 Properties / Publication time

The pubtime property identifies the date/time when the notification was first posted or published by the originator. The date/time is encoded in RFC3339 format with the Coordinated Universal Time (UTC) timezone (Z).

The publication date/time is critical for subscribers to prevent message loss in providing awareness of how far behind the publisher they may be.

The pubtime property is also valuable for change detection as part of updates and deletion notifications.

Ensuring pubtime is properly managed for updates and deletions is important for data and metadata download workflows. For example, an out-of-date pubtime can lead to errors for clients when managing updates or deletions in their local copies of data. An update with newer pubtime and identical datetime indicates a newer version of the data or metadata.

"properties": {  
 ...  
 "pubtime": "2022-03-20T04:50:18.314854383Z"  
 ...  
}

|  |  |
| --- | --- |
| **Requirement 7** | **/req/core/pubtime** |
| A | A WNM SHALL provide a properties.pubtime property. |
| B | The properties.pubtime property SHALL be in RFC3339 format. |
| C | The properties.pubtime property SHALL be in UTC timezone. |
| D | The properties.pubtime property SHALL be set to the current time by the original publisher of the notification. |
| E | The properties.pubtime property SHALL be set to the current time also for notifications about updates or deletions. |
| F | The properties.pubtime property SHALL NOT be modified by any intermediaries. |

### 1.9 Properties / Data identification

The data\_id property uniquely identifies the data described by the notification and is defined by the data producer. A data producer may use an identification scheme of their choice.

Example:

"properties": {  
 ...  
 "data\_id": "wis2/ma-marocmeteo/data/core/weather/surface-based-observations/synop/WIGOS\_0-504-1-60288\_20240210T130000"  
 ...  
}

|  |  |
| --- | --- |
| **Requirement 8** | **/req/core/data\_id** |
| A | A WNM SHALL provide a properties.data\_id property. |
| B | The properties.data\_id property SHALL be unique within the scope of the relevant dataset. |

|  |  |
| --- | --- |
| **Recommendation 1** | **/rec/core/data\_id** |
| A | The properties.data\_id property SHOULD NOT use an opaque id. It should be encoded with meaningful values to support client-side filtering. |

|  |  |
| --- | --- |
| **Permission 2** | **/per/core/data\_id** |
| A | The properties.data\_id property MAY contain a valid WIS2 topic, without the channel and version. |

### 1.10 Properties / Metadata identification

The metadata\_id property uniquely identifies the associated discovery metadata record. This property is an important linkage between a WCMP2 dataset discovery metadata record and the related data notifications. The inclusion of this property allows a subscriber to consult additional documentation of the dataset and understand the access control applied to the data.

Example:

"properties": {  
 ...  
 "metadata\_id": "urn:wmo:md:ca-eccc-msc:observations.swob"  
 ...  
}

|  |  |
| --- | --- |
| **Recommendation 2** | **/rec/core/metadata\_id** |
| A | A WNM SHOULD provide a properties.metadata\_id property that identifies the associated WCMP2 dataset discovery metadata record. See requirement for metadata identification in WCMP2. |

|  |  |
| --- | --- |
| **Permission 3** | **/per/core/metadata\_id** |
| A | A WNM MAY provide additional identifiers to discovery metadata records in non-WIS2 catalogue systems as a link object with (rel=related or rel=up). |

### 1.11 Properties / Producer

The producer property identifies the provider that initially captured and processed the source data, in support of data distribution on behalf of other Members.

Example:

"properties": {  
 ...  
 "producer": "fra"  
 ...  
}

|  |  |
| --- | --- |
| **Recommendation 3** | **/rec/core/producer** |
| A | A WNM SHOULD provide a properties.producer property when publishing data on behalf of other Members. |

### 1.12 Properties / Temporal description

The datetime property identifies the date and time of the data (for example, when a measurement was observed). When a data or metadata is updated or deleted, this value should identify the original data or metadata, which can be significantly different from the current time.

The start\_datetime and end\_datetime properties identify a temporal extent (for example, the start and end times of an NWP forecasting period). All dates and times are encoded in RFC3339 format with the UTC timezone (Z). A null value can also be used if a temporal description of the data cannot be derived.

**Example: Temporal instant.**

"properties": {  
 ...  
 "datetime": "2022-03-20T04:45:00Z"  
 ...  
}

**Example: Temporal extent.**

"properties": {  
 ...  
 "start\_datetime": "2022-03-20T04:45:00Z",  
 "end\_datetime": "2022-03-22T04:45:00Z"  
 ...  
}

**Example: No temporal description.**

"properties": {  
 "datetime": null,  
 ...  
}

|  |  |
| --- | --- |
| **Requirement 9** | **/req/core/temporal** |
| A | A WNM SHALL provide a temporal description by either a properties.datetime property or both the properties.start\_datetime and properties.end\_datetime properties. |
| B | The temporal description SHALL be in RFC3339 format. |
| C | The temporal description SHALL be in the UTC timezone. |
| D | The temporal description SHALL be set to null (using only properties.datetime) when a temporal description cannot be derived. |

### 1.13 Properties / Cache

Core data, by default, is cached by Global Cache services as described in the *Guide to WIS*, Volume II.

However, a data producer can use the properties.cache value to request Global Cache services to not cache their core data granule.

**Example: Specifying data not to be cached.**

"properties": {  
 "cache": false,  
 ...  
}

|  |  |
| --- | --- |
| **Permission 4** | **/per/core/cache** |
| A | A WNM MAY specify whether the data should be cached via the properties.cache property. |

### 1.14 Properties / Integrity

For data verification, it is recommended to include data integrity information via the integrity property. Providing this information will allow data consumers to ensure that a given data granule has not been corrupted during download.

The method property provides a format of the hashing method used to enable an integrity check of the data. The preferred values are sha256, sha384, sha512, sha3-256, sha3-384, and sha3-512.

The value property provides the result of the hashing method in base64 encoding.

Example:

"properties": {  
 ...  
 "integrity": {  
 "method": "sha512",  
 "value": "CPvTLiOfYRgfL3YNF/KKElwamwvLQwnzd96VnF2WoYuuH+hVIbwFSPQHHd/qa/fNVUBckviC5/HZs3Nx2jXEsA=="  
 }  
 ...  
}

|  |  |
| --- | --- |
| **Recommendation 4** | **/rec/core/integrity** |
| A | A WNM SHOULD provide a properties.integrity property, consisting of a method property identifying the hashing method (sha256, sha384, sha512, sha3-256, sha3-384, sha3-512) and a value property of the hashing result, when it can be easily derived. |

### 1.15 Properties / Content

The content property allows for the inclusion of data in the notification message when the length of the data, once encoded, is smaller than 4096 bytes.

The encoding property provides the character encoding of the data (UTF-8, Base64, or gzip), the gzip encoding means that the data are compressed using algorithm defined in [RFC1952](https://datatracker.ietf.org/doc/html/rfc1952) and consequently converted to text using Base64 encoding.

The value property provides the data in accordance with the encoding property.

The size property provides the size, in bytes, of the data in its original unencoded form, therefore this value shall not be directly compared with the size limit.

Example:

"properties": {  
 ...  
 "content": {  
 "encoding": "utf-8",  
 "value": "encoded bytes from the file",  
 "size": 457  
 }  
 ...  
}

|  |  |
| --- | --- |
| **Requirement 10** | **/req/core/content** |
| A | For data whose resulting size in the encoded form is greater than 4096 bytes, notifications SHALL NOT provide inline via properties.content.value. Note that the encoding may both enlarge the data size (for example, when binary data, such as BUFR, is Base64 encoded), as well as reduce the size (for example, when XML data are compressed with gzip). |

|  |  |
| --- | --- |
| **Recommendation 5** | **/rec/core/content** |
| A | A WNM SHOULD provide a content property, consisting of an encoding property (either utf-8, base64, or gzip), a value property of the data, as well as a size property with the length of the data. |

|  |  |
| --- | --- |
| **Permission 5** | **/per/core/content** |
| A | For data whose resulting size (after possible compression) is less than 4096 bytes, notifications MAY provide the data inline via properties.content.value. |

### 1.16 Links

The links array property consists of one or more objects providing URLs to access data.

Each link object provides:

* An href property with a fully qualified link to access the data
* A rel property providing an [IANA link relation](https://www.iana.org/assignments/link-relations/link-relations.xhtml) or [WIS link type](http://codes.wmo.int/wis/link-type) describing the relationship between the link and the message
* A type property providing the media type of the data
* A length property providing the length (in bytes) indicating the size of the data
* A security property providing a description of the access control mechanism applied (for example, recommended data with restrictions).

Links are used to communicate new data or metadata notifications. Links can also communicate when data or metadata has been deleted or invalidated.

**Example: Canonical link.**

"links": [{  
 "href": "https://example.org/data/4Pubsub/92c557ef-d28e-4713-91af-2e2e7be6f8ab.bufr4",  
 "rel": "canonical",  
 "type": "application/bufr"  
}]

**Example: Multiple links.**

"links": [{  
 "href": "https://example.org/data/4Pubsub/92c557ef-d28e-4713-91af-2e2e7be6f8ab.bufr4",  
 "rel": "canonical",  
 "type": "application/bufr"  
}, {  
 "href": "https://example.org/oapi/collections/my-dataset/items/my-data-granule",  
 "rel": "item",  
 "type": "application/json"  
}]

|  |  |
| --- | --- |
| **Requirement 11** | **/req/core/links** |
| A | A WNM SHALL provide a links array property. |
| B | The links array property SHALL contain at least one link with, at a minimum, the href and rel properties. |
| C | The links for core data SHALL NOT require further action in order to download the resource. |
| D | The links SHALL be HTTP, HTTPS, FTP or SFTP. |
| E | For new data and metadata notifications, the links array property SHALL provide at least one link with an IANA link relation of canonical to clearly identify the preferred access link. |
| F | For data or metadata update notifications, the links array property SHALL provide at least one link with a link relation of update to clearly identify the preferred access link. |
| G | For data or metadata deletions, the links array property SHALL provide at least one link with a link relation of deletion to clearly identify data which has been deleted or removed. |
| H | For metadata deletions, the properties.metadata\_id property SHALL be specified to support deletion of a WCMP2 record from the Global Discovery Catalogue. |

|  |  |
| --- | --- |
| **Recommendation 6** | **/rec/core/links** |
| A | A WNM SHOULD provide links using secure protocols such as HTTPS and SFTP, with HTTPS being the preferred option. |
| B | The link property SHOULD provide a length property to communicate the size of a given data download in advance of a data download workflow when the size of the data is known or can be easily derived. |
| C | The link relation of deletion SHOULD NOT be used for communicating a rolling data archive. |

|  |  |
| --- | --- |
| **Permission 6** | **/per/core/links** |
| A | A WNM links array property MAY provide link objects which reference APIs or Web Accessible Folders (WAF). |

#### 1.16.1 Access control

For recommended data, WNM links may also provide links to resources that implement access control in support of authentication and authorization. In secure data use cases, a user needs to be able to detect access controlled data as part of data discovery and evaluation. The example demonstrates how to express access control using HTTP Basic authentication for a given data access service.

**Example: Access controlled link.**

"links": [{  
 "rel": "data",  
 "type": "application/json",  
 "title": "link to WAF endpoint",  
 "href": "https://example.org/data/secure-data",  
 "security": {  
 "default": {  
 "type": "http",  
 "scheme": "basic",  
 "description": "Please contact the data provider for accessing this secured resource."  
 }  
 }  
}]

### 1.17 Additional properties

A WIS2 Notification Message can be extended as required for organizational purposes by adding properties (of any type) in the message. Additional properties do not break compliance with this specification.

Example:

"properties": {  
 ...  
 "\_comment": {  
 "validationErrors": [  
 "error 1",  
 "error 2"  
 ]  
 }  
 ...  
}

|  |  |
| --- | --- |
| **Permission 7** | **/per/core/additional\_properties** |
| A | A WNM MAY provide additional properties of any type in any part of the document as needed. |

# 2. WIS2 notification message resources

## 2.1 WMO Codes Registry

* <http://codes.wmo.int/wis/link-type>

## 2.2 WMO schemas server

Validation, examples and other resources are published at <https://schemas.wmo.int/wnm>.

# Conformance Class Abstract Test Suite (Normative)

## Conformance Class: Core

label

<http://wis.wmo.int/spec/wnm/1/conf/core>

subject

Requirements Class "core"

classification

Target Type:Notification Metadata

### Message size

label

/conf/core/message\_size

subject

/req/core/message\_size

test-purpose

Validate that a WNM has a valid message size.

Check that the size of the complete WNM does not exceed 8192 bytes.

### Validation

label

/conf/core/validation

subject

/req/core/validation

test-purpose

Validate that a WNM is valid to the authoritative WNM schema.

Run JSON Schema validation on the WNM against the WNM authoritative schema.

### Identifier

label

/conf/core/identifier

subject

/req/core/identifier

test-purpose

Validate that a WNM has a valid identifier.

Check for the existence of an id property in the WNM.

Check that the id property is a valid UUID.

### Conformance

label

/conf/core/conformance

subject

/req/core/conformance

test-purpose

Validate that a WNM notification provides valid conformance information.

Check for the existence of a conformsTo property in the WNM notification.

In the WNM notification’s conformsTo array property, check that ONE of the values is equal to http://wis.wmo.int/spec/wnm/1/conf/core.

### Version

label

/conf/core/identifier

subject

/req/core/identifier

test-purpose

Validate that a WNM has a valid version.

Check for the existence of an version property in the WNM.

Check that the id property is equal to v04.

### Geometry

label

/conf/core/geometry

subject

/req/core/geometry

test-purpose

Validate that a WNM provides a valid geometry property.

Check for the existence of one geometry property in the WNM.

Check that all geometry.coordinates value data types are integers or floats.

Check that geometry.coordinates longitudinal values are between -180 and 180.

Check that geometry.coordinates latitudinal values are between -90 and 90.

Check that geometry property is a valid GeoJSON geometry.

### Properties / Publication Time

label

/conf/core/pubtime

subject

/req/core/pubtime

test-purpose

Validate that a WNM has a valid pubtime.

Check for the existence of an properties.pubtime property.

Check that the properties.pubtime property is in RFC3339 format.

Check that the properties.pubtime property is in the UTC timezone.

### Properties / Data Identification

label

/conf/core/data\_id

subject

/req/core/data\_id

test-purpose

Validate that a WNM has a valid data\_id.

Check for the existence of an data\_id property.

### Properties / Temporal description

label

/conf/core/temporal

subject

/req/core/temporal

test-purpose

Validate that a WNM provides a valid temporal description.

Check for the existence of one properties.datetime or both properties.start\_datetime and properties.end\_datetime.

Check that the any of the properties.datetime or both properties.start\_datetime and properties.end\_datetime properties are in RFC3339 format.

Check that the any of the properties.datetime or both properties.start\_datetime and properties.end\_datetime properties are in the UTC timezone.

### Links

label

/conf/core/links

subject

/req/core/links

test-purpose

Validate that a WNM provides a link array property.

Check for the existence of a single links array property in the WNM.

Check that the links array property provides a minimum of one link object.

For each link object, check that the href property contains a valid protocol scheme of one of 'http', 'https', 'ftp', 'sftp'.

Check that the links array property contains one link object with a rel property with one of the values canonical, update, deletion as well as an href property.

# Schemas (Normative)

The schema document will only be published on <https://schemas.wmo.int/wnm/1.0.0> once the standard has been approved.

## WIS2 Notification Message Schema

$schema: https://json-schema.org/draft/2020-12/schema  
$id: https://raw.githubusercontent.com/wmo-im/wis2-notification-message/main/schemas/notificationMessageGeoJSON.yaml  
title: WIS2 Notification Message Encoding  
description: WIS2 Notification Message Encoding  
  
type: object  
properties:  
 id:   
 type: string  
 format: uuid  
 description: UUID (RFC4122) - Guarantee uniqueness of the message over (at least) a 24h period.  
 conformsTo:  
 type: array  
 contains:  
 const: http://wis.wmo.int/spec/wnm/1/conf/core  
 version:  
 type: string  
 description: DEPRECATED, please use `conformsTo`.  
 const: v04  
 type:  
 type: string  
 enum:  
 - Feature  
 geometry:  
 oneOf:  
 - enum:  
 - null  
 - $ref: 'https://raw.githubusercontent.com/opengeospatial/ogcapi-features/master/core/openapi/schemas/pointGeoJSON.yaml'  
 - $ref: 'https://raw.githubusercontent.com/opengeospatial/ogcapi-features/master/core/openapi/schemas/polygonGeoJSON.yaml'  
 properties:  
 type: object  
 properties:  
 pubtime:  
 type: string  
 format: date-time  
 description: |  
 Identifies the date/time of when the file was posted/published, in RFC3339 format.  
 The publication date/time is critical for subscribers to prevent message loss by knowing  
 their lag (how far behind the publisher they are).  
 data\_id:   
 type: string  
 description: |  
 Unique identifier of the data as defined by the data producer.  
 Data producers SHOULD NOT use an opaque id, but something meaningful to support client side filtering.  
 metadata\_id:  
 type: string  
 description: |  
 Identifier for associated discovery metadata record to which the notification applies to.  
 The identification SHOULD be from a WCMP2 discovery metadata record identifier from the WIS2  
 Global Discovery Catalogue. Identifiers based on external catalogue systems MAY be articulated as additional links.  
 producer:  
 type: string  
 description: |  
 Identifies the provider that initially captured and processed the source data, in support of data distribution on behalf of other Members.  
 datetime:  
 type:  
 - string  
 - null  
 format: date-time  
 description: Identifies the date/time of the data being published, in RFC3339 format.  
 start\_datetime:  
 type: string  
 format: date-time  
 description: Identifies the start date/time date of the data being published, in RFC3339 format.  
 end\_datetime:  
 type: string  
 format: date-time  
 description: Identifies the end date/time date of the data being published, in RFC3339 format.  
 cache:  
 type: boolean  
 description: |  
 Whether the data in the notification should be cached (if not specified, the default value is `true`).  
 When set to `false`, WIS2 Global Cache services do not cache the canonical link, and publish the  
 notification with an unmodified canonical link (which points back to the endpoint as specified by the data producer).  
 The notification is always published by the Global Cache regardless to the `cache` topic.  
 default: true  
 integrity:  
 type: object  
 description: Specifies a checksum to be applied to the data to ensure that the download is accurate.  
 properties:  
 method:  
 type: string  
 description: |  
 A specific set of methods for calculating the checksum algorithms:  
 \* ``sha256``: the Secure Hash Algorithm 2, 256 bits, value is base64 encoded.  
 \* ``sha384``: the Secure Hash Algorithm 2, 384 bits, value is base64 encoded.  
 \* ``sha512``: the Secure Hash Algorithm 2, 512 bits, value is base64 encoded.  
 \* ``sha3-256``: the Secure Hash Algorithm 3, 256 bits, value is base64 encoded.  
 \* ``sha3-384``: the Secure Hash Algorithm 3, 384 bits, value is base64 encoded.  
 \* ``sha3-512``: the Secure Hash Algorithm 3, 512 bits, value is base64 encoded.  
 enum:  
 - sha256  
 - sha384  
 - sha512  
 - sha3-256  
 - sha3-384  
 - sha3-512  
 value:  
 type: string  
 contentEncoding: base64  
 description: Checksum value.  
 required:  
 - method  
 - value  
 content:  
 type: object  
 description: Used to embed small products inline within the message.  
 properties:  
 encoding:  
 type: string  
 description: Encoding of content  
 enum:  
 - utf-8  
 - base64  
 - gzip  
 size:  
 type: integer  
 maximum: 4096  
 description: |  
 Number of bytes contained in the file. Together with the ``integrity`` property, it provides additional assurance that file content was accurately received.  
 Note that the limit takes into account the data encoding used, including data compression (for example `gzip`).  
 value:  
 type: string  
 description: The inline content of the file.  
 maxLength: 4096  
 required:  
 - encoding  
 - size  
 - value  
 required:  
 - pubtime  
 - data\_id  
 oneOf:  
 - allOf:  
 - required:  
 - start\_datetime  
 - end\_datetime  
 - allOf:  
 - required:  
 - datetime  
  
 links:  
 type: array  
 minItems: 1  
 items:  
 allOf:  
 - $ref: 'https://raw.githubusercontent.com/opengeospatial/ogcapi-features/master/core/openapi/schemas/link.yaml'  
 - properties:  
 security:  
 type: object  
 $ref: https://raw.githubusercontent.com/OAI/OpenAPI-Specification/3.1.0/schemas/v3.0/schema.yaml#/definitions/Components/properties/securitySchemes  
  
oneOf:  
 - required:  
 - id  
 - conformsTo  
 - type  
 - geometry  
 - properties  
 - links  
 - required:  
 - id  
 - version  
 - type  
 - geometry  
 - properties  
 - links  
  
example:  
 $ref: https://raw.githubusercontent.com/wmo-im/wis2-notification-message/main/examples/example1.json

# Examples (Informative)

## WIS2 Notification Message Examples

**Example: single observation including meaningful geometry, observation datetime and content.**

{  
 "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"  
 }  
 ]  
}

**Example: NWP product including polygon geometry, start\_datetime and end\_datetime. The polygon is an array with 5 elements. The first (and last) elements are most southwestern point of the rectangle using longitude and latitude and followed by other coordinates in a clockwise direction..**

{  
 "id": "31e9d66a-cd83-4174-9429-b932f1abe1be",  
 "conformsTo": [  
 "http://wis.wmo.int/spec/wnm/1/conf/core"  
 ],  
 "type": "Feature",  
 "geometry": {  
 "type": "Polygon",  
 "coordinates": [  
 [  
 [  
 -7.75,  
 40.43  
 ],  
 [  
 -7.75,  
 78.46  
 ],  
 [  
 71.91,  
 78.46  
 ],  
 [  
 71.91,  
 40.43  
 ],  
 [  
 -7.75,  
 40.43  
 ]  
 ]  
 ]  
 },  
 "properties": {  
 "pubtime": "2022-03-20T04:50:18Z",  
 "start\_datetime": "2022-03-20T00:06:00Z",  
 "end\_datetime": "2022-03-20T00:12:00Z",  
 "integrity": {  
 "method": "sha512",  
 "value": "A2KNxvks...S8qfSCw=="  
 },  
 "data\_id": "dataset/4546/abcdef-abcd-abcd-abcd-abcdefabcd",  
 "metadata\_id": "urn:wmo:md:fr-meteo-france:gap123"  
 },  
 "links": [  
 {  
 "href": "https://example.org/data/nwp/92c557ef-d28e-4713-91af-2e2e7be6f8ab.grib",  
 "rel": "canonical",  
 "type": "application/x-grib2"  
 }  
 ]  
}

**Example: minimal viable message compliant to the specification.**

{  
 "id": "31e9d66a-cd83-4174-9429-b932f1abcdef",  
 "conformsTo": [  
 "http://wis.wmo.int/spec/wnm/1/conf/core"  
 ],  
 "type": "Feature",  
 "geometry": null,  
 "properties": {  
 "pubtime": "2022-11-20T16:40:37Z",  
 "datetime": "2022-11-11T11:11:11Z",  
 "data\_id": "data/data-123/items/abcdefab-abcd-1234-5678-0123456789ab",  
 "metadata\_id": "urn:wmo:md:test-nmhs-xyz:some\_dataset",  
 "cache": false  
 },  
 "links": [  
 {  
 "href": "https://example.org/92c557ef-d28e-4713-91af-2e2e7be6f8ab.txt",  
 "rel": "canonical"  
 }  
 ]  
}

**Example: notification of the deletion of a data granule.**

{  
 "id": "31e9d66a-cd83-4174-9429-b932f1abcdef",  
 "conformsTo": [  
 "http://wis.wmo.int/spec/wnm/1/conf/core"  
 ],  
 "type": "Feature",  
 "geometry": null,  
 "properties": {  
 "pubtime": "2022-12-22T16:40:37Z",  
 "datetime": "2022-11-11T11:11:11Z",  
 "data\_id": "data/data-123/items/abcdefab-abcd-1234-5678-0123456789ab",  
 "metadata\_id": "urn:wmo:md:test-nmhs-xyz:some\_dataset",  
 "cache": false  
 },  
 "links": [  
 {  
 "href": "https://example.org/92c557ef-d28e-4713-91af-2e2e7be6f8ab.txt",  
 "rel": "deletion"  
 }  
 ]  
}

# Bibliography

* W3C/OGC: Spatial Data on the Web Best Practices, W3C Working Group Note 28 September 2017, <https://www.w3.org/TR/sdw-bp>
* W3C: Data on the Web Best Practices, W3C Recommendation 31 January 2017, <https://www.w3.org/TR/dwbp>
* IANA: Link Relation Types, <https://www.iana.org/assignments/link-relations/link-relations.xml>

# Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Release | Editor | Primary clauses modified | Description |
| 2022-12-05 | Template | Tom Kralidis | all | update from TT-Protocols/ET-W2AT |

1. <https://community.wmo.int/governance/commission-membership/commission-observation-infrastructures-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/standing-committee-information-management-and-technology-sc-imt> [↑](#footnote-ref-20)
2. <https://community.wmo.int/governance/commission-membership/infcom> [↑](#footnote-ref-22)
3. <https://ogcapi.ogc.org/features> [↑](#footnote-ref-24)
4. <https://datatracker.ietf.org/doc/html/rfc7946> [↑](#footnote-ref-26)
5. <https://www.w3.org/TR/dwbp> [↑](#footnote-ref-28)
6. <https://www.w3.org/TR/sdw-bp> [↑](#footnote-ref-30)
7. <https://en.wikipedia.org/wiki/FAIR_data> [↑](#footnote-ref-32)
8. <https://library.wmo.int/doc_num.php?explnum_id=11113#page=9> [↑](#footnote-ref-34)
9. <https://docs.opengeospatial.org/is/17-069r4/17-069r4.html> [↑](#footnote-ref-39)
10. <https://datatracker.ietf.org/doc/html/rfc7946> [↑](#footnote-ref-41)
11. <https://datatracker.ietf.org/doc/html/rfc8259> [↑](#footnote-ref-42)
12. <https://datatracker.ietf.org/doc/html/rfc3339> [↑](#footnote-ref-44)
13. <https://datatracker.ietf.org/doc/html/rfc4122> [↑](#footnote-ref-46)
14. <https://www.w3.org/TR/sdw-bp> [↑](#footnote-ref-48)
15. <https://www.w3.org/TR/dwbp> [↑](#footnote-ref-49)
16. <https://www.w3.org/TR/vocab-dcat> [↑](#footnote-ref-50)
17. <https://www.iana.org/assignments/link-relations/link-relations.xml> [↑](#footnote-ref-52)
18. <https://json-schema.org> [↑](#footnote-ref-54)
19. <https://github.com/wmo-im/wis2-topic-hierarchy> [↑](#footnote-ref-56)
20. <https://json-schema.org> [↑](#footnote-ref-70)
21. <https://en.wikipedia.org/wiki/YAML> [↑](#footnote-ref-71)